ANNA UNIVERSITY, CHENNAI

NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY

B. E. MARINE ENGINEERING

REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

I AND II SEMESTERS (FULL TIME) CURRICULA AND SYLLABI

SEMESTER I

SL. No.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3101	Technical English for Marine Engineers - I	HSMC	4	0	0	4	4
3.	MA3101	Mathematics for Marine Engineering – I	BSC	4	0	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3101	Chemistry for Marine Engineering	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
PRACTICAL								
7	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
			TOTAL	**17**	**0**	**8**	**25**	**21**

SEMESTER – II

SL. No.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3201	Technical English for Marine Engineers – II	HSMC	4	0	0	4	4
2.	MA3201	Mathematics for Marine Engineering – II	BSC	4	0	0	4	4
3.	PH3251	Materials Science	BSC	3	0	0	3	3
4.	BE3251	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.		NCC Credit Course Level 1*	-	2	0	0	2	2
PRACTICAL								
7.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
8.	BE3271	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**0**	**12**	**28**	**22**

*NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

IP3151 **INDUCTION PROGRAMME**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.
Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:
Guide to Induction program from AICTE

HS3101 TECHNICAL ENGLISH FOR MARINE ENGINEERS – I **L T P C**
4 0 0 4

COURSE OBJECTIVES :

- To improve the communicative competence of learners
- To help learners use language effectively in academic / technical contexts
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
- To use language effectively to express their opinions in various media.

UNIT I COMMUNICATING **12**

Listening - Short conversation: Introducing to new classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form (Joining a course or similar) Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form. Reading - Reading brochures (technical context) ; Reading telephone messages / social media messages relevant to technical context; Reading emails. Writing - Writing emails / messages; Letters of enquiry Grammar - Simple Present Tense & Present Progressive; Question forms: Wh-questions; Question Tags; Indirect questions; Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (used in technical context)

UNIT II NARRATING **12**

Listening - Listening to podcast; Listening to anecdotes / stories / Event narration; Watching documentaries & interviews with celebrities. Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / summarising of documentaries / podcasts/ interviews. Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, Reading travel & technical blogs. Writing - Guided writing; Paragraph writing (biographical/ autobiographical/ narrative), Short report on an event (field trip etc.) Blogging. Grammar – Simple Past tense & Past Progressive tense; Subject-Verb Agreement; Preposition - Vocabulary - Word forms (prefixes& suffixes); Discourse Markers (Connectives & Sequence words); antonyms&synonyms– phrasal verbs.

UNIT III DESCRIBING **12**

Listening - Listen to a product descriptions; Listen to a process descriptions; Listen to a lecture; Listen/ View an advertisement about a product. Speaking – Picture description; Giving instruction to use the product; Presenting a product; Summarising the lecture. Reading - Reading advertisements; Reading gadget reviews; Reading user manuals. Writing - Writing definitions; Writing instructions; Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; Homophones

UNIT IV CLASSIFYING **12**

Listening – Listening to TED Talks; Listening to Scientific lectures; watching educational videos. Speaking – Small Talk; Mini presentations on select topics; Giving recommendations for an issue. Reading – Newspaper articles; Journal reports - Domain specific; Tables / Suitable graphical images. Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Use of graphic organizers; Writing recommendations; Transcoding (chart/graph/table to paragraph). Grammar – Articles; Pronouns - Possessive & Relative clauses. Vocabulary - Collocations; Fixed / Semi fixed expressions

UNIT V EXPRESSING **12**

Listening – Listening to Debates; Listening to /viewing different viewpoints on an issue; Listening to panel discussion. Speaking – Small group discussions; Debates; Expressing opinions through Simulations & Roleplay activities, Reading – Reading editorials; Reading Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content v Function words

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- To listen and comprehend complex academic texts
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. Learning to Communicate by Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House

MA3101	MATHEMATICS FOR MARINE ENGINEERING – I	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES:

- To provide the required knowledge on fundamentals of geometry integrals and integral calculus for engineering applications.
- To understand the basic concepts of differentiation.
- To apply the concept of partial differentiation for the functions of several variables.
- To understand the basic concepts of integration.
- To apply the integration concepts in double and triple integrations.

UNIT I THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of lines and planes in three dimensional space -Equation of a sphere – Plane section of a sphere – Tangent plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

UNIT II DIFFERENTIAL CALCULUS 12

Differentiation of algebraic, circular, exponential and logarithmic functions, products, quotient functions of a function and simple implicit functions - Successive differentiation : Introduction and notation - n^{th} order derivatives of standard functions - n^{th} order derivatives using (a) Trigonometric identities and standard functions (b) Partial fractions - Leibnitz's theorem - Maclaurin's theorem - Taylor's theorem - Indeterminate forms and L'Hospital's rule - Maxima and Minima of one variable functions – Concavity - Curve tracing of cartesian curves.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

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

UNIT IV INTEGRAL CALCULUS 12

Integration of standard forms by substitution and by parts - Definite integral as the limit of a sum - Application of integration to area under curve - Volume of revolution - First moment of area and the position of a centroid of an area - Work done by variable forces - Mean values, Root mean square values of sin nx and cos nx. Rules of Guldinus -Theorems of parallel and perpendicular axes - Second moments of area and moments of inertia of a rectangular and circular laminas.

UNIT V MULTIPLE INTEGRALS 12

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

TOTA L: 60 PERIODS

COURSE OUTCOMES:

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

- Understand the fundamentals of geometry integrals and integral calculus for engineering applications.
- Appreciate for having the basic concepts of differentiation.
- Understand to apply the concept of partial differentiation for the functions of several variables.
- Understand the basic concepts of integration and how to apply the integration concepts in double and triple integrations.
- The basic concepts of analytical geometry and differential and integral calculus learnt by the Students will be applied to marine engineering.

TEXT BOOKS:

1. Grewal B.S, “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, New Delhi, 2018.
2. KreyszigE, "Advanced Engineering Mathematics", 10th Edition, John Wiley, New Delhi, India, 2016.

REFERENCES:

1. Bali N. P and Manish Goyal, “A Text Book of Engineering Mathematics”, 9th Edition, Laxmi Publications Ltd., 2014.
2. Embleton, W. and Jackson, L., “Mathematics for Engineers”, Vol - I, 7th Edition, Reed’s Marine Engineering Series, Thomas Reed Publications, 1997.
3. Jain R.K and Iyengar S.R.K,” Advanced Engineering Mathematics”, 5thEdition, Narosa Publishing House Pvt. Ltd., 2016.
4. James, G., “Advanced Engineering Mathematics”, 7th Edition, Pearson Education, 2007.
5. Ramana, B.V, “Higher Engineering Mathematics”, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

PH3151 ENGINEERING PHYSICS L T P C
3 0 0 3

COURSE OBJECTIVES

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS 9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

UNIT II ELECTROMAGNETIC WAVES 9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

- Understand the importance of mechanics.
- Express their knowledge in electromagnetic waves.
- Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- Understand the importance of quantum physics.
- Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

CY3101 CHEMISTRY FOR MARINE ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To introduce the basic concepts on the chemistry and mechanism of different types of corrosion of materials.
- To facilitate the understanding of various corrosion control methods.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER TECHNOLOGY 9

Water: Sources and impurities; Significance and estimation (only mention of methods) of - turbidity, colour, pH, acidity**,** alkalinity, hardness, solids, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese, arsenic, DO, BOD, COD, nitrogen, grease, volatile acids. **Treatment of water:** Zeolites process and ion exchange demineralization; **Desalination of water:** Reverse osmosis and Electro dialysis; **Municipal water treatment:** Primary treatment and Disinfection (UV, Ozonation, break-point chlorination).

UNIT II CHEMISTRY OF CORROSION 9

Introduction: Dry or chemical corrosion, Wet or electrochemical corrosion, Mechanism of wet or electrochemical corrosion- galvanic (or bimetallic) corrosion- concentration cell corrosion- passivity- underground or soil corrosion- pitting corrosion- intergranular corrosion- water line corrosion- stress corrosion- microbiological corrosion- galvanic series- factors influencing corrosion; Uniform and localized corrosion.

UNIT III CORROSION CONTROL METHODS 9

Corrosion control by: Material selection and design; Electrochemical protection - sacrificial anodic protection and impressed current cathodic protection; Protective coatings: Metallic coatings - hot dipping, metal cladding, anodizing, galvanizing, tinning, electroplating and electroless plating; Non-metallic inorganic coatings; Organic coatings: paints, varnishes, enamels and lacquers.

UNIT IV NANOCHEMISTRY 9

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Stability of nucleus: mass defect (problems), binding energy;Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy;Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Fuel cells:H_2-O_2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To apply the knowledge of corrosion for material selection and fabrication for specific requirements.

- To recommend appropriate corrosion control methods for material and equipments protection.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S.Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2016.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

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; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

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, Voter's age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data'', Third Edition, MIT Press 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

1. Allen B. Downey, "Think Python : How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

BS3171 PHYSICS AND CHEMISTRY LABORATORY L T P C
0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.

4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOK:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

HS3201 TECHNICAL ENGLISH FOR MARINE ENGINEERS - II

L	T	P	C
4	0	0	4

COURSE OBJECTIVES :

- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners' awareness of the general rules of writing for specific audiences
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placement opportunities.

