Bangabandhu Sheikh Mujibur Rahman Maritime University, Bangladesh

Curriculum of 4-Year "Bachelor of Maritime Science (Engineering)

Effective from the Session:20 __- Onwards

RECORD OF AMENDMENTS

CHANGE NO	DATE INSERTED	SIGNATURE	NAME	REMARKS

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PREAMBLE

1 Program Description

The Bachelor of Maritime Science (Engineering) is a 4 year Undergraduate degree program of Bangabandhu Sheikh Mujibur Rahman Maritime University (BSMRMU), Bangladesh that deals with Maritime Education & Training. Also provides technical training and the methodology necessary for marine propulsion, electrical, refrigeration, and steering systems, its operation and maintenance as well as controlling the operation of the ship and care for persons on board at the operational and management level of marine engineering.

2 Program Educational Objectives

The aim of Bachelor of Maritime Science (Engineering) Program is to

a. Provide and equip students with knowledge, understanding, proficiencies, skills, competences, attitudes and values to qualify and prepare them for assessment and certification as Officer-in-Charge of an Engineering Watch (OICEW) in a manned engine-room or designated duty engineer officer in a periodically unmanned engine room on seagoing ships powered by main propulsion machinery of 750 kW propulsion power or more; and

b. Produce graduates who are qualified to pursue a professional career or advanced studies in a related maritime field of specialization

3 Program Outcomes

The graduates of the Bachelor of Maritime Science (Engineering) program shall have acquired the knowledge and competences necessary to perform the following:

a. Demonstrate the ability to perform the competence, at the operational level under Section A-III/1 of the STCW Code.

b. Apply knowledge in mathematics, science and technology in solving problems related to the profession and the workplace.

c. Work in a multi-cultural and/or multi-disciplinary team.

d. Understand professional and ethical responsibilities.

e. Communicate effectively in oral and written English.

f. Understand the impact and implications of various contemporary issues in the global and social context of the profession.

g. Engage in lifelong learning and keep abreast with developments in the field of specialization and/or profession.

h. Use appropriate techniques, skills and modern tools in the practice of the profession in order to remain globally competitive.

j. Conduct research using appropriate research methodologies.

4 Enabling Objectives (Specific Professions/Careers/Occupations or Trades)

The Syllabus for the 4-Year **"Bachelor of Maritime Science (Engineering)"** is according to the requirements of STCW conventions as amended of IMO and that of the Department of Shipping, Government of the People's Republic of Bangladesh for competencies required for "**Officer in charge of an Engineering Watch".** A graduate of the Bachelor of Maritime Science (Engineering) program is prepared for careers in, among others:

a. Merchant Marine profession and Commercial Marine fishing

b. Maritime Industry

c. Ship building and repair

d. Ship operations and management

e. Port operations and management

f. Ship surveying and inspection

g. Offshore industry

h. Maritime Education and Training

j. Industrial and Commercial Establishment

k. Government Service

l. Bangladesh Navy

m. Bangladesh Coast Guard

n. Maritime Industry Authority, etc.

5 Course Designation System

Each course is designated by a maximum of four letter code identifying the programme or department offering the course followed by a four-digit number having the following interpretation:

a. The first digit corresponds to the year in which the course is normally taken by the students.
b. The second digit corresponds to the semester in which the course is normally taken by the students.
c. The last two digits denote a course, where an odd number is used for a theoretical course and an even number for Laboratory/Practical course.

6 Curriculum Structure

Bachelor of Maritime Science (Engineering) Programme consists of total 58 courses excluding non-credit courses and divided into the following categories:

Category	No. of Theory Courses	No. of Lab/Practical Courses	No. of Non-Credit Courses	Credit Hours
Core Courses (ME)	23	8	-	81
Optional Course (ME)	1	-	-	3
Allied Engineering Courses	4	3	-	16.5
Basic Science	5	2	-	18
Humanities/Social Science	6	1	-	19.5
Thesis	-	1	-	8
On- Board Training/ Industrial Attachment	-	1	-	12
Presentation Skill/Study Tour	-	2	-	3
Degree ++	-	-	3	-
Total	**39**	**18**	**3**	**161**

Code	Course Name	Credit
Core Courses		
Theory		
ME 1101	Applied Mechanics	3
ME 1103	Engineering Thermodynamics	3
ME 1105	Material Strength & Workshop Process	3
ME 1207	Machine Drawing-I	3
ME 1209	Pump, Refrigeration & Air-Conditioning	3
ME 2111	Marine Internal Combustion Engine-I	3
ME 2113	Marine Propulsion & Steering	3
ME 2115	Basic Naval Architecture	3
ME 2117	Marine Boiler & Steam Engineering	3
ME 2119	Fluid Mechanics & Hydraulics	3
ME 2121	Machine Drawing-II	3
ME 2223	Marine Internal Combustion Engine-II	3
ME 2225	Machine Drawing-III	3
ME 2227	Applied Heat	3
ME 2229	Marine Fuels & Lubricants	3
ME 2231	Turbocharger & Scavenging Technology	3
ME 4133	Deck Machineries & Bridge Equipment	3
ME 4135	Maneuvering & Associated Systems	3
ME 4137	Ship Construction & Repair	3
ME 4139	Control Engineering & Mechatronics	3
ME 4141	Maritime Safety & Environmental Science	3
ME 4143	Research Methodology	3
ME 4245	Fuel Combustion System & Energy Efficiency	3
Practical		
ME 1102	Marine Workshop Practices-I	1.5
ME 1204	Marine Workshop Practices-II	1.5
ME 2106	Maintenance of Machineries-I	1.5
ME 2108	Marine Workshop Practices-III	1.5
ME 2210	Maintenance of Machineries-II	1.5
ME 4112	Engine Room Simulator Sessional	1.5
ME 4214	Control Engineering & Mechatronics Sessional	1.5
ME 4216	Welding Technology	1.5
Optional Course – Anyone from the following		
ME 4247	Fishing Vessel Technology	3
ME 4249	Recycling of Marine Structure	3
ME 4251	Power Plant Technology	3
Allied Engineering Courses		
Theory		
EEE 1201	Basic Electrical & Electronics Engineering	3
EEE 2103	Marine Electrical Machineries	3
EEE 4105	Marine Electrical Installation & Instrumentation	3
EEE 4207	Power System Protection	3

Practical		
CSE 1102	Computer Programming & Applications	1.5
EEE 1202	Basic Electrical & Electronics Engineering Sessional	1.5
EEE 4104	Marine Electrical Installation & Instrumentation Sessional	1.5
Basic Science		
Theory		
PHY 1101	Physics-I	3
MATH 1101	Mathematics-I	3
PHY 1203	Physics-II	3
MATH 1203	Mathematics-II	3
CHEM 2201	General Chemistry	3
Practical		
PHY 1202	Physics Sessional	1.5
CHEM 2202	General Chemistry Sessional	1.5
Humanities/Social Science		
Theory		
HUM 1101	English	3
HUM 1203	Leadership & Professional Ethics	3
HUM 4105	Maritime Law & Policy	3
HUM 4207	বাংলা ভাষা (Bangla Language)	3
HUM 4209	Bangladesh Studies	3
HUM 4211	Maritime Economics	3
Practical		
HUM 1102	Maritime English & Communication Skill Sessional	1.5
Project & Thesis		
ME 4000	Thesis	8
On- Board Training/ Industrial Attachment- Anyone from the following		
ME 3002	On-Board Training	12
ME 3004	Alternative to On-Board Training (Maritime Apprenticeship)	12
Presentation Skill/Study Tour		
DEV 2202	Industrial Visit	1.5
DEV 4204	Seminar/Workshop	1.5
Degree ++ (Non Credit)		
----------	Degree ++ (Three courses)	----------
Total 57 Courses (Excluding Degree++ Courses)		161