UNIT I COMPARING & CONTRASTING 12

Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison) Speaking – Marketing a product, Persuasive Speech Techniques. Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases, Vocabulary – Etymology (Root words), Vocabulary in Context, comparative adjectives

UNIT II CAUSE & EFFECT 12

Listening - Listening to longer technical talks, Completing information – gap- filling exercises based on them. Listening to technical information from podcasts – Listening to process description – Listening to event description to identify cause & effects - Speaking – Describing and discussing the reasons of accidents or disasters based on news reports. Reading - Reading longer technical texts on accidents/disasters, Man-made and natural disasters Writing – Cause and Effect Essays, Letters / emails of complaint, Writing responses to complaints. Grammar - Active, Passive Voice, Impersonal passives, Infinitive and Gerunds Vocabulary – Word Formation (Noun-Verb-Adj-Adv), Adverbs

UNIT III PROBLEM SOLVING 12

Listening – Listening / Watching movie scenes/ documentaries depicting technical problem and suggesting solutions. Speaking – Case-based group discussion, Group Discussion (virtual and face to face) - Techniques and Strategies, Ethical dilemmas Reading - Case Studies of the domain, excerpts from literary text, Critical Reading of news reports. Writing – Letter to the Editor, Writing Checklists, Problem solution essay / Argumentative Essay Grammar - Error identification & correction, If conditional clauses Vocabulary - Compound Words, Sentence Completion

UNIT IV REPORTING 12

Listening – Listening to news reports – Watching documentaries – Summarising Speaking – Interviewing, Presenting an oral report, Mini presentations on select topics; Reading – Newspaper articles; Domain specific Journal reports with infographics(Tables/graphs/charts). Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions, Phrasal verbs

UNIT V PRESENTING 12

Listening – Listening to TED Talks, Presentations, Formal job interview, (analysis of the interview performance); Speaking – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids; Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses Vocabulary – Idioms

TOTAL : 60 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

- To compare and contrast products and ideas in the technical texts
- To identify causes and effects in events, industrial processes specific to the subject.
- To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- To report events and processes of a technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes in the context of job search

TEXT BOOKS:

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University
2. Learning to Communicate by Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

REFERENCES:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

MA3201 MATHEMATICS FOR MARINE ENGINEERING – II

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To provide the required skill to apply the concepts of ordinary differential equations.
- To provide the required skill to apply higher order differential equations in marine applications.
- To provide the required skill to apply vector calculus.
- To provide the required skill to apply complex variables.
- To provide the required skill to apply Laplace transformation in marine engineering problems.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS – FIRST ORDER AND APPLICATIONS 12

Definition- Order and degree - Formation of differential equation - Solution of first order, first degree equations in variable separable form, homogeneous equations, other substitutions - Equations reducible to homogeneous and exact differential equations - Equations reducible to exact Integration- Factor - Linear differential equation of first order first degree, reducible to linear - Applications to electrical circuits and orthogonal trajectories

UNIT II ORDINARY DIFFERENTIAL EQUATIONS – HIGHER ORDER AND APPLICATIONS 12

Higher (n^{th}) order linear differential equations - Definition and complementary solution - Methods of obtaining particular integral - Method of variation of parameters - Method of undetermined coefficients - Cauchy's homogeneous linear differential equations and Legendre's equations - System of ordinary differential equations - Simultaneous equations in symmetrical form - Applications to deflection of beams, struts and columns - Applications to electrical circuits and coupled circuits

UNIT III VECTOR CALCULUS 12

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

UNIT IV ANALYTIC FUNCTIONS 12

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

UNIT V LAPLACE TRANSFORM 12

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Apply the concepts of ordinary differential equations.
- Apply higher order differential equations in marine applications.
- Apply vector calculus.
- Apply complex variables.
- Apply Laplace transformation in marine engineering problems.
- The basic and fundamental knowledge gained by the students in the application of ordinary differential equations vector fields and transformations will be applied by them in the process field related to marine engineering.

TEXT BOOKS:

1. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2018.
2. Kreyszig E, "Advanced Engineering Mathematics", 10th Edition, John Wiley, India, 2016.

REFERENCES:

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 10thEdition, Laxmi Publications (p) Ltd., 2015.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 5thEdition, Narosa Publishing House Pvt. Ltd., 2016.
3. James, G., "Advanced Engineering Mathematics", 5thEdition, Pearson Education, 2016.
4. Ramana B.V, "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd., New Delhi, 2016.

PH3251 MATERIALS SCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the students to understand the basics of crystallography and its importance in studying materials properties.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT I CRYSTALLOGRAPHY 9

Crystal structures: BCC, FCC and HCP – directions and planes - linear and planar densities – crystal imperfections- edge and screw dislocations – grain and twin boundaries - Burgers vector and elastic strain energy- Slip systems, plastic deformation of materials - Polymorphism – phase changes – nucleation and growth – homogeneous and heterogeneous nucleation.

UNIT II ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory :Tunneling – degenerate states – Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – paramagnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.

UNIT III SEMICONDUCTORS AND TRANSPORT PHYSICS 9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

UNIT IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices –excitonic state – Electro-optics and nonlinear optics: Modulators and switching devices – plasmonics.

UNIT V NANOELECTRONIC DEVICES 9

Quantum confinement – Quantum structures – quantum wells, wires and dots – Zener-Bloch oscillations – Resonant tunneling – quantum interference effects - mesoscopic structures - Single electron phenomena – Single electron Transistor. Semiconductor photonic structures – 1D, 2D and 3D photonic crystal. Active and passive optoelectronic devices – photo processes – spintronics – carbon nanotubes: Properties and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students should be able to

- know basics of crystallography and its importance for varied materials properties
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of functional nanoelectronic devices.

TEXT BOOKS:

1. V.Raghavan. Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015.
2. S.O. Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.
3. Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley (India), 2007.
4. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, Mc-Graw Hill India (2019)
5. G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.

REFERENCES:

1. R.Balasubramaniam, Callister's Materials Science and Engineering. Wiley (Indian Edition), 2014.
2. Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering, 2013.
3. Robert F.Pierret, Semiconductor Device Fundamentals, Pearson, 2006
4. Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Pearson, 2017
5. Ben Rogers, Jesse Adams and Sumita Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2017.

BE3251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT III ANALOG ELECTRONICS 9

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument, Standards and calibration, Operating Principle, types -Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, Second Edition, McGraw Hill Education, 2020
2. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson Education, Second Edition, 2017.
3. Sedha R.S., “A textbook book of Applied Electronics”, S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, “Dorf’s Introduction to Electric Circuits”, Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2015.

REFERENCES:

1. Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, ‘Digital Fundamentals’, 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010

GE3251 ENGINEERING GRAPHICS **L T P C**
2 0 4 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

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 PLANE CURVES AND FREEHAND SKETCHING 6+12

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.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12

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.

UNIT III PROJECTION OF SOLIDS 6+12

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. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6 +12

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)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

COURSE OUTCOMES:

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

- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development of simple solids.

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

REFERENCES:

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. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

(ARMY WING) NCC CREDIT COURSE LEVEL - I

NX3251	L	T	P	C
	2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

NCC CREDIT COURSE LEVEL 1*

NX3252	(NAVAL WING) NCC CREDIT COURSE LEVEL - I	L	T	P	C
		2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

NCC CREDIT COURSE LEVEL 1*

NX3253	(AIR FORCE WING) NCC CREDIT COURSE LEVEL – I	L	T	P	C
		2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

GE3271 ENGINEERING PRACTICES LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in commonhousehold wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES **15**

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES **15**

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone..
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

TOTAL = 60 PERIODS

COURSE OUTCOMES:

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

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processeslike turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

BE3271 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS

1. Verification of ohms and Kirchhoff's Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

1. Use experimental methods to verify the Ohm's and Kirchhoff's Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM

B.E. MARINE ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Program educational objectives are broad statements that describe what graduates are expected to attain within a few years after graduation. Program educational objectives are based on the needs of the program's constituencies.

1	Graduates will have the knowledge for the application of scientific principles, Mathematical methods, technical and Innovative skills to perform analysis, application engineering, and system or process development in Marine Industry.
2	Graduates will have the knowledge by engaging in continuous education and will have the ability to function effectively as leaders on professional teams with ability to communicate effectively using speaking, writing and presentation skills.
3	Graduates of the program are to have demonstrated the competent to carry out the Engineering watch at sea and to maintain systems or processes and to direct, supervise, and make important decisions regarding the design and engineering of problems based on engineering fundamentals and modern technological tools.
4	Graduates will demonstrate a respect for professional, ethical and social and environmental issues as well as a commitment to safety, quality and productivity.
5	Graduates will demonstrate disciplined way of working as a part of teams in multidisciplinary projects or shipping companies so as to meet the National and International standards.

PROGRAM OUTCOMES (POs):

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs):

In addition to POs, each program should have 3 to 4 PSOs. These statements are the outcomes of a program which should make the students to realize the fact that, the knowledge and techniques learnt in this course has a direct implication for the betterment of society and its sustainability.

1	The ability to have thorough knowledge of Maritime industry in accordance with the STCW-conventions 2010 amendments made time-to-time.
2	Possess an overall and conscious understanding about Marine engineering at the operational and management level
3	Possess knowledge of National and International rules and regulations concerning Marine engineering
4	Possess the necessary skill for the technical operation of ships in both off-shore and on-shore.

PEO's – PO's & PSO's MAPPING

PEO	**PO**												**PSO**			
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
1	2	2	2	1	2						1	1	2	2	2	3
2				1	2	1			1	2	1	1	2	2	2	2
3	1	1	2	1	2			1	1	2	1		2	3	2	3
4						1	2	2				1	3	3	3	3
5						1			1		1		3	3	3	3
Avg	3/2=1.5	3/2=1.5	4/2=2	3/3=1	6/3=2	3/3=1	2/1=2	3/2=1.5	3/3=1	4/2=2	4/4=1	3/3=1	12/5=2.4	13/5=2.6	12/5=2.4	13/5=2.6

ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
B. E. MARINE ENGINEERING
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS III AND IV
SEMESTER I

Sl. No.	Course code	Course Title	Cate - Gory	Periods per week			Total contact periods	Credits
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3101	Technical English for Marine Engineers - I	HSMC	3	0	0	3	3
3.	MA3101	Mathematics for Marine Engineering – I	BSC	4	0	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3101	Chemistry for Marine Engineering	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
7.	GE3152	**அறிவியல் தமிழ் /Scientific Thoughts in Tamil**	HSMC	1	0	0	1	1
PRACTICAL								
7	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
8	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
	GE3172	English Laboratory [$]	EEC	0	0	2	2	1
			TOTAL	**17**	**0**	**10**	**27**	**22**

[$] Skill Based Course

SEMESTER – II

Sl. No.	Course code	Course Title	Cate - Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	HS3201	Technical English for Marine Engineers – II	HSMC	2	0	0	2	2
2.	MA3201	Mathematics for Marine Engineering – II	BSC	4	0	0	4	4
3.	PH3251	Materials Science	BSC	3	0	0	3	3
4.	BE3251	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.		NCC Credit Course Level 1#	-	2	0	0	2	2
7.	GE3252	**தமிழர் மரபு / Heritage of Tamils**	HSMC	1	0	0	1	1
PRACTICAL								
8.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
9.	BE3271	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
10.	GE3272	Communication Laboratory / Foreign Language [$]	EEC	0	0	4	4	2
			TOTAL	**15**	**0**	**16**	**31**	**23**

[#] NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

[$] Skill Based Course

SEMESTER III

S. No.	Course Code	Course Title	Cate Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	MA3351	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2.	MV3301	Marine Hydraulics and Fluid Machinery	ESC	3	0	0	3	3
3.	MV3302	Strength of Materials for Marine Engineering	ESC	3	0	0	3	3
4.	MV3303	Marine Auxiliary Machinery	PCC	4	0	0	4	4
5.	MV3304	Ship Construction	PCC	3	0	0	3	3
6.	MV3305	Seamanship, Elementary Navigation and Survival at Sea	PCC	3	0	0	3	3
PRACTICALS								
7.	MV3311	Marine Hydraulics and Fluid Machinery Laboratory	ESC	0	0	4	4	2
8.	MV3312	Strength of Materials and Applied Mechanics Laboratory	ESC	0	0	4	4	2
9.	GE3361	Professional Development[$]	EEC	0	0	2	2	1
			TOTAL	**19**	**1**	**10**	**30**	**25**

$ Skill Based Course

SEMESTER IV

S. No.	Course Code	Course Title	Cate Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	MV3401	Marine Electrical Machines	ESC	3	1	0	4	4
2.	MV3402	Marine Refrigeration and Air Conditioning	ESC	3	2	0	5	4
3.	MV3403	Ship's Fire Prevention and Control	PCC	3	0	0	3	3
4.	MV3405	Marine Diesel Engines	PCC	4	0	0	4	4
5.	MV3406	Marine Boilers and Steam Engineering	PCC	3	0	0	3	3
6.	GE3451	Environmental Sciences and Sustainability	BSC	2	0	0	2	2
7.		NCC Credit Course Level 2[#]		3	0	0	3	3
PRACTICALS								
8.	MV3411	Welding Techniques, Lathe and Special Machine Shop	PCC	0	0	4	4	2
9.	MV3412	Heat Engines, Boiler Chemistry and Refrigeration Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**3**	**8**	**29**	**24**

[#] NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER V

S. No.	Course Code	Course Title	Cate Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	MV3501	Marine Propulsion	PCC	3	0	0	3	3
2.		Professional Elective I	PEC	-	-	-	-	3
3.		Professional Elective II	PEC	-	-	-	-	3
4.		Professional Elective III	PEC	-	-	-	-	3
5.		Professional Elective IV	PEC	-	-	-	-	3
6.		Mandatory Course-I[&]	MC	3	0	0	3	0
PRACTICALS								
7.	MV3511	Electrical Engineering, Electronics and Microprocessor Laboratory	ESC	0	0	4	4	2
8.	MV3512	Marine Machinery Drawing	ESC	0	0	4	4	2
			TOTAL	-	-	-	-	**19**

[&] Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MCI)

SEMESTER VI

S. No.	Course Code	Course Title	Cate Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	MV3601	Stability of Ships	PCC	4	0	0	4	4
2.		Open Elective – I*	OEC	3	0	0	3	3
3.		Professional Elective V	PEC	-	-	-	-	3
4.		Professional Elective VI	PEC	-	-	-	-	3
5.		Professional Elective VII	PEC	-	-	-	-	3
6.		Professional Elective VIII	PEC	-	-	-	-	3
7.		Mandatory Course-II[&]	MC					0
8.		NCC Credit Course Level 3[#]		3	0	0	3	3
PRACTICALS								
9.	MV3611	Fire Fighting, Controls and Simulator Laboratory	PCC	0	0	4	4	2
10.	MV3612	Measurement and Instrumentation Laboratory	PCC	0	0	4	4	2
			TOTAL	-	-	-	-	**23**

***Open Elective – I shall be chosen from the emerging technologies**

[&] Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MCII)

[#] NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

SEMESTER VII/VIII*

S. No.	Course Code	Course Title	Cate Gory	Periods Per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	MV3701	Ship Operational Management and IMO Requirements	PCC	3	0	0	3	3
2.	MV3702	Marine Vehicles Performance	PCC	3	0	0	3	3
3.	MV3703	Human Values and Ethics	HSMC	2	0	0	2	2
4.		Elective – Management #	HSMC	3	0	0	3	3
5.		Open Elective – II**	OEC	3	0	0	3	3
6.		Open Elective – III***	OEC	3	0	0	3	3
7.		Open Elective – IV***	OEC	3	0	0	3	3
PRACTICALS								
8.	MV3711	Project Work	EEC	0	0	0	6	3
			TOTAL	**20**	**0**	**0**	**26**	**23**

***If students undergo "Marine Workshop Practical and Afloat Training", in Semester VII, then the courses offered during semester VII will be offered during semester VIII.**

****Open Elective – II shall be chosen from the emerging technologies.**

*****Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes)**

 # Elective - Management shall be chosen from the elective Management courses

SEMESTER VIII/VII*

Sl. No.	Course Code	Course Title	Category	Contact periods	Periods per week			C
					L	T	P	
		THEORY						
1.	MV3811	Marine Workshop Practical and Afloat Training	EEC		8hrs per day – 6 days a week, 24 weeks, 500 Marks. Sessional Marks 200 Report + Viva 300			**18**

If students undergo "Marine Workshop Practical and Afloat Training", in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

TOTAL CREDITS: 177

ELECTIVE – MANAGEMENT

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE3752	Principles of Management[#]	HSMC	3	0	0	3	3
2.	GE3753	Total Quality Management	HSMC	3	0	0	3	3
3.	GE3754	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	GE3755	Human Resource Management[#]	HSMC	3	0	0	3	3
5.	GE3756	Knowledge Management	HSMC	3	0	0	3	3
6.	GE3757	Industrial Management	HSMC	3	0	0	3	3

[#] If the courses enrolled either in Professional Elective courses or Management Elective, the same courses shall not be repeated.

MANDATORY COURSES I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX3082	Elements of Literature	MC	3	0	0	3	0
3.	MX3083	Film Appreciation	MC	3	0	0	3	0
4.	MX3084	Disaster Management	MC	3	0	0	3	0

MANDATORY COURSES II

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3085	Well Being with traditional practices (Yoga, Ayurveda and Siddha)	MC	3	0	0	3	0
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3	0
5.	MX3089	Industrial Safety	MC	3	0	0	3	0

PROFESSIONAL ELECTIVE COURSES:VERTICALS			
VERTICAL 1	**VERTICAL 2**	**VERTICAL 3**	**VERTICAL 4**
LOGISTICS AND SUPPLY CHAIN MANAGEMENT	**DIVERSIFIED COURSES GROUP 1**	**DIVERSIFIED COURSES GROUP 2**	**DIVERSIFIED COURSES GROUP 3**
Automation in Manufacturing	Ship logistics and Management	Mechanics of Marine Machines	High Voltage Engineering
Warehousing Automation	English for Competitive Examination	Marine Manufacturing Technology	Marine Control Engineering and Automation
Material Handling Equipment, Repair and Maintenance	Principles of Management	Marine Engineering Materials	Marine Electronics
Robotics	Human Resource Management	Marine Corrosion and Prevention	Marine Robotics
Container Logistics	Safety Precautions and Watch Keeping	Marine Machinery and Systems Design	Cyber Physical Systems
Logistics in Manufacturing, Supply Chain and Distribution	Ship Safety and Environmental Protection	Special Duty Vessels and Type of Operation	Autonomous Ships
Data Science	Advanced Marine Heat Engines	Marine Vehicles	Underwater Vehicles
-	Marine Engineering Thermodynamics	Fuel Cell Technologies	Offshore Technology

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.

Total number of courses per vertical may change as 6 or 7 or 8. If there is shortage of courses in a vertical then necessary courses may be chosen from another vertical of the same programme.

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL 1: LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total contact periods	Credits
				L	T	P		
1.	CME373	Automation in Manufacturing	PEC	3	0	0	3	3
2.	CME374	Warehousing Automation	PEC	3	0	0	3	3
3.	CME375	Material Handling Equipment, Repair and Maintenance	PEC	3	0	0	3	3
4.	CME376	Logistics in Manufacturing, Supply Chain and Distribution	PEC	3	0	0	3	3
5.	CME377	Container Logistics	PEC	3	0	0	3	3
6.	CME378	Robotics	PEC	2	0	2	4	3
7.	CME379	Data Science	PEC	3	0	0	3	3

VERTICAL 2: DIVERSIFIED COURSES GROUP 1

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total contact periods	Credits
				L	T	P		
1.	MV3001	Ship logistics and Management	PEC	3	0	0	3	3
2.	MV3002	English for Competitive Examination	PEC	3	0	0	3	3
3.	MV3003	Principles of Management #	PEC	3	0	0	3	3
4.	MV3004	Human Resource Management #	PEC	3	0	0	3	3
5.	MV3005	Safety Precautions and Watch Keeping	PEC	3	0	0	3	3
6.	MV3006	Ship Safety and Environmental Protection	PEC	3	0	0	3	3
7.	MV3007	Advanced Marine Heat Engines	PEC	3	0	0	3	3
8.	MV3008	Marine Engineering Thermodynamics	PEC	3	0	0	3	3

If the courses enrolled either in Professional Elective courses or Management Elective, the same courses shall not be repeated.

VERTICAL 3: DIVERSIFIED COURSES GROUP 2

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total contact periods	Credits
				L	T	P		
1.	MV3009	Mechanics of Marine Machines	PEC	3	0	0	3	3
2.	MV3010	Marine Manufacturing Technology	PEC	3	0	0	3	3
3.	MV3011	Marine Engineering Materials	PEC	3	0	0	3	3
4.	MV3012	Marine Corrosion and Prevention	PEC	3	0	0	3	3
5.	MV3013	Marine Machinery and Systems Design	PEC	3	0	0	3	3
6.	MV3014	Special Duty Vessels and Type of Operation	PEC	3	0	0	3	3
7.	MV3015	Marine Vehicles	PEC	3	0	0	3	3
8.	MV3016	Fuel Cell Technologies	PEC	3	0	0	3	3

VERTICAL 4: DIVERSIFIED COURSES GROUP 3

Sl. No.	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1.	MV3017	High Voltage Engineering	PEC	3	0	0	3	3
2.	MV3018	Marine Control Engineering and Automation	PEC	3	0	0	3	3
3.	MV3019	Marine Electronics	PEC	3	0	0	3	3
4.	MV3020	Marine Robotics	PEC	3	0	0	3	3
5.	MV3021	Cyber Physical Systems	PEC	3	0	0	3	3
6.	MV3022	Autonomous Ships	PEC	3	0	0	3	3
7.	MV3023	Underwater Vehicles	PEC	3	0	0	3	3
8.	MV3024	Offshore Technology	PEC	3	0	0	3	3

OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories.)