7 Course Schedule for Bachelor of Maritime Science (Engineering)

Year-1: Semester-1		
Code	**Course Name**	**Credit**
Theoretical		
HUM 1101	English	3
PHY 1101	Physics-I	3
MATH 1101	Mathematics-I	3
ME 1101	Applied Mechanics	3
ME 1103	Engineering Thermodynamics	3
ME 1105	Material Strength & Workshop Process	3
Practical		
HUM 1102	Maritime English & Communication Skill Sessional	1.5
CSE 1102	Computer Programming & Applications	1.5
ME 1102	Marine Workshop Practices-I	1.5
Total		**22.5**

Year-1: Semester-2		
Code	**Course Name**	**Credit**
Theoretical		
HUM 1203	Leadership & Professional Ethics	3
PHY 1203	Physics-II	3
MATH 1203	Mathematics-II	3
EEE 1201	Basic Electrical & Electronics Engineering	3
ME 1207	Machine Drawing-I	3
ME 1209	Pump, Refrigeration & Air-Conditioning	3
Practical		
PHY 1202	Physics Sessional	1.5
EEE 1202	Basic Electrical & Electronics Engineering Sessional	1.5
ME 1204	Marine Workshop Practices-II	1.5
Total		**22.5**

Year-2: Semester-1		
Code	**Course Name**	**Credit**
Theoretical		
EEE 2103	Marine Electrical Machineries	3
ME 2111	Marine Internal Combustion Engine-I	3
ME 2113	Marine Propulsion & Steering	3
ME 2115	Basic Naval Architecture	3
ME 2117	Marine Boiler & Steam Engineering	3
ME 2119	Fluid Mechanics & Hydraulics	3
ME 2121	Machine Drawing-II	3
Practical		
ME 2106	Maintenance of Machineries-I	1.5
ME 2108	Marine Workshop Practices-III	1.5
Total		**24**

Year-2: Semester-2		
Code	**Course Name**	**Credit**
Theoretical		
CHEM 2201	General Chemistry	3
ME 2223	Marine Internal Combustion Engine-II	3
ME 2225	Machine Drawing-III	3
ME 2227	Applied Heat	3
ME 2229	Marine Fuels & Lubricants	3
ME 2231	Turbocharger & Scavenging Technology	3
Practical		
CHEM 2202	General Chemistry Sessional	1.5
DEV 2202	Industrial Visit	1.5
ME 2210	Maintenance of Machineries-II	1.5
Total		**22.5**

Year-3		
Code	**Course Name**	**Credit**
ME 3002	On-Board Training	12
OR		
ME 3004	Alternate to On-Board Training (Maritime Apprenticeship)	12
Total		**12**

Year-4: Semester-1		
Code	**Course Name**	**Credit**
Theoretical		
HUM 4105	Maritime Law & Policy	3
EEE 4105	Marine Electrical Installation & Instrumentation	3
ME 4133	Deck Machineries & Bridge Equipment	3
ME 4135	Maneuvering & Associated Systems	3
ME 4137	Ship Construction & Repair	3
ME 4139	Control Engineering & Mechatronics	3
ME 4141	Maritime Safety & Environmental Science	3
ME 4143	Research Methodology	3
Practical		
EEE 4104	Marine Electrical Installation & Instrumentation Sessional	1.5
ME 4112	Engine Room Simulator Sessional	1.5
ME 4000	Project & Thesis	--
Total		**27**

Year-4: Semester-2		
Code	**Course Name**	**Credit**
Theoretical		
HUM 4207	বাংলা ভাষা (Bangla Language)	3
HUM 4209	Bangladesh Studies	3
HUM 4211	Maritime Economics	3
EEE 4207	Power System Protection	3
ME 4245	Fuel Combustion System & Energy Efficiency	3
	Optional -1 *	3
	Practical	
DEV 4204	Seminar/Workshop	1.5
ME 4214	Control Engineering & Mechatronics Sessional	1.5
ME 4216	Welding Technology	1.5
ME 4000	Thesis	8
Total		**30.5**

List of Optional Courses:

Category	Code	Course Name
Optional-1*	ME 4247	Fishing Vessel Technology
	ME 4249	Recycling of Marine Structure
	ME 4251	Power Plant Technology

Grand Total = 22.5+22.5+24+22.5+12+27+30.5 = 161 Credits

List of Degree++ Courses:

Each student shall have to register minimum 3 (Three) degree++ courses as a part of requirement of the degree. A list of probable degree++ courses are given below:

- Maritime Ancillary Courses Training
- Additional Workshop Training
- Ship Design Software Training
- Supply Chain Management
- E-Procurement
- Project Management
- Maritime English
- Other Trainings (if needed)

8 Equivalence with Marine Engineer Officer Competency Examination:

The Syllabus for the 4-year **"Bachelor of Maritime Science (Engineering)"** is according to the requirements of STCW conventions as amended of IMO and that of the Directorate General of Shipping, Government of the People's Republic of Bangladesh for competencies required for "**Officer in charge of an Engineering Watch"**.

THE CERTIFICATE OF COMPETENCY(COC) LEVEL CLASS-3,2,1 FOR MARINE ENGINEER OFFICER EXAMINATION			
Serial No	Subjects according to the requirements of STCW conventions as amended of IMO and DG Shipping for COC(Certificate of Competency level) of Marine Engineer Officer	STCW requirements covered by the Subjects under this curriculum.	
1	Mathematics	Mathematics-I	*COC -3*
		Mathematics-II	
2	Applied Mechanics	Applied Mechanics	*COC-3,2,1*
		Fluid Mechanics & Hydraulics	*COC-2,1*
3	Applied Heat	Engineering Thermodynamics	*COC-3,2,1*
		Applied Heat	*COC-2,1*
4	Electro-technology	Basic Electrical & Electronics Engineering	*COC-3,2,1*
		Marine Electrical Machineries	*COC-2,1*
		Marine Electrical Installation & Instrumentation	*COC-2,1*
		Power System Protection	*COC-2,1*
5	Naval Architecture	Basic Naval Architecture	*COC-3,2,1*
		Ship Construction & Repair	*COC-2,1,*
6	Machine Drawing	Machine Drawing-I	*COC-2,1*
		Machine Drawing-II	*COC-2,1*
		Machine Drawing-III	*COC-2,1*
7	Engineering Knowledge (General)	Pump, Refrigeration & Air-Conditioning	*COC-3,2,1*
		Marine Propulsion & Steering	*COC-2,1*
		Marine Fuels & Lubricants	*COC-2,1*
		Fuel Combustion System & Energy Efficiency	*COC-2,1*
		Deck Machineries & Bridge Equipment	*COC-2,1*
		Control Engineering & Mechatronics	*COC-2,1*
		Maritime Safety & Environmental Science	*COC-1*
8	Engineering Knowledge (Motor)	Engineering Thermodynamics	*COC-3,2,1*
		Marine Internal Combustion Engine-I	*COC-3,2,1*
		Marine Internal Combustion Engine-II	*COC-3,2,1*
		Marine Boiler & Steam Engineering	

		Turbocharger & Scavenging Technology	
		Maneuvering & Associated Systems	

9 Course Profile

9.1 Year-1, Semester-1

9.1.1 HUM 1101: English

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an understanding in English language such that the students can use English in written and oral form in day to day life in a multicultural environment.