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS351	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS352	IoT Concepts and Applications	OEC	2	0	2	4	3
3.	OCS353	Data Science Fundamentals	OEC	2	0	2	4	3
4.	OCS354	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVES – III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS351	English for Competitive Examinations	OEC	3	0	0	3	3
2.	OCE353	Lean Concepts, Tools And Practices	OEC	3	0	0	3	3
3.	OMG352	NGOs and Sustainable Development	OEC	3	0	0	3	3
4.	OMG353	Democracy and Good Governance	OEC	3	0	0	3	3
5.	OME353	Renewable Energy Technologies	OEC	3	0	0	3	3
6.	OME354	Applied Design Thinking	OEC	2	0	2	4	3
7.	OMF351	Reverse Engineering	OEC	3	0	0	3	3
8.	OMF353	Sustainable Manufacturing	OEC	3	0	0	3	3
9.	OAU351	Electric and Hybrid Vehicle	OEC	3	0	0	3	3
10.	OAS352	Space Engineering	OEC	3	0	0	3	3
11.	OIM351	Industrial Management	OEC	3	0	0	3	3
12.	OIE354	Quality Engineering	OEC	3	0	0	3	3
13.	OSF351	Fire Safety Engineering	OEC	3	0	0	3	3
14.	OML351	Introduction to non-destructive testing	OEC	3	0	0	3	3
15.	OMR351	Mechatronics	OEC	3	0	0	3	3
16.	ORA351	Foundation of Robotics	OEC	3	0	0	3	3
17.	OAE352	Fundamentals of Aeronautical engineering	OEC	3	0	0	3	3
18.	OGI351	Remote Sensing Concepts	OEC	3	0	0	3	3
19.	OAI351	Urban Agriculture	OEC	3	0	0	3	3
20.	OEN351	Drinking Water Supply and Treatment	OEC	3	0	0	3	3
21.	OEE352	Electric Vehicle technology	OEC	3	0	0	3	3
22.	OEI353	Introduction to PLC Programming	OEC	3	0	0	3	3
23.	OCH351	Nano Technology	OEC	3	0	0	3	3
24.	OCH352	Functional Materials	OEC	3	0	0	3	3
25.	OBT352	Biomedical Instrumentation	OEC	3	0	0	3	3
26.	OFD352	Traditional Indian Foods	OEC	3	0	0	3	3
27.	OFD353	Introduction to food	OEC	3	0	0	3	3

		processing						
28.	OPY352	IPR for Pharma Industry	OEC	3	0	0	3	3
29.	OTT351	Basics of Textile Finishing	OEC	3	0	0	3	3
30.	OTT352	Industrial Engineering for Garment Industry	OEC	3	0	0	3	3
31.	OTT353	Basics of Textile Manufacture	OEC	3	0	0	3	3
32.	OPE351	Introduction to Petroleum Refining and Petrochemicals	OEC	3	0	0	3	3
33.	OPE352	Energy Conservation and Management	OEC	3	0	0	3	3
34.	OPT351	Basics of Plastics Processing	OEC	3	0	0	3	3
35.	OEC351	Signals and Systems	OEC	3	0	0	3	3
36.	OEC352	Fundamentals of Electronic Devices and Circuits	OEC	3	0	0	3	3
37.	OBM351	Foundation Skills in integrated product Development	OEC	3	0	0	3	3
38.	OBM352	Assistive Technology	OEC	3	0	0	3	3
39.	OMA352	Operations Research	OEC	3	0	0	3	3
40.	OMA353	Algebra and Number Theory	OEC	3	0	0	3	3
41.	OMA354	Linear Algebra	OEC	3	0	0	3	3

OPEN ELECTIVES – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS352	Project Report Writing	OEC	3	0	0	3	3
2.	OCE354	Basics of Integrated Water Resources Management	OEC	3	0	0	3	3
3.	OMA355	Advanced Numerical Methods	OEC	3	0	0	3	3
4.	OMA356	Random Processes	OEC	3	0	0	3	3
5.	OMA357	Queuing and Reliability Modelling	OEC	3	0	0	3	3
6.	OMG354	Production and Operations Management for Entrepreneurs	OEC	3	0	0	3	3
7.	OMG355	Multivariate Data Analysis	OEC	3	0	0	3	3
8.	OME352	Additive Manufacturing	OEC	3	0	0	3	3
9.	OME353	New Product Development	OEC	3	0	0	3	3
10.	OME355	Industrial Design &	OEC	2	0	2	4	3

		Rapid Prototyping Techniques						
11.	OMF352	Micro and Precision Engineering	OEC	3	0	0	3	3
12.	OMF354	Cost Management of Engineering Projects	OEC	3	0	0	3	3
13.	OAU352	Batteries and Management system	OEC	3	0	0	3	3
14.	OAU353	Sensors and Actuators	OEC	3	0	0	3	3
15.	OAS353	Space Vehicles	OEC	3	0	0	3	3
16.	OIM352	Management Science	OEC	3	0	0	3	3
17.	OIM353	Production Planning and Control	OEC	3	0	0	3	3
18.	OIE353	Operations Management	OEC	3	0	0	3	3
19.	OSF352	Industrial Hygiene	OEC	3	0	0	3	3
20.	OSF353	Chemical Process Safety	OEC	3	0	0	3	3
21.	OML352	Electrical, Electronic and Magnetic materials	OEC	3	0	0	3	3
22.	OML353	Nanomaterials and applications	OEC	3	0	0	3	3
23.	OMR352	Hydraulics and Pneumatics	OEC	3	0	0	3	3
24.	OMR353	Sensors	OEC	3	0	0	3	3
25.	ORA352	Foundation of Automation	OEC	3	0	0	3	3
26.	ORA353	Concepts in Mobile Robotics	OEC	3	0	0	3	3
27.	OAE353	Drone Technologies	OEC	3	0	0	3	3
28.	OGI352	Geographical Information System	OEC	3	0	0	3	3
29.	OAI352	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3
30.	OEN352	Biodiversity Conservation	OEC	3	0	0	3	3
31.	OEE353	Introduction to control systems	OEC	3	0	0	3	3
32.	OEI354	Introduction to Industrial Automation Systems	OEC	3	0	0	3	3
33.	OCH353	Energy Technology	OEC	3	0	0	3	3
34.	OCH354	Surface Science	OEC	3	0	0	3	3
35.	OBT353	Environment and Agriculture	OEC	3	0	0	3	3
36.	OFD354	Fundamentals of Food Engineering	OEC	3	0	0	3	3
37.	OFD355	Food safety and Quality Regulations	OEC	3	0	0	3	3
38.	OPY353	Nutraceuticals	OEC	3	0	0	3	3
39.	OTT354	Basics of Dyeing and Printing	OEC	3	0	0	3	3

40.	OTT355	Fibre Science	OEC	3	0	0	3	3
41.	OTT356	Garment Manufacturing Technology	OEC	3	0	0	3	3
42.	OPE353	Industrial safety	OEC	3	0	0	3	3
43.	OPE354	Unit Operations in Petro Chemical Industries	OEC	3	0	0	3	3
44.	OPT352	Plastic Materials for Engineers	OEC	3	0	0	3	3
45.	OPT353	Properties and Testing of Plastics	OEC	3	0	0	3	3
46.	OEC353	VLSI Design	OEC	3	0	0	3	3
47.	OEC354	Industrial IoT and Industry 4.0	OEC	2	0	2	4	3
48.	OBM353	Wearable devices	OEC	3	0	0	3	3
49.	OBM354	Medical Informatics	OEC	3	0	0	3	3

B.E. MARINE ENGINEERING										
S.No	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII/VIII	VIII/ VII	
1	HSMC	4	3					5		10
2	BSC	12	7	4	2					25
3	ESC	5	11	10	8	4				38
4	PCC			10	14	3	8	6		41
5	PEC					12	12			24
6	OEC						3	9		12
7	EEC	1	2	1				3	18	25
8	Non-Credit /(Mandatory)					√	√			
Total		21	22	25	24	19	23	23	18	177

ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 of Regulations 2021.

VERTICALS FOR MINOR DEGREE (In addition to the all the verticals of other programmes)

VERTICAL I FINTECH AND BLOCK CHAIN	VERTICAL II ENTREPRENEURSHIP	VERTICAL III PUBLIC ADMINISTRATION	VERTICAL IV BUSINESS DATA ANALYTICS	VERTICAL V ENVIRONMENTAL AND SUSTAINABILITY
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics For Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Datamining For Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management For Business	Administrative Theories	Marketing And Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation And Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL 1: FINTECH AND BLOCK CHAIN

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG331	Financial Management	PEC	3	0	0	3	3
2.	CMG332	Fundamentals of Investment	PEC	3	0	0	3	3
3.	CMG333	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	CMG334	Introduction to Blockchain and its Applications	PEC	3	0	0	3	3
5.	CMG335	Fintech Personal Finance and Payments	PEC	3	0	0	3	3
6.	CMG336	Introduction to Fintech	PEC	3	0	0	3	3

VERTICAL 2: ENTREPRENEURSHIP

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG337	Foundations of Entrepreneurship	PEC	3	0	0	3	3
2.	CMG338	Team Building & Leadership Management for Business	PEC	3	0	0	3	3
3.	CMG339	Creativity & Innovation in Entrepreneurship	PEC	3	0	0	3	3
4.	CMG340	Principles of Marketing Management For Business	PEC	3	0	0	3	3
5.	CMG341	Human Resource Management for Entrepreneurs	PEC	3	0	0	3	3
6.	CMG342	Financing New Business Ventures	PEC	3	0	0	3	3

VERTICAL 3: PUBLIC ADMINISTRATION

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG343	Principles of Public Administration	PEC	3	0	0	3	3
2.	CMG344	Constitution of India	PEC	3	0	0	3	3
3.	CMG345	Public Personnel Administration	PEC	3	0	0	3	3
4.	CMG346	Administrative Theories	PEC	3	0	0	3	3
5.	CMG347	Indian Administrative System	PEC	3	0	0	3	3
6.	CMG348	Public Policy Administration	PEC	3	0	0	3	3

VERTICAL 4: BUSINESS DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG349	Statistics For Management	PEC	3	0	0	3	3
2.	CMG350	Datamining For Business Intelligence	PEC	3	0	0	3	3
3.	CMG351	Human Resource Analytics	PEC	3	0	0	3	3
4.	CMG352	Marketing And Social Media Web Analytics	PEC	3	0	0	3	3
5.	CMG353	Operation And Supply Chain Analytics	PEC	3	0	0	3	3
6.	CMG354	Financial Analytics	PEC	3	0	0	3	3

VERTICAL 5: ENVIRONMENTAL AND SUSTAINABILITY

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CES331	Sustainable infrastructure Development	PEC	3	0	0	3	3
2.	CES332	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	CES333	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	CES334	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	CES335	Green Technology	PEC	3	0	0	3	3
6.	CES336	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	CES337	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	CES338	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 9+3

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
2. Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.

REFERENCES:

1. Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
2. Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015.
3. James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
4. Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
6. Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

MV3301 MARINE HYDRAULICS AND FLUID MACHINERY L T P C
3 0 0 3

COURSE OBJECTIVES:

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

- To impart knowledge on properties of fluid
- To understand fluid kinematics and dynamics
- Learn laminar and turbulent flow of fluid
- To understand the working principles and characteristics of different types of pumps used onboard ship
- Able to classify and understand working of turbines

UNIT I FLUID STATICS 9

Properties of fluid – pressure head – Pascal's law – absolute and gauge pressures – measurement of pressure – manometers (single, U-tube, differential), Mechanical gauges – Hydrostatic forces on a submerged plane and curved surfaces – centre of pressure – Buoyancy and Floatation – Meta-centric height – stability of floating and submerged bodies.

UNIT II FLUID KINEMATICS AND DYNAMICS 9

Kinematics: Types of fluid flow – Types of flow lines – rate of flow – continuity equation – circulation and vorticity – stream function, velocity potential – equipotent line – cauchy riemann equations – flow nets.
Dynamics: Euler's Equation of motion – bernoulli's equation – applications – venturimeter, orifice meter, pilot tube – free liquid jet – impulse momentum equation – coriolis co-efficients –flow through an orifice – torricelli's theorem – hydraulic coefficients.

UNIT III LAMINAR AND TURBULENT FLOWS 9

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

UNIT IV PUMPS 9

Roto dynamic pumps – principles of dimensional analysis – Buckinghams theorem – important dimensionless numbers applicable to fluid mechanics – impact of jets – force exerted by a jet on flat, curved plates and pipe bends. Surge pressure and control – centrifugal pumps – some definitions – pump output and efficiencies – effect of vane angle– cavitation – constructional details, pump characteristics, multistage pumps. Axial flow pumps – characteristics – constructional details, non-dimensional parameters – efficiencies. Vibration & noise in hydraulic pumps.

UNIT V HYDRAULIC TURBINES **9**

Classification of hydraulic turbines – pelton turbines, velocity triangle – efficiencies – non dimensional numbers, working principle of the pelton wheel. francis and kaplan turbines – velocity triangles, - efficiencies of the draft tubes, hydraulic turbine characteristics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: To understand the Fluid properties and effect of various forces acting on different planes, surfaces and Pipes.
CO2: The In-viscid flow and Real Viscous flow and their characteristics.
CO3: To understand the working principles of pumps.
CO4: To understand and apply the theoretical knowledge hydraulic turbines fitted on board ships.
CO5: Apply basic equation of laminar flow and turbulent flows of liquid.

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. Roberson, J.A. and Crowe C.T., "Engineering Fluid Mechanics", 6th Edition, John wiley, 1999.
2. Narayana Pillai,N,"Principles of Fluid Mechanics and Fluid Machines",3rd Edition, University Press, 2013
3. James A. Fay, "Introduction to Fluid Mechanics", PHI Learning Pvt. Ltd.,1994
4. Anthony Esposito, " Fluid Power with Applications",6th Ed. Pearson, 2003
5. R K Rajput, "Fluid Mechanics and Hydraulic Machines" 2nd revised Edition, S.Chand & Company Ltd., New Delhi, 2002
6. Bruce,R.M., Donald, F.Y., Theodore, H.O., "Fundamentals Of Fluid Mechanics" 5th Edition, John Wiley &Sons (Asia) Pvt. Ltd. India,2002

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	1															
2		1														
3					1											
4	1															
5		1														
Avg	2	2			1											

MV3302 STRENGTH OF MATERIALS FOR MARINE ENGINEERS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.

CO2: Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.

CO3: Apply basic equation of simple torsion in designing of shafts and helical spring

CO4: Calculate the slope and deflection in beams using different methods.

CO5: Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

REFERENCES:

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PS O4
1	1															
2	1															
3		1														
4				1												
5		1														
Avg	2	2		1												

MV3303 MARINE AUXILIARY MACHINERY L T P C
0 0 4

COURSE OBJECTIVES:

- To impart knowledge on pumps, piping systems and its fittings
- Inculcate knowledge on heat exchanger, evaporators and distillers
- To acquire peripheral knowledge on oil purifier, air compressor and deck machinery.
- To impart knowledge on pollution prevention equipment's
- To understand the concepts of steering gear system

UNIT I PUMPS, PIPING SYSTEMS AND FITTINGS 12

Layout of main and auxiliary machinery in Engine Rooms of different ships, different types of pumps – centrifugal, gear, screw and reciprocating- characteristics performance, applications and maintenance. Piping system- bilge and ballast, fuel oil bunkering and service, lubricating oil, engine central cooling system, steam and condensate system, central priming system, control and service air system, hydrophore system and fire main system. Different types of valves- globe, gate, butterfly, relief valve, Quick closing valve, pressure reducing valve, SDNR valve- principle, working and applications. Principle and working of simplex and duplex filters, Autoclean, back flushing and magnetic filters. Different types of packing materials used on board the ships.

UNIT II HEAT EXCHANGERS, EVAPORATORS AND DISTILLERS 12

Principle of surface heat transfer–description, contact heat transfer, construction of shell and tube type–flat plate type, single and double pass–lubricating oil coolers, fuel oil heaters, fresh water coolers, compressed air coolers, Calorifier. Maintenance of heat exchanger and Thermal expansion allowance Distilling equipment on board a ship, methods of distillation- single effect and double effect shell type evaporator, low pressure vacuum evaporator, flash evaporators, multiple effect evaporators. Maintenance of Freshwater generator. Salinometer- Reverse osmosis desalination plant – membranes - drinking water and treatment.

UNIT III THEORY OF OIL PURIFIER, AIR COMPRESSOR AND DECK MACHINERY. 12

Construction, operation, maintenance of fuel oil and lubrication oil purifiers- clarifiers together with self de sludge operation. Construction and Operation, maintenance of main air compress. Theory of air compressor. Emergency air compressor. Uses of compressed air on board the ships. Construction and operation of bow thrusters, cargo winches, windlass and mooring winches.

UNIT IV POLLUTION PREVENTION EQUIPMENTS 12

Prevention of pollution by oil, garbage, sewage- IMO requirement as per MARPOL act. Operation, construction, maintenance of oily water separator both manual and automatic versions- coalescence- ODMS- Control system – Discharge criteria of waste bilge water. Operation, construction, maintenance of incinerator- sludge burning procedure. Construction and operation of sewage treatment plant on board the ships- comminutor- plant - Discharge criteria of treated sewage water

UNIT V STEERING SYSTEM **12**

Hydraulic Telemotor system (Transmitter and receiver), Bypass valve–charging system, hydraulic power unit–hunting gear heleshaw pump principle, construction and operation pawl and ratchet mechanism, 2-ram and 4-ram steering gear– Electro-hydraulic steering gear-safematic steering gear Rotary vane steering gear–construction–operation–safety features, relief, isolating and bypass valves, steering system regulations and testing–trouble shooting. Rudder restraining, Automatic system, general arrangement–rudder and pintle, rudder wear down–rudder carrier-swivel bearing

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the knowledge on Characteristics and application of pumps, different Pipeline systems.
CO2: Work on modern Fresh water generator, Shell and Plate type heat exchanger and drinking water treatment plant.
CO3: Construct and Operate the Purifiers, Two stage air compressor and different types of deck machinery.
CO4: Adapt and operate Oily water separator, Incinerator and Sewage treatment plant.
CO5: Modern usage of Steering Gear Operation system.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Heinz P Bloch, Fred K Geitner,” Machinery Component Maintenance and repair” 3rd edition, Elsevier,2010.
2. MARPOL 73/78, IMO Publication, 2001.
3. Vikram Gokhale, N. Nanda, “Advanced Marine Engineering Knowledge Vol. II”, 2nd Edition, Engineer Enterprises, Mumbai, 2001.
4. “Pumping and Piping Diagram”, IME Publication 1999
5. Vikram Gokhale & N. Nanda, “Marine Engineering Knowledge for Junior Engineers, 3rd Edition, Engineer Enterprises, Mumbai, 1999.
6. DK Sanyal, “Principle and Practices of marine diesel engine” 2nd edition, Bhandarkar Publication, Mumbai, 1998.

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	2															
2	1				1											
3			1													
4				1												
5					1											
Avg	3/2 =1.5			1	2/2= 1											

MV3304 **SHIP CONSTRUCTION** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- Understand the Ships terms and stresses onboard ships structure.
- Determine the Primary and Secondary girders used onboard ships.
- Distinguish between Fore-end and After-end arrangements onboard ships.
- Understand the free board and Tonnage onboard ships.
- Acquire the knowledge of Off shore Technology and Ship's Survey.

UNIT I SHIP TERMS **9**

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

UNIT II BOTTOM & SIDE FRAMING **9**

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

UNIT III FORE & AFT END ARRANGEMENTS **9**

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

UNIT IV FREE BOARD AND TONNAGE **9**

Significance and details of markings various international Regulations. Plimsol LineShipyard Practice - layout of a shipyard – Mould loft –Optical marking – Automatic plate cutting, Fabrication and assembly etc., Ship Types -Tankers, Ventilation arrangements for pump rooms, holds and oil fuel tanks – Bulk Carriers, Arrangement for the carriage of dangerous goods in bulk– Container ships – L.N.G., L.P.G., and Chemical carriers – Lash ships – Passenger ships – Dredgers – Tugs etc., - Constructional details and requirements.

UNIT V OFFSHORE TECHNOLOG **9**

Drilling ships and Platforms – Supply vessels – fire fighting arrangement – Pipe laying ships – special auxiliary service ships. Ship Surveys : Survey rules – Functions of ship classification – Societies – Surveys during construction – Periodical surveys for retention of class.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the knowledge to identify ships stresses.
CO2: Design the Primary and Secondary girders used onboard ships.
CO3: Analyze the Fore-end and After-end arrangements onboard ships.
CO4: Demonstrate the free board and Tonnage onboard ships
CO5: Interpretation of data regarding Ship's Survey

TEXT BOOKS:

1. D.J. Eyres, "Ship Construction", 4th Edition, Butter worth – Heinemann, Oxford, 1994.
2. Stokoe,E.A., "Reed's Ship Construction for Marine Engineers", 1st Edition, Thomas Reed Publication, London, 2000.
3. Thomas Lamb, " Ship Design and Construction", 1st Ed., SNAME, 2003

REFERENCES:

1. A.J. Young, "Ship Construction Sketch & Notes", 1st Edition, Butter worth – Heinemann, London,1980.
2. H.J. Pursey, "Merchant Ship Construction", 7th Edition, Brown Son & Ferguson Ltd. GlasGow Great Britain, 1994.
3. Larrie D. Ferreiro, " Ships and Science", 1st Ed. SNAME, 2006
4. Richard Lee Storch, Colin P. Hammon, Howard McRaven Bunch, and Richard C. Moore, "Ship Production, 1st Ed., SNAME,1995

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	1															
2			1													
3				1												
4											1					
5				1												
Avg	1		1	2/2 =1							1					

MV3305 SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA **L T P C 3 0 0 3**

COURSE OBJECTIVES:

- To impart working knowledge on Deck equipment and ship department
- Understand working of navigational system and equipment used.
- Practice on various knots
- To impart on LSA knowledge on life saving appliances.
- To practice survival techniques at sea

UNIT I SEAMAN & THEIR DUTIES **9**

Ship's Department, General ship knowledge ad nautical terms like poop-deck forecastle, bridge etc. deck equipment: winces, windlass, derricks cranes, gypsy, capstan, hatches and function. navigation lights and signals: port and starboard, forward and aft mast lights, colors and location. look out, precautions and bad weather, flags used on ships, flag etiquette, sound signals.