Learning Outcomes:

Successful completion of this course shall enhance the students English language competences and provide the skills necessary to carry out internal and external communication while on board the vessel.

Syllabus Contents:

1. Grammar - Structure of sentences - Active / Passive Voice - Direct / Indirect Narration;
2. Essay - Descriptive - Comparative - Argumentative - Thesis statement- Structure of opening / concluding paragraphs - Body of the essay;
3. Reading Comprehension - Global- Contextual- Inferential- Select passages from recommended text;
4. Business Correspondence - Letter Writing – Formal, Drafting, Bio-data Resume'/Curriculum Vitae;
5. Report Writing - Structure, Types of report - Practice Writing;
6. Communication / Public Speaking skills, Features of effective speech, verbal-nonverbal;
7. Group discussion - principle – practice;
8. The places and manners of articulation of the English sounds;
9. Vocabulary;
10. Comprehension;
11. Composition on current affairs;
12. Précis writing;
13. Short stories written by some well-known classic writes.

9.1.2 PHY 1101: Physics-I

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an understanding on the concepts, principles and processes of basic science in the particular field of structure of matter, electricity and magnetism, and modern physics.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Properties of matter and problems related to physics of materials on the atomic and molecular state.

2. Basic concept of electricity and magnetism such as potential and field.
3. Relativity and quantum physics
4. Relate concepts together and to the other areas of physics.

Syllabus Contents:

1. **Structure of Matter:** Crystalline and non-crystalline solids, Single crystal and poly-crystal solids, Unit cell, Crystal systems, Co-ordinations number, Crystal planes and directions, NaCl and CsCl structure, Packing factor, Miller indices, Relation between inter-planer spacing and Miller indices, Bragg's Law, Methods of determination of inter-planer spacing from diffraction patterns; Defects in solids: Point defects, Line defects, Bonds in solids, Inter-atomic distances, Calculation of cohesive and bonding energy, Introduction to bond theory, Distinction between metal, Semiconductor and insulator.
2. **Oscillations:** Simple Harmonic Motion (SHM). Mass-Spring system, Energy conservation in mass energy system. Damped SHM-Under-damped, over-damped motion, Critical damping, Forced Oscillations, Resonance, and Superposition of Periodic Motion: Beats, Lissajous Figures
3. **Hydrostatics:** Hydrostatic pressure; Change of pressure with elevation; Pascal's law; Equilibrium of floating bodies.
4. **Surface Tension and Viscosity:** Adhesive and Cohesive Forces; Molecular origin of Surface Tension; Pressure and surface tension; Contact angle and capillarity; Measurement of the angle of contact; Experimental determination of surface tension; Factors affecting surface tension;Newton's law of Viscosity; Stokes Law; Terminal velocity for Falling bodies.
5. **Electricity & Magnetism:** Coulomb's Law, Electric field (E), Gauss's Law and its application, Electric potential (V), Capacitors and capacitance, Capacitors with dielectrics, Dielectrics-an atomic view, Charging and discharging of a capacitor, Ohm's Law, Kirchoff's Law, Magnetic field, Magnetic induction, Magnetic force on a current carrying conductor, Torque on a current carrying loop, Hall effect, Faradays Law of electromagnetic induction, Lenz's Law, Self-induction, Mutual induction, Magnetic properties of matter, Hysteresis curve, Electromagnetic oscillation, L-C oscillation and its analogy to simple harmonic motion.
6. **Modern Physics:** Michelson-Morley's experiment, Galilean transformation, Special theory of relativity and its consequences, Quantum theory of radiation, Photo-electric effect, Compton effect, Wave Particle duality, Interpretation of Bohr's postulates, Radioactive disintegration, Properties of nucleus, Nuclear reactions, Fission, Fusion, Chain reaction, Nuclear reactor**.**

9.1.3 MATH 1101: Mathematics-I

3.00 Credit, 3 hrs. /wk.

Aims:
The objective of the course is to solve the Algebraic problems, Matrices, Trigonometrical problems, Statistical problems in maritime domain and to teach the students differential and integral calculus that is most widely used in the engineering core subjects. It will provide the foundation in mathematics to prepare the students for subjects that are more specialized.

Learning Outcomes:
On successful completion of this unit, students will be able to:

1. Algebraic to problems relevant, theory of equations, matrices including inverse matrix, compute eigen values and eigen vectors using characteristic polynomial, solve system of linear equations.
2. Trigonometrical problem relevant to De-moivres theorem, exponential functions of complex arguments and Gregory's series.
3. Statistical problems relevant to Discrete and continuous variables, Frequency Distributions, Mean,

Median and Mode, Mean deviation and standard deviation, Correlation and its applications, understand the basic of statistical methods in the context of marine technology.

4. calculate limits, infinite limits and limit at infinity using appropriate techniques including L' Hospital Rule
5. compute derivatives of various types of functions
6. expand functions using Taylor's theorem and Maclaurin's theorem.
7. evaluate maximum and minimum value of functions of single and double variables.
8. calculate indefinite and definite integrals by basic integration formulas

Syllabus Contents:

1. **Algebra:**
   Theory of Equations: relations between roots and Co-efficient; Sums of the power of the roots; Descartes' rule of signs; increasing or decreasing all roots of the equation by the same number.
2. **Matrices:**
   Different kind of matrices; elementary properties; solution of systems of equations.
3. **Trigonometry:**
   a. De Moivres' Theorem
   b. Deduction from De-Moivres' Theorem
   c. Trigonometrically and exponential functions of complex arguments
   d. Gregory's Series
4. **Statistics:**
   a. Discrete and continuous variables
   b. Frequency Distributions
   c. Mean, Median and Mode
   d. Mean deviation and standard deviation
   e. Correlation and its applications
5. **Differential Calculus:**
   a. Differential Co-efficient
   b. Successive differentiation
   c. Partial Differentiation
   d. Maxima and Minima
6. **Integral Calculus:**
   a. Indefinite Integrals
   b. Definite Integrals

9.1.4 ME 1101: Applied Mechanics

3.00 Credit, 3 hrs. /wk.

Aims:

To provide the required knowledge on fundamentals of Engineering Mechanics.

Learning Outcomes:

Upon completion of this course, the student will gain a comprehensive knowledge on applied mechanics.

Syllabus Contents:

1. **Vector & Vector diagrams:** Resultant & equilibrium, triangle & polygon of Forces, Concurrent & parallel forces, Bow's notation, component of a force, Slings, Jib cranes, reciprocating engine, framed structure, Non coplanar force, etc.
2. **Velocity and Acceleration**: Linear & angular velocity, acceleration, Projectiles, Relative velocity, Mass- Accelerating Force etc.

3. **Work, power and Energy:** Work, Power, Power: Reciprocating engine, Rotary; Transmission of power by chain/belt/gears, Energy, Kinds, Kinetic energy: Rotation, Translation & rotation, etc.
4. **Centripetal Acceleration:** Centrifugal force, balancing, governor, simple harmonic motion, etc.
5. **Sliding Friction**: Coefficient of friction, inclined planes, etc.
6. **Moments:** First moments, Second moments, related problems about moments, etc.
7. **Lifting Machines**: Various lifting techniques, etc.
8. **Stress & Strain:** Stress & strain, strength of material, Working stress & factor of safety, Elasticity, Modulus of elasticity, tensile stress to destruction, Stress & compound bars, elastic strain energy, Suddenly applied & shock loads, stress on oblique plans, etc.
9. **Strength of Pressure vessels:** Stresses in thin cylinder, working pressure, Effect on seam strength, etc.
10. **Bending of Beams:** Condition of equilibrium, Shearing forces & bending moments with necessary diagram, etc.
11. **Stresses in Beams:** Stresses in beams, Deflection of beams, etc.
12. **Torsion:** Torsion, torque &stress, torsional Resilience, Torque & power, maximum & mean torque, transmission of power, deflection of a closely coiled helical spring, Hydraulic steering gear, etc.

9.1.5 ME 1103: Engineering Thermodynamics

3.00 Credit, 3 hrs. /wk.

Aims:

(i) To provide the Learners basics idea of temperature, pressure, volume, mass, heat that is the thermodynamic properties and their relations.

(ii) To develop the knowledge about thermodynamic laws, processes, cycles, P-V & T-S diagrams and their application. Knowledge about Enthalpy, Entropy, steam properties, internal combustion engines and parts of engines.

(iii) To have a good knowledge of working principle of 2 Stroke and 4 Stroke Marine IC Engines related problems, compressors, steam, steam engine, gas dynamics, gas turbine, Fuels and combustion etc.

Learning Outcomes:

Upon completion of this course, the student will gain a comprehensive knowledge on engineering thermodynamics

Syllabus Contents:

1. **Fundamentals**
   Mass, force of gravity, work power energy, mechanical efficiency, pressure, pressure gauges, manometer, gauge pressure & absolute pressure. Barometer, Vacuum gauge. Volume & specific volume, Temperature & absolute temperature, swept volume & clearance volume, system, boundary, thermodynamic processes and cycles, Heat & specific heat. Mechanical equivalent of heat, water equivalent, latent heat & sensible heat, thermal expansion of metals, Linear expansion, expansion of liquids, Apparent cubical expansion.
2. **Perfect Gases**
   Boyle's & Charles' laws, Combination of Boyle's & Charles' laws. Characteristic equation of a perfect gas, Specific heat of gases, Energy equation, relationship between specific heats, Ratios of specific heat. Compression & expansion of a gas in closed system. Ratios of expansion & compression. Relationship between temperature, volume and pressure for constant pressure, volume, temperature, Isothermal and Adiabatic process. Work transfer. Relationship between heat energy supplied & works done and problems
3. **Enthalpy and Entropy**
   Definition of Enthalpy and Entropy: Unit of entropy, General expression for change of entropy of a

perfect gas, change of entropy of a perfect gas during various thermodynamic processes and problems

4. **Ideal Cycles**
   Ideal thermal efficiency, Carnot cycle, Ericson cycle, sterling cycle, Otto cycle. Diesel cycle, Dual combustion cycle and P-V and T-S diagrams, related problems.
5. **Diesel Engine Cycle**
   4-stroke and 2-Stroke cycles; Deviation from ideal Condition in actual engines; Limitation in parameters, Timing Diagrams of 2-stroke and 4-stroke engines. General Description of I.C. Engines; Comparative study of slow speed, medium speed and high speed diesel engines suitability and requirements for various purposes.
6. **Fuels, Combustion & Dissociation**
   Definition of Fuel, combustion. Combustion Equation, Analysis of the Products of Combustion, stoichiometric combustion, Actual combustion, Calorific value, chemical equation. Excess Air, Mixture strength. Dissociation. Effect of Dissociation on LC-Engines.

9.1.6 ME 1105: Material Strength & Workshop Process

3.00 Credit, 3 hrs. /wk.

Aims:

To provide the theoretical knowledge to support the use of hand, power and machine tools and measuring instruments that is required in marine engineering maintenance.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Understand the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior
2. Apply the systematic methods for solving engineering problems in solid mechanics
3. Analyze the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading
4. Build the necessary theoretical background for further structural analysis and design courses
5. The use of common workshop tools;
6. The use of machine tools and machine process;
7. The use of measuring instruments;
8. Fitting and overhauling of machines;
9. Safety measures in workshop process

Syllabus Contents:

1. **Material Strength:** Stiffness relationships; Hooke's law; Stress and strain; Modulus; Simple beam theory; Second moment of area; Bending stress; Shear force and bending moment diagrams; Torsional, combined and off-axis loading; Principal stresses.
2. **Common Workshop Tools**: Description and uses of different types of calipers, Straightedges, try squares, vices, Hammers, chisels, Scrapers, files, Drills, reamers, Tapes, V-Blocks, face plate, Marking blocks, Carpentry tools, Patten maker's tools, smithy tools Molding tools.
3. **Machine process & Machine Tools**: The geometry of cutting processes machines of cutting, chip formation, cutting forces and power, Friction of chip on tools Generation and dissipation of heat in cutting. Standard nomenclature for cutting tools. Cutting speeds and feeds, estimation of machining

time. The fundamental Cutting process. Application in hand tools as chisel, file and saw, geometrical control of the cutting edge.

4. **Measuring Instruments & Inspection:** Description and use of Venire scale, Micrometer, Dial gauge, Depth gauge, thread gauge, Feeler gauge, Wire Gauge, pattern maker's scale, Taper gauge, snap gauge, plug gauge, Optical methods of measurement, Principles of interchangeability, limit system. Use of limit gauge.
5. **Safety Measures:** Sources of danger and methods of protection. Types of guards and safety devices, factory Act regulations.

9.1.7 HUM 1102: Maritime English & Communication Skill Sessional

1.50 Credit, 3 hrs. /wk.

Aims:

To provide adequate knowledge on English that deals with maritime terminology and the use of English sufficient to allow the use of engineering publications and the performance of engineering duties concerned with the ship's safety and operation.

Learning Outcomes:

This course will:

1. Enable trainees to master the English language related to marine engineering;
2. develop trainees' ability to use engineering publications written in English and perform the engineer's duties;
3. Ensure that trainees possess the knowledge, understanding and proficiency in English as set out in the STCW Code;
4. Give trainees wide-ranging opportunities to practise communication in English for both maritime and general purposes; and
5. Promote the study skills essential for continuing independent learning at sea

Syllabus Contents:

Adequate knowledge of the English language to use engineering publications:

1. Use publications regarding main and auxiliary machinery and associated control systems
2. Use publications regarding fuel, lubrication, bilge, ballast and other pumping systems and associated control systems
3. Use publications regarding electrical, electronic and control systems
4. Use publications regarding hand tools, machine tools and measuring instruments for fabrication and repair on board
5. Use publications regarding pollution prevention requirements
6. Use publications regarding seaworthiness of the ship
7. Use publications regarding preventing, controlling and fighting fires on board
8. Use publications regarding life-saving appliances
9. Use publications regarding monitoring compliance with legislative requirements
10. Use publications regarding personnel and ship safety

Adequate knowledge of the English language to perform engineering duties:

1. Use internal communication systems
2. English language associated with taking over and handing over a watch
3. English language associated with keeping a watch and handing over a watch
4. English language associated with maintenance of the machinery space logs and the significance of the readings taken
5. English language of safety and emergency procedures
6. English language of application of leadership and team working skills
7. English language associated with Port State Control
8. English language associated with bunkering operation

9.1.8 CSE 1102: Computer Programming & Applications

1.50 Credit, 3 hrs. /wk.

Aims:

The objective of this course is to build upon the engineering student's knowledge of engineering problem solving and computer programming skills.