UNIT II ROPE KNOTS AND MOORINGS **9**

Types of knots. practice of knot formation, materials of ropes, strength, care and maintenance, use of mooring line, heaving line, rat guards, canvas and it's use. anchors: their use, drooping and weighing anchor, cable stopper.

UNIT III NAVIGATION 9

General knowledge of principal stars. Sextant, Navigation compasses, echo sounder, Gps, Glonass, log and uses, barometer and weather classification, G.M.T and Zonal time, wireless Navigational Instruments, radar satellite navigation etc.

UNIT IV LIFE BOATS & LIFE RAFTS 9

Life buoy, EPRIB, SART, TPA, Construction, equipment carried, carrying capacity. Davits and their operation, Launching of life rafts (Inflatable type) Embarkation into lifeboat and life raft. Survival pack, Stowage and securing arrangement, Abandon ship: Manning of lifeboat and life raft. Muster list. Radio an alarm signals, Distress signals (S.O.S) Distress Calls time and Radio frequency. Pyro – techniques.

UNIT V SURVIVAL AT SEA 9

Survival difficulties and factors, equipment available, duties of crew members, Initial action on boarding, Maintaining the craft, Practical: Knots, bends and hitches, Ropes splice, donning of life jackets, life boat drills. Lowering & hoisting of life boats (model).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Operate deck equipment's and carry out department duties
CO2: Apply knowledge choose the ropes for different types of requirement
CO3: Distinguish and select different Navigational equipment for the ship smooth functioning
CO4: Demonstrate competency skills on life saving appliance
CO5: Survive at different condition of sea

TEXT BOOKS:

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

REFERENCES

1. A.N. Cockcroft, "Seamenship and Nautical knowledge", 27th Edition, Brown son & Ferguson Ltd., Glasgow 1997.
2. Richards, " Principles of Modern Radar ", Yesdee Publishing's Pvt. Ltd., Indian Reprint 2012
3. Capt.P.M.Sarma , "Theory of Marine Gyro Compass"'1st Ed. , Bhandarkar Publications, 2002

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	1		1					1				1	1			
2	1							1								
3	1				1		1							1		1
4		1							1			1			1	
5				1				1				1		1		
Avg	3/2 =1.	1/1 =1	1/1 =1	1/1 =1	1/1 =1		1/1 =1	3/2 =1.5	1/1 =1			3/2 =1.5	1/1 =1	2/2 =1.5	1/1 =1	1/1 =1

MV3311	MARINE HYDRAULICS AND FLUID MACHINERY LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVE:

- To impart knowledge on properties of fluid
- To understand fluid kinematics and dynamics
- Learn laminar and turbulent flow of fluid

LIST OF EXPERIMENTS

(A) FLUID MECHANICS LAB **20**

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

(B) FLUID MACHINERY LAB **25**

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: Understand the flow behavior of fluids

CO2: Calculate the frictional losses and C_d of fluids when it passes through various obstructions

CO3: Calculate the performance characteristics of hydraulic pumps and turbines.

REFERENCES

1. Laboratory Manuals
2. Anthony Esposito, "Fluid Power with Applications",6th Ed. Pearson, 2003
3. Schobeiri, "Fluid Mechanics for Engineers", 1st Ed. Springer, Indian Reprint 2013(Yesdee Publishings Pvt. Ltd.)
4. Shesha Prakash, "Experiments in Hydraulics and Hydraulic Machines: Theory and Procedures", 1st Ed. PHI Learnings Pvt. Ltd.,, 2011

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS
FLUID MECHANICS LABORATORY

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

FLUID MACHINERY LABORATORY

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

MV3312 STRENGTH OF MATERIALS AND APPLIED MECHANICS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVE:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion

STRENGTH OF MATERIALS LAB

LIST OF EXPERIMENTS

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

APPLIED MECHANICS LAB

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: To operate the various testing machines.
CO2: To carry out various tests on materials
CO3: To choose the best materials for a particular use, based on the test results

REFERENCES

1. Laboratory Manuals
2. Jindal, U.C., " Strength of Materials', 1st Ed., Pearson, 2011

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

SL.NO	NAME OF THE EQUIPMENT	QTY.
1.	UTM (Universal Testing Machine)	01
2.	Compression Testing Machine	01
3.	Deflection Testing Rig	01
4.	Hardness – Vickers, Brinell, Rockwell, Testing Machines	01
5.	Spring Testing Machines – Tension, Compression	01
6.	Impact Testing Machines – (Izod, Charpy)	01
7.	Load Cells	01
8.	Fatigue Testing Machine	01
SL.NO	**NAME OF THE EQUIPMENT**	**QTY.**
1.	Crucible furnace	01
2.	Sand Strength Testing Machine	01
3.	Permeability	01
4.	Shear Strength Testing Machine	01
5.	Compression Strength Testing Machine	01
6.	Transfer Strength Testing Machine	01

MV3401 MARINE ELECTRICAL MACHINES L T P C
3 1 0 4

COURSE OBJECTIVES:

- To expose the students to the Electrical equipment's fitted on boards ships, the concepts of electrical measurements and electrical distribution systems.
- To make the students to understand the concepts of Electricity production,
- To impart knowledge on measurements, cable faults and AC Machines used in Marine Engineering.
- To understand Principles of operation and construction details of synchronous motors, induction machines
- To impart knowledge on Speed control and trouble shooting in induction machines.

UNIT I PRINCIPLES OF D.C. MACHINES AND GENERATORS 9+3

Principles of DC machines – construction – winding and E.M.F equations – armature reaction – commutation – brush shift – compensating winding – D.C. generator – their characteristics- methods of excitation – parallel operation – performance equations.

D.C. Motor –their characteristics – starting and reversing – speed – torque equations – starters– speed control including electronic method of control – testing of D.C. machines for finding out the losses and efficiency – braking of D.C. motor, Ward-Leonard control.

UNIT II TRANSFORMERS 9+3

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

UNIT III ALTERNATORS 9+3

Alternators – general arrangement – construction of salient pole and cylindrical rotor types – types of stator windings – E.M.F equation – distribution and pitch factor –waveform of E.M.F. generated – rotating magnetic field – armature reaction – voltage regulation – load characteristics – open circuit and short circuit tests – E.M.F and M.M.F. methods – parallel operation of alternators – KW and KVA sharing – Brushless alternator – static excitation system.

UNIT IV SYNCHRONOUS MOTORS 9+3

Principle of operation of 3-phase synchronous motor. – operation of infinite bus bars torque/angle characteristics – hunting – methods of starting – merits and limits of synchronous motor over others.

UNIT V INDUCTION MACHINES 9+3

Three phase induction motor –Principle of operation and theory of action – slip speed–rotor to stator relationship – rotor frequency – rotor e.m.f. and current – equivalent circuit relationship between rotor IR loss and rotor slip – torque/Slip characteristics – starting torque and maximum running Torque-Effect of change in supply voltage on Torque-Induction generator.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Operate D.C. Machines
CO2: Operate and Maintain Transformers
CO3: Design features of Alternators – their construction and operation.
CO4: Synchronous the motor
CO5: Operate and maintain induction machines

TEXT BOOKS:

1. Edmund G R, Kraallavers, “Advanced Electo-technology For Marine Engineers”, 2nd Ed. Reeds Vol 07, Adlard Coles Nautical, London, 2010
2. W. Laws, “Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.
3. IHerman, “Electrical Transformers and Rotating Machines”, 3rd Ed. Cengage, First Indian Reprint 2012 (Yesdee Publishings Pvt. Ltd.),
4. Edmund GR Kraal, Stanley Buyers, Christopher Lavers, “Basic electro-technology for marine engineers”, 4th Ed. Reeds Vol 06,2013
5. Hughes Edward, “Electrical technology”, 2nd edition, “ELBS with DP Publications”, USA, 1996.
6. I.J Nagrath and D.P Kothari, “Basic Electrical Engineering”, 2nd Edition, McGraw Hill Publishing Co., Ltd., New Delhi, 2002.

REFERENCES:

1. Uppal S.L., “Electrical Power”, 13th Edition, Khanna publishers, Mumbai, 2002.
2. Berde M.S.,” Electric Motor Drives”, 1st Edition, Khanna Publishers, Mumbai, 1995.
3. W. Laws, “Electricity Applied To Marine Engineering”, 4th edition, The Institute Of Marine Engineers, London, 1998.
4. Gorti Ramamurthi, “Handbook of Electrical Power Distribution”, 2nd Ed.Universities Press, 2009

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
1	1	1										1			1	1
2	1	1										1			1	1
3	1		1									1				
4	1		1									1			1	1
5	1	1	1									1			1	1
Avg	5/5=1	3/3=1	3/3=1									5/5=1			4/4=1	4/4=1

MV3402 MARINE REFRIGERATION AND AIR CONDITIONING L T P C
3 2 0 4

COURSE OBJECTIVES:

To impart the knowledge of students in

- Reciprocating compressors
- basic refrigeration and air conditioning
- Marine refrigerating plants
- LMTD and NTU Methods

UNIT I RECIPROCATING COMPRESSORS

Ideal cycle for compressors work transfer in a single stage compressor – mass flow – volume flow – free air delivery – effect of clearance and volumetric efficiency in single stage compressors. Multi stage compression neglecting clearance volume. Condition for minimum work input and perfect inter cooling. Tandem in line arrangements in compressors. air motors.

UNIT II BASIC REFRIGERATION AND AIR CONDITIONING

Reversed Carnot cycle – vapour compression cycle – refrigerating effect – co-efficient of performance – cooling capacity – refrigerants used in marine practice and their justification - rating of refrigeration plant – methods for improving C.O.P. – use of vapour tables – applied problems.

UNIT III MARINE REFRIGERATING PLANTS

Typical marine refrigerating plants with multiple compression and evaporator system – heat pump cycles – refrigeration in liquefied gas carriers – applied problems.

UNIT IV MARINE AIR CONDITIONING

Principles of air conditioning – Psychrometric properties of air – comfort conditions – control of humidity – airflow and air conditioning capacity – calculation for ships plants.

UNIT V BASIC DESIGN OF HEAT EXCHANGERS

Introduction - types - LMTD and NTU method - double-pipe, shell and tube type, condenser and evaporator – problems

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Calculate the performance of Reciprocating compressors
CO2: Understand the aspects of Marine refrigeration and air-conditioning
CO3: Operate Marine refrigeration plants
CO4: Apply the knowledge on maintaining air conditioning
CO5: Efficient design of Heat Exchangers for Air conditioning and refrigeration plants.