Learning Outcomes:

On successful completion of this unit, students should be able to:

1. Understand/identify the terms of computer technology
2. write and execute computer programs to solve engineering problems
3. develop computer programs from flowcharts and implement these programs in advance software Programming language
4. generate, edit, compile, and debug computer programs
5. generate graphical solutions or representations of given engineering problems

Syllabus Contents:

1. **Introduction to computer application & automation:** Goals of office automation, characteristics of office and office automation system, obstacle to the growth of office automation, trends in office automation, Office automation tools and technology, Word processing & Excel, Power point. GNUPLO.
2. **Introduction to Computer Programming**: Flow chart and algorithm; Variables and operators; Functions; Sequential, Selective and Repetitive Structures; Arrays; Subprograms; Applications in Marine Engineering.

Exercises/Projects: Hands on exercises/project work using computer programs (MATLAB/ FORTRAN/ C++, etc.).

9.1.9 ME 1102: Marine Workshop Practices-I

1.50 Credit, 3 hrs. /wk.

Aims:

To provide the students with sufficient practical skill on the use of hand and power tools as required on board to perform the duties of an operational level engineer officer.

Learning Outcomes:

After successful completion of this course, trainees will possess sufficient skill and knowledge in the use of hand and power tools to carry out and/or supervise the work normally encountered as maintenance or repair work on board ship. Trainees will be able to select and use the correct tools in any given situation and carry out the necessary maintenance to ensure that they are kept in good order and ready for use.

Syllabus Contents:

Experiment/Jobs list: **[**Experiment/Jobs must be carried out from the following lists]

1. Introduction to elements of marine workshop.
2. Safety issues of Marine workshop/ Marine workshop practices
3. Orientation of hand held engineering tools including bench vice, different types of files; screw drivers; centre punch; hammer; hacksaw frame and blade; dividers; slide calipers etc.
4. Preparation of a square bar from mild steel plate as per given dimensions.
5. Preparation of a drill drift using hand held engineering tools.
6. Preparation of a chisel from MS rod using different engineering tools.
7. Preparation of chipping hammer from MS plate using different engineering tools
8. Preparation of a fitting fixing from MS plate using different engineering tools.

9.2 Year-1, Semester-2

9.2.1 HUM 1203: Leadership & Professional Ethics

3.00 Credit, 3hrs. /wk.

Aims:

(i) To provide the students with the knowledge, skill and understanding of leadership, teamwork and management skills at the operational level on board a ship; to meet STCW requirements for the application of leadership and team working skills, in accordance with the 2010 Manila Amendments, specifically as stated in table A-II/1, A-III/1 and A-III/6.

(ii) To provide the students with an overview of Professional Ethics like Human Values, Engineering Ethics, Engineering as Social Experimentation, Safety, Responsibilities and Rights, Global Issues, etc.

Learning Outcomes:

This course will enable the students to have:

1. Working knowledge of shipboard personnel management and training;
2. A knowledge of related international maritime conventions and recommendations, and national legislation;
3. Ability to apply task and workload management;
4. Knowledge and ability to apply effective resource management; and
5. Knowledge and ability to apply decision-making techniques
6. Knowledge on professional ethics

Syllabus Contents:

PART-A

1. **Introduction to Management Principles & Practice:** Need for sound Management principles and Practice & growth of modern management through various Managerial Functions, Planning, Organizing, staffing, Directing, controlling & Co-ordination; Principles of locating a Plant & Developing Organization Structure. Various types of organizational structures; Authority & Responsibility. Boundaries of Authority.
2. **Shipboard personnel management and training:** Organization of crew, authority structure, responsibilities, cultural awareness, inherent traits, attitudes, behavior, cross-cultural communication; shipboard situation, informal social structures on board; human error, situation awareness, automation awareness, complacency, boredom; leadership and team working; training, structured shipboard training programs; knowledge of personal abilities and behavioral characteristics.
3. **International Maritime conventions and national legislation:** International maritime conventions – SOLAS, MARPOL, STCW, and MLC, role of IMO, ILO; Recommendations and national legislation.
4. **Task and workload management:** Planning and coordination; personnel assignment; human limitations; personal abilities; time and resource constraints; prioritization; workloads, rest and fatigue; management (leadership) styles; challenges and responses.
5. **Resource management:** Effective communication on board and ashore; allocation,assignment and prioritization of resources; decision making reflecting team experience; assertiveness and leadership, including motivation; obtaining and maintaining situational awareness; appraisal of work performance; short and long term strategies.
6. **Decision-making techniques**: situation and risk assessment; identify and consider generated options; selecting course of action; evaluation of outcome effectiveness; decision making and problem solving techniques; authority and assertiveness; judgement; emergencies and crowd management.
7. **Personnel Management:** The personnel function Requirement & role of psychological tests in recruitments; Training, performance appraisal and reward system, Legal requirements and regulation of working Condition, Employer's liabilities for health and safety, Leadership and Discipline, Motivation and incentives, Problems of Accident, Fatigue, etc., Relationship with Trade union and workers participation in management.

PART-B

1. **Human Values:** Objectives, Morals, Values, Ethics, Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place, Spirituality.
2. **Engineering Ethics**: Overview, Senses of engineering ethics, Variety of moral issues, Types of inquiries, Moral dilemma, Moral autonomy, Moral development (theories), Consensus and controversy, Profession, Models of professional roles, Responsibility, Theories about right action (Ethical theories), Self-control, Self-interest, Customs, Religion, Self-respect, Case study: Choice of the theory.
3. **Engineering As Social Experimentation:** Engineering as, Engineers as responsible experimenters, Codes of ethics, Industrial standards, A balanced outlook on law, Case study: The challenger.
4. **Safety, Responsibilities And Rights:** Safety definition, Safety and risk, Risk analysis, Assessment of safety and risk, Safe exit, Risk-benefit analysis, Safety lessons from 'the challenger', Case study: Power plants, Collegiality and loyalty ,Collective bargaining, Confidentiality ,Conflict of interests,

Occupational crime, Human rights, Employee rights, Whistle blowing, Intellectual property rights.

5. **Global Issues:** Globalization, Multinational corporations, Environmental ethics, Computer ethics, Weapons development, Engineers as managers, Consulting engineers, Engineers as expert witness, Engineers as advisors in planning and policy making, Moral leadership, Codes of ethics.

9.2.2 PHY 1203: Physics-II

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an understanding on the concepts, principles and processes of applied science in the particular field of waves and oscillations, geometrical optics, and wave mechanics.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Mathematical wave equation
2. Optical modulation and detection
3. Wave function.

Syllabus Contents:

1. **Waves & Oscillations:** Differential equation of a simple harmonic oscillator, Total energy and average energy, Combination of simple harmonic oscillations, Lissajous figures, Spring-mass system, Calculation of time period of torsional pendulum, Damped oscillation, Determination of damping coefficient, Forced oscillation, Resonance, Two-body oscillations, reduced mass, Differential equation of a progressive wave, Power and intensity of wave motion, Stationary wave, Group velocity and phase velocity, Architectural acoustics, Reverberation and Sabine's formula.
2. **Geometrical Optics:** Combination of lenses: Equivalent lens and equivalent focus length, Cardinal points of a lens, Power of a lens; Defects of images: Spherical aberration, Astigmatism, Coma, Distortion, Curvature, Chromatic aberration; Optical Instruments: Compound microscope, Polarizing microscope, Resolving power of a microscope, Camera and photographic techniques.
3. **Wave Mechanics:** Principles of statistical physics, Probabilities, Classical statistics, Quantum statistics, Bose-Einstein statistics, Fermi-Dirac statistics and their applications, Fundamental postulates of wave mechanics, Time dependent Schrodinger equation, Schrodinger equation for one-electron atom and its solution.

9.2.3 MATH 1203: Mathematics-II

3.00 Credit, 3 hrs. /wk.

Aims:

The objective of the course is to teach the students co-ordinate geometry, vector analysis, ordinary differential equations and complex variable that is most widely used in the engineering core subjects. It will provide the foundation in mathematics to prepare the students for subjects that are more specialized.

Learning Outcomes:

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

1. solve applied problems using the concept of Geometry.
2. explain the concept of differentiation and integration of vector valued function.
3. provide a physical interpretation of the gradient, divergence and curl.
4. explain the fundamental concept of differential equations.
5. distinguish between linear, nonlinear, partial and ordinary differential equations.
6. solve 2nd and higher order differential equations using different methods.

7. learn about complex variable

Syllabus Contents:

1. **Co-ordinate Geometry:**
    a. Pair of straight Lines, General equations of second degree, the Tangents and normal on the curves.
    b. Co-ordinates of three dimensions, Direction cosines and ratios, plane.
2. **Vector Analysis:** Position vector of a point; Resolution of vectors; Scalar and vector product of two vectors and their geometrical interpretation; Triple products and multiple products; Application to geometry and mechanics. Linear combinations; Linear dependence and independence of vectors; Differentiation and integration of vectors together with elementary applications; Definition of line; surface and volume integrals; Gradient; Divergence and Curl of point functions; various formulae; Divergence/Gauss's theorem; Stoke's theorem.
3. **Ordinary Differential Equation:** Degree and order of ordinary differential equation; Formation of differential equations; Solutions of first order differential equations by various methods: Variables separable, Homogenous equations, Equation reducible to homogeneous form, exact differential equations, the linear equations. Linear differential equations with constant co-efficient, and Inverse Operator; Solution of general linear equations of 2^{nd} and higher orders with constant coefficient.
4. **Complex Variable:** Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, Complex differentiation and the Cauchy-Riemann equations, Mapping by elementary functions. Line integral of a complex function, Cauchy's integral theorem, Cauchy's integral formula, Liouville's theorem, Taylor's and Laurent's theorem, Singular points, Residue, Cauchy's residue theorem, Evaluation of residues, Contour integration, Conformal mapping.

9.2.4 EEE 1201: Basic Electrical & Electronics Engineering

3.00 Credit, 3 hrs. /wk.

Aims:

To provide students with the theoretical knowledge on the fundamentals of marine electrical & electronic practice.

Learning Outcomes:

The student will learn about 'Basic Marine Electro-Technology' in regards to comprehensive idea of circuit variables and elements, simple resistive circuits, techniques of circuit analysis, network theorems, maximum power theorem, energy storage elements, magnetic quantities and magnetic circuits, PN unction diode, BJT, FET, MOSFET, Amplifier, Op Amp, Oscillator, Communication, etc.

Syllabus Contents:

Basic Electrical Technology

1. **The electric circuits**: Ohm's law , Simple Series and parallel circuits& Related problem, voltage and

current division, Simple mixed circuit related problem , Wye(Y)-delta transformation , Kirchhoff's current and voltage laws& related problem, independent and dependent sources

2. **Network theorems**: Source transformation, Superposition, Thevenin's, Norton's theorem & Maximum power transfer theorem with applications in circuits having independent sources,
3. **Energy storage elements**: Inductors and capacitors, series parallel combination of inductors and capacitors. Responses of RL and RC circuits: Natural and step responses.
4. **Magnetic quantities and variables**: Flux, permeability and reluctance, magnetic field strength, magnetic potential, Magnetic materials, B-H curves, M-H curves, Hysteresis, Eddy current.
5. **Electromagnetic Induction**: Lenz law, Faraday's Electromagnetic induction law, Fleming's R/L hand rule & its area of application (Generator/ motor principle).
6. **Alternating Current Theory**: Simple continuous periodic waves: frequency, amplitude, instantaneous, maximum r.m.s. and average values, or factor; Phase representation of AC quantity; Use of complex quantities in AC circuits: Phase difference; Parameters of AC circuit; Relationship between resistance, reactance and impedance; Simple series(R, L, C, RL, RC, RLC) and parallel (RLC) ac circuits with related wave & phasor /vector diagram, Related problems. Concept of different power in ac circuit, Power factor; treatment of power factor & improving Power factor. Resonance circuit; Concept of Single & Poly phase system;
7. **Three phase system**: Delta/star Connection & Power; Balanced three phase system: treatment of three phase circuit, Effect of unbalanced load

Basic Electronics Technology

1. **P-N Junction as a Circuit Element**: P-N junction diode, Biasing, current-voltage characteristics of a PN junction diode. Simplified dc and ac diode models.
2. **Rectifier, Filters & Power supply**: Rectification & rectifier, Rectifier classification, filter & its Classification, Zener diode & voltage stabilizer.
3. **Bipolar Junction Transistors**: Construction, Working principle of PNP and NPN transistor, Biasing, Common base, Common-emitter and Common Collector Configurations, Input and output characteristics of CB,CE, and CC configuration, Load line analysis, Operating point. Performance of transistor operation, cutoff and saturation points, BJT as a switch, Single stage BJT amplifier circuits: BJT as a voltage amplifier/Current Amplifier; Concept of Multistage amplifier.
4. **FET & MOSFET**: Introduction to FET & MOSFET, MOSFET as a switch, CMOS inverter.
5. **Thyristor/SCR**: Construction, working principle, characteristics, uses, Advantages/disadvantages
6. **Others**: Introduction to Oscillators, Op Amp, digital electronics.

9.2.5 ME 1207: Machine Drawing-I

3.00 Credit, 3 hrs. /wk.

Aims:

To provide a general understanding of the technical aspects of engineering drawing to meet the mandatory minimum requirements for knowledge, understanding and proficiency related to maintenance and repair at the operational Level.

Learning Outcomes:

On completion of this course, students will be:

1. Competent to obtain any required information from engineering drawings produced to international standards and conventions.
2. Should the need arise; they will also be able to produce drawings of an adequate standard for the

manufacture of components.

3. They will possess knowledge of design principles which will enable maximum benefit to be gained from subsequent experience.