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 McGraw-Hill, Delhi, 1985.
3. Stott. J.R, “Refrigeration Machinery And Air Conditioning Plant”, Marine Engineering Practice, Vol-1 P Part-05, IMarEST, London, 1998

REFERENCES:

1. D.A. Taylor, “Introduction to Marine Engineering”, 2nd Edition, Butter Worth, London,1993.
2. J.R. Stott, “Refrigerating Machinery and Air Conditioning Plant”, 1st Edition, The Institute of Marine Engineers, London, 1974, Reprint 1998.
3. Ghoshdastidar, P.S., “ Heat transfer”, 2nd Edition, Oxford University Press, 2012
4. Sukhatme, S.P., “ Heat Transfer”,4th Ed. Universities Press, 2011
5. Roy, J. Dossat, “Principles Of Refrigeration”, 1st Ed., Pearson, 2006
   Kuppan Thulukkanam, “Heat Exchanger Design Handbook”, 1st Ed., CRC Press, 2000

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	1	1	1			1					1	1			1	
2		1					1	1								1
3	1				1				1	1			1		1	
4		1				1	1				1			1		
5			1	1	1						1			1		1
Avg	2/2=1	3/3=1	2/2=1	1/1=1	2/2=1	2/2=1	2/2=1	1/1=1	1/1=1	1/1=1	3/3=1	1/1=1	1/1=1	2/2=1	2/2=1	2/2=1

MV3403 SHIP'S FIRE PREVENTION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

To impart knowledge in students on:

- Fire protection built in ships.
- Detection and safety systems.
- Firefighting Equipment.
- Fire control.
- Safety measures of firefighting equipment.

UNIT I FIRE PROTECTION BUILT IN SHIPS

SOLAS convention, requirements in respect of materials of construction and design of ships, (class A, B, type BHDS), fire detection systems, fire test, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements for firefighting systems and equipment's on different vessels, fire doors & fire zones.

UNIT II DETECTION AND SAFETY SYSTEMS

Fire safety precautions on cargo ships, tankers and passenger ships during working. Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Description of various systems fitted on ships including micro mist and extinguishing system.

UNIT III FIRE FIGHTING EQUIPMENT

Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, construction, operation and merits of different types of portable, non-portable and fixed fire extinguishers installations for ships, properties of chemicals used, water-mist fire suppression system. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use. control of class A, C & class D fires, Combustion products & their effects on life safety.

UNIT IV FIRE CONTROL

Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, cargo holds and galley. 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, shipboard organization for fire and emergencies. Combustion products and their effects on life safety, fire signal and muster. Fire drill. Leadership and duties, Fire control plan, human behaviour.

UNIT V SAFETY MEASURES

Special safety measures for preventing, fighting fire in tankers, chemical carriers, oil rigs, supply vessels, and fire fighting ships - Safe working practice with respect to fire on board ships and first aid for hazards arising from fire in ships.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Fire protection, Detection and Safety systems in ships.
- Construction, Operation and Maintenance of Fixed and portable Fire Extinguishers in ships.
- Fire prevention and control in oil tankers, LPG / LNG carriers, Chemical tankers, oil rigs, supply vessels
- Operation of Fire fighting ships
- Extinguish Major Fire and Follow safe working practices.

TEXT BOOKS:

1. Frank Rush Brook, “Fire Aboard”, 3rd Edition, Brown, son & Ferguson Ltd., Glassgow. 1988.
2. Victory.G, Owen.I.H, “Fire Fighting Equipment And Its Use In Ships”, Marine Engineering. Practice, Vol 1, Part 05, IMarEST, London, Reprint 1998
3. M.G. Stavitsky, V.I. Vostryakov, M.F.Kortunov, V.I. Martynenko & V.M. Sidoryok., “Fire. Fighting Aboard ships Vol. I & Vol. II, Structural Design and Fire Extinguishing System”, 1st Ed. Gulf publishing company, Houston, London, 1983.

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	2	1	1	1		1	1							1		1
2	2	1	1		1										1	1
3	2	1			1	1						1			1	1
4					1					1						1
5	2	1			1		1			1		1			1	1
Avg	8/4 =2	4/4 =1	2/2 =1	1/1 =1	4/4 =1	2/2 =1	2/2 =1			2/2 =1		2/2 =1		1/1 =1	3/3 =1	5/5 =1

MV3405 **MARINE DIESEL ENGINE** **L T P C**
4 0 0 4

OBJECTIVES:

- To impart knowledge on various components of marine diesel engines and familiarisation on marine lubricating oils and associated systems
- To acquire peripheral knowledge on combustion of marine diesel engines, scavenging and turbocharging system.
- To impart knowledge on marine fuels and its properties, exhaust valve function.
- To impart brief knowledge on main engine safeties and associated systems.
- To understand the importance of reduction on marine air pollutant and acquire basic knowledge on modern intelligent engines.

UNIT I COMPONENTS OF MARINE DIESEL ENGINE AND LUBRICATION SYSTEM 12

Constructional details of Marine diesel engines- Welded construction for bedplates, Foundation bolts, 'A' frames, crosshead and guide shoes, main bearings, Crankshaft and its types - Cam shaft, connecting rod, stuffing box- Piston and piston rod, cylinder liners, cylinder heads and its mountings, tie rods, Engine chocks and its types- merits and demerits of chocks.

Auxiliary power transmission- chain and belt – gear transmission etc. Lubricating oils properties and testing of lubricating oils- Types of lubrications - Lubrication system- Main and crosshead bearing lubrication - Rocker arm- Cylinder liner lubrication. lubricating oil contamination- microbial attack- remedies - Alpha lubricator - cylinder oil properties - Cylinder lubricating quills- significance of cylinder lubricating oil.

UNIT II SCAVENGING&TURBOCHARGING AND COMBUSTION PROCESS 12

Scavenging system in two stroke and four stroke engines - various types of scavenging in two stroke engines- Merits and demerits of various scavenging system- under piston scavenging - scavenge manifolds and scavenge cooler -auxiliary blowers and its importance. Turbo charging and supercharging- types of turbocharging system - pulse and constant pressure type – axial and radial flow turbo charging- merits and demerits -significance of Turbo charger – turbo charger seals and arrangements- wet and dry cleaning of turbocharger -expansion allowance in exhaust manifold- turbo charger lubrication system- turbocharger surging. various factors affecting the combustion- two stroke and four stroke engine piston - various types of piston rings – piston ring clearances- types of piston cooling system – merits and demerits of different type of piston cooling systems.

UNIT III MARINE FUEL OIL, FUEL SYSTEM AND ENGINE RATINGS 12

Fuel oil properties - fuel oil system – fuel oil mixing column, fuel pumps -jerk and common rail systems - VIT Super VIT & Electronic injection systems. fuel injector - Incorporation of FQSL along with the VIT system on the engine- Pre combustion and post combustion effects. Exhaust valve types and its operation- Rotocap mechanism - Exhaust valve timing in 2's and 4's Marine Diesel engine – Factors affecting the operation of exhaust valves. Combustion of fuel - Mean Piston speed- Mean effective pressure- Compression ratio- Reasons for variation in compression pressure and peak pressure and its effect on engines - critical speed- MCR & CSR ratings - Heat balance diagram - Fuel contaminants -Microbiological attack.

UNIT IV MAIN ENGINE SAFETIES AND ASSOCIATED SYSTEM 12

Starting and reversing systems of Marine diesel engines - Maneuvering system - Main Engine auto slowdown and shutdown -Crash maneuvering - Safety interlock system – turning gear arrangement and importance, Crankcase relief valve - crankcase inspection, oil mist detector and its operation, crankshaft deflection. main engine power delivery- Indicator instrument- Power card -simple draw cards and out of phase diagrams - significance of power diagram - power calculations- fault detection.

UNIT V EMISSION CONTROL AND MODERN INTELLIGENT ENGINES 12

Control of NO_X, SO_X in exhaust emission -deviation from ideal condition in actual engines, comparative study of slow speed, medium speed and high engines. Construction and Operation of Sulzer, MAN and B&W, Mitsui, Mitsubishi etc. Latest development in marine diesel engines–cam less engines, UMS–Operation, Intelligent engines - RT-flex engines.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

1. Define and identify solution to Marine fuel injection systems.
2. Explain the combustion inside marine engines
3. Apply and recognize the need for the appropriate techniques to enhance fuel system.
4. Illustrate and Asses the Maneuverings systems of various marine diesel engines
5. Select the modern tools to distinguish emission controls.

TEXT BOOKS:

1. Wood yard, Doug, “Pounder’s Marine Diesel Engines”, 7th Edition, Butter Worth Heinemann Publishing, London, 2014.
2. Sanyal D.K, “Principle & Practice of Marine Diesel Engines”, 2nd Edition, Bhandarkar Publication, Mumbai, 2010
3. D.A. Taylor, “Introduction to Marine Engineering”, 2nd Edition, Butter worth – Heinemann, London, 1996

REFERENCE BOOKS:

1. Christensen, Stanley G “Lamb's Questions and Answers on The Marine Diesel Engine”, 8th Edition, Butter Worth Publications, 2001
2. John Lamb, “Marine Diesel Engines”, 8th Edition, Butter worth – Heinemann, London, 1990.
3. Christen Knak, “Diesel Motor Ships Engines and Machinery”, 1st Edition, Marine Management Ltd., London, 1990.
4. C.C Pounder, “Marine Diesel Engines”, 6th Edition, Butter worth – Heinemann, Scotland, 1995.
5. S. H. Henshall, “Medium and High-Speed Diesel Engines for Marine Use”, 1st Edition, Institute of Marine Engineers, Mumbai, 1996.
6. VL Maleev, “Internal Combustion Engines”, 2nd edition, McGraw-Hill book co., Singapore, 1987.
7. A.B. Kane, “Marine Internal Combustion Engines”, 1st Edition, Shroff Publishers & Distributors, Mumbai, 1984.

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
1	2	1	1										1			
2	1														1	
3					1							1		1	1	
4				1		1										1
5					1		1							1		1
Avg	3/2=1.5	1/1=1	1/1=1	1/1=1	2/2=1	1/1=1	1/1=1					1/1=1	1/1=1	2/2=1	2/2=1	2/2=1

MV3406 MARINE BOILERS AND STEAM ENGINEEERING L T P C
3 0 0 3

COURSE OBJECTIVE:

To Impart the knowledge to the students on

- Marine boilers and steam engines.
- Operation & Maintenance of Boilers
- The concept of marine steam plants operations
- Lubrication for Steam Engines and Turbines
- Operation and maintenance of turbines

UNIT I MARINE BOILERS & BOILER MOUNTINGS 9

Scotch Boiler, Cochran, Spanner, Clarkson thimble tube, Waste heat recovery calculation, Lamont exhaust gas boiler, Composite boilers, Water tube boilers – Babcock Wilcox, Foster Wheeler – D-type, Double evaporation boilers. Safety Valves – Improved High Lift, Full lift and full Bore type: Gauge glass – Ordinary plate type and remote Indicator; Automatic feed regulator, three element High & Low water level alarms, Main Steam stop valve, Retractable type Soot blower etc.