Syllabus Contents:

1. **Types of Drawing:** General arrangement; assembly drawings; component drawings; single-part drawings; pictorial drawings.
2. **Line-work:** First angle and third angle projection; third-angle projection with hidden detail; auxiliary projection
3. **Pictorial Projection:** isometric projections; oblique projections
4. **Development:** The development of a 90°intersection of circular trucking, a cone, square pyramid, square-to- round transition piece.
5. **Dimensioning:** Dimensions a simple component, applying all correct standards
6. **Geometrical Tolerancing:** Tolerancing data to engineering drawings, to include examples of Straightness, flatness, roundness, cylindricity, concentricity, squareness, parallelism, angularity, position
7. **Limits and Fits:** various ways of indicating limits of size, including tolerance, actual size, basic size, nominal size, hole basis fits,
8. **Diagrams:** The interpretation of piping, hydraulic and pneumatic diagrams

9.2.6 ME 1209: Pump, Refrigeration & Air-Conditioning

3.00 Credit, 3 hrs. /wk.

Aims:

(i) To provide a foundation for the appreciation of the working principle, operation and maintenance of marine refrigeration and air conditioning technology in line with the requirement of the operation level certificate of competency.

(ii) To provide a foundation for the appreciation of technical aspects of the operation, maintenance and troubleshooting of pump and associated systems that includes evaporators and distillers, heat exchangers and condensers.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Working principles of refrigeration, air conditioning and ventilation systems;
2. Characteristics and regulatory requirements of gases, oils in the above system;
3. System components, maintaining the temperature and humidity, trouble shooting.
4. Principles of Pumping and types of pumps
5. Construction, operation, maintenance and troubleshooting of distillers
6. Construction, operation, maintenance and troubleshooting of heat-exchangers.

Syllabus Contents:

Refrigeration & Air-Conditioning

1. **Refrigeration:** Principles of refrigeration; Marine refrigeration cycle; Refrigerating compressors; Refrigerating system components; Refrigerating system brines; Cold storage spaces, Refrigerants used

in marine practice and their justification, Control of temperature in various rooms in domestic Plants.

2. **Air conditioning and ventilation systems**: Block diagram of an air conditioning system, system components and arrows to indicate flow of refrigeration conditioning system, Operation and maintenance of Plants. Control and Safety equipment States how to control temperature and humidity in the air.
3. **Machinery and Cargo Ventilation:** Design and constructional details, International requirements, Operation & maintenance of Equipment.

Pump and Pumping Technology

1. **Piping arrangement:** Layout of main and auxiliary machinery in engine room, arrangements of steam, bilge, ballast and oil fuel systems, Lube oil and Cooling system with various fittings. Domestic fresh water and sea water hydrophone system.
2. **Pumps:** Types of pumps for various requirements, their characteristics and application in ships. Centrifugal, Gear Pumps, Screw pumps and Reciprocating pumps. Care and Maintenance of pumps.
3. **Operation of pumping system:** Routine Pumping Operations; Operation of Bilge Ballast and Cargo Pumping Systems
4. **Evaporators and distillers:** Construction and Operation of different types of evaporators. Fresh Water generators. Conditioning arrangements of distilled water for drinking purpose.
5. **Heat Exchangers:** tubular and plate type, reasons of corrosion, tube removal, plugging, and materials used.
6. **Condensers:** Shapes and types of condensers, constructional details, location &method of securing, working principles, contraction and expansion allowances, leak test. Effect - change of temperature, circulating water quantity, condenser surface.

9.2.7 PHY 1202: Physics Sessional

1.50 Credit, 3 hrs. /wk.

Aims:

Objective of this course is to teach the students how to conduct experiment using the protocols and methods offered as in the discipline and interpret the results of experiments.

Learning Outcomes:

On successful completion of this unit, students will be able to:

1. demonstrate that they can conduct an experiment using the protocols and methods offered as in the discipline.
2. interpret the results of experiments, observations, understand and explain the random or systematic error associated with their experiment and make appropriate conclusion.

Syllabus Contents:

[Physics sessional is based on the theory courses Physics-I & Physics-II. Minimum 7 (Seven) experiments must be carried out from the following lists.]

1. Determination of specific resistance of a wire using a meter bridge.
2. Determination of high resistance by the method of deflection.

3. Determination of the specific heat of a liquid by the method of cooling.
4. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
5. Determination of frequency of a tuning fork by using Melde's Apparatus.
6. Determination of the value of g, acceleration due to gravity by means of a compound pendulum.
7. Determination of spring constant and effective mass of a given spring and hence to calculate the rigidity modulus of the material of the spring.
8. Determination of buoyant up draught as a function of immersion depth (Archimedes principle).
9. Determination of the surface tension of water by the method of capillary rise.
10. Determination of the surface tension of mercury and the angle of contact by Quinckes' method.
11. Determination of the wavelength of various spectral lines by a spectrometer using a plane diffraction grating.
12. Determination of radius of curvature of a Plano convex lens by Newton's ring method.
13. Determination of focal length and the power of a convex lens by displacement method with the help of an optical bench.

9.2.8 EEE 1202: Basic Electrical & Electronics Engineering Sessional

1.50 Credit, 3 hrs. /wk.

Aims

The students will perform experiments/jobs to provide a foundation for practical skills relating to the theories learned in the theory course 'Basic Marine Electro technology'

Learning Outcomes:

On successful completion of this unit, students will be able to demonstrate that they can conduct an experiment/Jobs using the protocols and methods offered as in the discipline.

Syllabus Contents: [Minimum 7 (Seven) experiments/Jobs must be carried out from the following lists.]

1. Introduction to Electrical quantities measuring meters (Ammeter, Voltmeter, Ohmmeter, Multi meter, Wattmeter, Energy meter etc.)
2. Characteristics of Series & Parallel circuit.
3. Verification of Ohm's Law.
4. Verification of KCL & KVL.
5. Study of Superposition Theorem circuit Analysis.
6. Determination the value of resistance & inductance in a coil.(RL series AC circuit)
7. Determination the value of resistance & capacitance in a RC series AC circuit.
8. Determination the value of resistance, Inductance & capacitance in a RLC series AC circuit.
9. Determination the Power factor from a single phase AC circuit.
10. Measurement of the Power of Single phase and three phase balanced AC circuit.
11. Study the relation between line voltage/currents & phase voltage/ current in Star & Delta Connected load.
12. Determination of phases sequence from the three phase circuit.
13. Determination the value of Resistor & capacitor using color code.
14. Show the skill of identifying the electronic components & soldering/de soldering

15. Study the lead identification and testing of diode, BJT, FET, MOSFET.
16. Study the V-I characteristics of PN junction diode
17. Study the I/O characteristics of a Transistor.
18. Design and Construction of half wave/Full wave rectifier & calculation of ripple factor
19. Study the I/O characteristics of a Transistor
20. Others experiments/Jobs(if Needed) based on the theory course 'Basic Electro technology

9.2.9 ME 1204: Marine Workshop Practices-II

1.50 Credit, 3 hrs. /wk.

Aims:

To provide a theoretical & practical knowledge on lathe, shaper, drill machine, gas cutting & brazing, etc.

Learning Outcomes:

The trainees will acquire skills on

1. The use of lathes and shaping machines;
2. The maintenance of machine tools to ensure that they are kept in good working order and ready for use;
3. The correct procedure for setting up and securing work for given machining operations;
4. Selecting the appropriate machine tools and machining sequence for any given task.
5. Hand on skill on gas cutting & brazing

Syllabus Contents:

(Study the necessary theory on lathe, shaper, drill machine, gas cutting & brazing, etc. & safety issues about them)

List of Jobs/ Experiments: [Minimum 3 (three) Jobs /experiments must be carried out from the following topic /lists.]