UNIT II OPERATION & MAINTENANCE OF BOILERS 9

Pre-commissioning procedures, Hydraulic tests, steam raising and Operating procedures, Action in the event of shortage of water. Regular boiler water tests on board. Blowing down of boiler, Laying up a boiler; general maintenance, External and internal tube cleaning. Tube renewals, etc., maintenance, inspection and survey of boilers. Refractory: **P**urposes of refractory, types of refractory and reasons for failure. Oil burning: Procedure of Liquid fuel burning in open furnace, Various types of atomizer, Furnace arrangement for oil burning, Boiler Control System i.e. master control, fuel control, air control and viscosity control, Introduction to Automation.

UNIT III MARINE STEAM PLANTS 9

Steam engines - History of multiple expansion marine reciprocating engines &steam turbines. Description of different types of steam turbines. Layout of plant - General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use, open and closed feed system.

Condensers - Types of condensers, constructional details, location & working principles, contraction and expansion allowances, leak test. Effect of change of temperature, circulating water quantity, change of main engine power, condenser surface.

UNIT IV LUBRICATION FOR STEAM ENGINES AND TURBINES 9

Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication-oil system and emergency lubrication arrangement.

UNIT V OPERATION AND MAINTENANCE OF TURBINES 9

Turbine drain system, turbine gland system, warming through a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency controls, emergency operation of turbines, vibration in marine steam turbine, steam turbine losses. Breakdown and faultfinding. Selection of materials: Materials used in various components like blades, rotors, casings, sealing glands, gears etc. & their justification.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Define the Waste heat recovery system and boiler mountings.
CO2: Infer the Operation and Watch keeping of boilers.
CO3: Demonstrate the Construction of steam turbines and steam engines.
CO4: Illustrate The Various Method of Lubrication of turbines
CO5: Define the operation and maintenance of steam turbines.

TEXT BOOKS:

1. J.H. Milton & R.M. Leach, “Marine Steam Boilers”, 4th Edition, Butter worth, London, 1980
2. C. McBirnie, “Marine Steam Engines and Turbines”, 4th Edition, Butter worth, London 1980.
3. Thomas D. Morton, “Steam Engineering Knowledge for Marine Engineers”, 3rd Edition, Thomas Reed Publications, London 1979.

REFERENCES

1. GTH. Flanagan, “Marine Boilers” 3rd Edition, Butter worth, London, 2001.
2. K.M.B. Donald, “Marine Steam Turbines”, 1st Edition, Institute of Marine Engineers, London, 1977.
3. Leslie Jackson and Thomas D. Morton, “General Engineering Knowledge for Marine Engineers, Reed’s Vol.8, Thomas Reeds Publication, United Kingdom, 2003
4. Norros.A, “Operation of Machinery in Ships Steam Turbines, Boilers”, Marine Engineering Practice, Vol 2, Part 15, IMarEST, London, 2000

MAPPING OF COS AND POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	1	1	1											1		
2			1	1					1	1			1			
3			1					1	1							1
4					1										1	
5			1									1				
Avg	1/1=1	1/1=1	4/4=1	1/1=1	1/1=1			1/1=1	2/2=1	1/1=1		1/1=1	1/1=1	1/1=1	1/1=1	1/1=1

GE3451 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY L T P C
2 0 0 2

COURSE OBJECTIVES:

1. To study the nature and its impacts on human life.
2. To study the environmental pollution, its types, control methods and protection acts
3. To provide the knowledge of about the energy management and energy resources
4. To study the concepts of Sustainability, global warming and Management
5. To study the Sustainability Practices and socio economical changes

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 9

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course the students would be able to

1.Understand the nature and its impacts on human life.
2.The students have the knowledge and awareness of Environmental Pollution.
3.Understanding of the energy sources and scientific concepts/principles behind them
4.Understand the concepts of the Sustainability and Management
5.Understand the Sustainability Practices and socio economical changes

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 .
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MV3411 WELDING TECHNIQUES, LATHE AND SPECIAL MACHINE SHOP L T P C
0 0 4 2

COURSE OBJECTIVE:

To develop skill of the students on

- Welding and Welding techniques
- Usage of hand tools
- Sheet metal work and pipe work

WELDING TECHNIQUES

LIST OF EXPERIMENTS

1. WELDING - Exercises in Electric Arc welding and Gas welding Advanced Techniques.
2. HAND TOOLS - Hand tools, sharpening, Powered hand tools, Measurements etc. Exercise involving above.
3. SHEET METAL WORKING - Simple Exercise.
4. PIPE WORK - Experiments involving thin pipes, Joining, bending, welding and inspection.

LATHE & SPECIAL M/C SHOP

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: To carry out repair of Ship machinery and components by welding
CO2: To do any kind of sheet metal works
CO3: To make machine components using Lathes and Special machines such as milling, grinding and slotting machine.

REFERENCES:

1. Youssef, “Machining Technology”, 1st Vol. Taylor & Francis, Indian Reprint 2012 (Yesdee Publishing’s Pvt. Ltd.)
2. Kuppuswamy, G., “Principles of Metal Cutting”, 1st Ed. Universities Press, Reprint 2013
3. Mukherjee,S., “Metal Fabrication Technology”,1st Ed., PHI Learning Pvt. Ltd., 2010
4. Larry Jeffus, “ Welding and Metal Fabrication”, 1st. Ed. Cengage Learning, Indian Print,2012 (Yesdee Publishings Pvt. Ltd.)

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

WELDING TECHNIQUES, LATHE AND SPECIAL MACHINE SHOP:

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

WELDING WORK SHOP

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

FITTING SHOP

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

MV3412 HEAT ENGINES, BOILER CHEMISTRY AND REFRIGERATION LABORATORY **L T P C 0 0 4 2**

COURSE OBJECTIVE:

To develop skill of the students on

- Demonstration ability to carry out the different tests on heat engines.
- Carrying out the Performance and Characteristics of heat engines.
- Performance tests on boiler feed water, oils, fuels and lubricants based on the test results
- Operation and Maintenance of Refrigeration and Air Conditioning.

HEAT ENGINES LAB

LIST OF EXPERIMENTS

1. Flue gas analysis by Orsat apparatus.
2. Study and performance characteristics of steam turbine.
3. Dryness fraction of steam using calorimeters.
4. Performance characteristics of a constant speed air blower.
5. Verification of fan laws and static efficiency of air blower.
6. Test on Reciprocating compressor.
7. C.O.P. of a Refrigeration plant.
8. Performance test on A/C plant.
9. Testing of fuels - calorific value, proximate analysis
10. Testing of fuels - Ultimate analysis, octane number, cetane number.
11. Testing of lubricants - flash point, fire point, pour point.
12. Testing of lubricants- Viscosity index, corrosion stability, carbon residue.
13. Testing of lubricants - Mechanical stability, ash content.
14. Wind Tunnel - Drag and lift measurements.
15. Performance test on IC Engine as per BIS specifications.

BOILER CHEMISTRY LAB

16. To determine hardness content of the sample of boiler water in P.P.M. in terms of CaCO3.
17. To determine Chloride Content of the sample of water in P.P.M. in terms of CaCO3.

18. To determine Alkalinity due to Phenolphthaline, total Alk. and Caustic Alk. Of the sample of water (in P.P.M).
19. To determine Phosphate Content of the sample of water.
20. To determine dissolved Oxygen content of the sample of water.
21. To determine sulphate content of given sample of water.
22. To determine Ph-value of the given sample of water.
23. Boiler trial.
24. Water Testing - Dissolved oxygen, total-dissolved solids, turbidity.
25. Water Analysis (Fresh and sea water)- Chloride, sulphate, hardness.
26. Sludges and scale deposit - Silica, volatile and non-volatile suspended matter.

REFRIGERATION LABORATORY

27. Watch keeping: Parameters to be monitored during running of refrigeration unit.
28. Various cut-outs, viz, pressure, temperature
29. Determination of actual COP, theoretical COP and Carnot COP.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students will be able to:

CO1: To Perform various tests on the heat engines
CO2: To Analyze the results to understand the performance characteristics of Engines
CO3: To Perform Boiler water tests, Sea water and fresh water tests
CO4: To Choose the best water, oils, fuels and lubricants based on the test results.

REFERENCES:

1. Laboratory Manuals
2. Skelly.J.D, **"**Water Treatment**",** Marine Engineering Practice **,** Vol-2 Part-14**,** IMarEST, London, 2004
3. Mathur, M.L., Sharma, R.P., "Internal Combustion Engines", 7th Ed. Dhanpat rai Publications, REPRINT 2002
4. Willard W. Pulkrabek, "Engineering Fundamentals of the Internal Combustion Engines", 1st Ed., PHI Learnings Pvt. Ltd., 2011
5. Flanagan,G.T.H, 'Marine Boilers", 1st Ed. ,Elsevier, 1990

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
HEAT ENGINES LAB

Sl.No	Name of the Equipment	Qty.
1.	Orsat Apparatus	02 nos
2.	Steam Turbine	01
3.	Steam Calorimeter	01
4.	Air Blower	01
5.	Air Compressor	02 nos
6.	Vapour Compression Refrigeration test rig	01
7.	Vapour compression Air Conditioning test rig	01
8.	Bomb calorimeter and Junker's calorimeter	01
9.	Crucible Metener Burner, Electric Benser Hot air oven	01
10.	Flash & Fire point – closed cup apparatus	01
	Redwood's Viscometer	01
	Say bolt's Viscometer	01
11.	Carbon residue apparatus.	
12.	Wind Tunnel	01

FUELS AND LUBRICATION OIL TESTING EQUIPMENTS

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

BOILER CHEMISTRY LAB

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

THERMAL ENGINEERING

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

INTERNAL COMBUSTION ENGINES SECTION

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

MARINE AC & REFRIGERATION LABORATORY

Sl.No	Name of the Equipment	Qty.
01	Marine Refrigeration Plant (10 ton capacity)	**01**
02	Marine Air Conditioning Plant (10 ton capacity)	**01**
03	Vapour compression and Vapour Absorption refrigeration test RIG	**01 each**

POS:

CO	PO												PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
1	1	1	1		1							1				
2		1	1												1	1
3	1	1	1													
4				1	1							1				1
5		1		1			1	1					1			
Avg	2/2=1	4/4=1	3/2=1.5	2/2=1	2/2=1		1/1=1	1/1=1				2/2=1	1/1=1		1/1=1	2/2=1