1. **Square block:** To make a square block by Shaper machine. The job involve measuring of MS shaft as per given measurement and scribing; cutting of the shaft by power hacksaw machine; fixing the shaft on shaper machine vice and carry out the job on shaper machine
2. **Tapered shaft:** To make a tapered shaft on lathe machine. The work involve measuring of MS shaft as per given measurement and scribing; cutting of the shaft by power hacksaw machine; to fit the shaft on lathe machine chuck; to start the job on lathe machine.
3. **Gas Cutting & Brazing:** Comprehensive study on Gas cutting & brazing & necessary jobs related to Gas cutting & brazing.

9.3 Year-2, Semester-1

9.3.1 EEE 2103: Marine Electrical Machineries

3.00 Credit, 3 hrs. /wk.

Aims:

To provide a foundation on 'Marine Electrical Machineries' in regards to working principle, construction, characteristics and maintenance of different types of transformers and motors.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Construction and operational principles of DC generators and DC motors;
2. Construction and operational principles of AC generators and AC motors;
3. Construction, operation and performance of transformers; and
4. Parallel operation of alternators.

Syllabus Contents:

1. **Introduction**: Introduction to marine electrical machineries
2. **DC generators:** Principle; Construction; Choice Of Armature Winding; emf Equation; Types; Losses; Power Stages; Efficiency; Armature Reaction; Characteristics; Parallel Operation
3. **DC motors**: Principle; Generator Vs Motor Operation; Back emf; Voltage Equation; Power Equation & Condition For Maximum Power; Dc Motor Types; Torque; Speed Regulation; Power Stages; Characteristics; Speed Control; Starter; Application.
4. **AC generator:** Elementary alternator, Construction, frequency, field, generated emf, alternator characteristics, armature reaction, Alternator on No Load & on Load, alternator regulation, Prediction of Voltage Regulation, windings of alternator.
5. **Parallel operation of alternators:** Requirements, synchronizing, synchronizing lamp, synchronoscope, Field variation, dividing load in parallel operation, hunting.
6. **Transformer**: Working principle, Construction, Types- (core type & shell type), Elementary theory for ideal transformer, E.M.F. equation, Transformation ratio, three phase transformer- (Operating principle, Different types of connection).
7. **Transformer Vector diagram and Equivalent circuit**: Transformer with losses but no magnetic leakage, Transformer with winding resistance but no magnetic leakage, Transformer with resistance and leakage reactance, Equivalent circuit of a transformer.
8. **Transformer test & Performance:** Voltage regulation, Transformer tests- (open-circuit &short-circuit test), Losses in a transformer, Efficiency, All-Day Efficiency& condition for maximum efficiency, Instrument transformer- (current & voltage Transformer).
9. **AC Motor:** Principle; Kinds; Production Of Rotating Field (two-phase & three-phase supply) and mathematical proof; **The Induction Motors**: Construction; Theory Of Operation; Slip; Rotor Current Frequency; Torque; Torque Slip Characteristics; Speed Regulation; Speed Control; Power Stage; Methods Of Starting, **Slip ring motors , Synchronous Motor; Universal Motor ; Etc.**

9.3.2 ME 2111: Marine Internal Combustion Engine-I

3.00 Credit, 3 hrs. /wk.

Aims:

(i) To provide an understanding on the basic concepts, working principles and processes of marine internal combustion engines.

(ii) To provide a foundation for the appreciation of working principles, components, maintenance and troubleshooting of large-bore, 4-stroke marine diesel engines running at low speed, normally using direct drive, fitted with piston rods and guides.

(iii) To provide some ideas on regular watch keeping.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. 4-stroke engine working principle
2. Engine fuel oil, lubricating oil and cooling system
3. Safety devices in engines
4. Calculation of engine power
5. Construction and operational principles of 2- stroke marine diesel engine components.
6. Maintenance and repair of 4-stroke marine diesel engines.
7. Performance monitoring and troubleshooting of 2-stroke marine diesel engines.
8. Modern trends of 4-stroke marine diesel engines.

Syllabus Contents:

1. Review of Heat-engine cycle & Ideal-gas cycle
2. **Introduction:** General Description of I.C. Engines. Comparative study of slow speed, medium speed and high speed diesel engines suitability and requirements for various purposes.
3. **Safety and Prevention of mishaps in I.C. Engines:** Causes and prevention of crank-case explosion, and Scavenge fires. Detection of same and safety fittings provided to prevent damage. Starting airline explosion.
4. **Medium and high-speed four-stroke Marine diesel engines:** Engine components including bedplate, cylinder block, cylinder jacket, cylinder liner, cylinder head, exhaust gas manifold, air-inlet manifold, air cooler, engine crankcase, bearing housing and shell, lubrication-oil sump, piston, connecting rod, connecting rod bolts, gudgeon pin, crankshaft, camshaft and chain, push rods, fuel injector, air inlet and exhaust valves and rockers.
5. **Coupling and Gears:** Engine couplings and reduction gears used in conjunction with medium speed engine, development in exhaust valve design, V-type engine details.
6. **Watch Keeping:** Importance of watch keeping, Records keeping, log book, watch handing over & taking over etc.

9.3.3 ME 2113: Marine Propulsion & Steering

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an understanding on the working principle, operation, maintenance and trouble-shooting on steering gear, shafting arrangement and propellers.

Learning Outcomes:

On successful completion of this unit, students will be able to do operation, maintenance and trouble-shooting on steering gear, shafting arrangement and propellers.

Syllabus contents:

1. **Steering gears:** Operation and Constructional details of various types of steering machinery. Tele-motor systems, transmitters and receivers Variable Delivery Pumps used in steering gears, axial and radial displacement types. Hunting action of Steering gear. Emergency Steering arrangement. Care and Maintenance of Steering gear plants.
2. **Shafting:** Methods of shaft alignment, constructional details and working of Thrust blocks. Intermediate shaft bearing and Stern tube bearing. Oil water lubricated stern Tubes. Sealing Glands. Stresses in Tail

End, Intermediate and Thrust Shafts.

3. **Propellers:** Various types of propellers and their features, structure and materials for propellers, definition of propeller diameter, pitch, pitch ratio, boss ratio, pressure side,
   suction side, leading edge, following edge, blade section, blade rake, fixing of propeller on the propeller shaft, highly -skewed (skew back) propeller and its advantage, controllable pitch propeller (CCP) and its mechanism of changing blade angle, the advantages and disadvantages of a controllable pitch propeller in comparison with fixed pitch propeller (FPP), the cavitation of propellers and explains its generating mechanism, propeller singing and explains its generating mechanism and preventive measures.
4. Different types of ship stabilizer. Bow Thrusters

9.3.4 ME 2115: Basic Naval Architecture

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an understanding of the geometry of ships & hydrostatic calculation with emphasis on stability of ships. Propulsion and rudder theory will also be addressed in this course.

Learning Outcomes:

After successful completion of this course, the participants will have sufficient knowledge on:

1. Maintaining the seaworthiness of the ship, including ship stability, carriage of cargoes on deck; heavy lifts, containers, bulk cargoes, grain, dangerous goods, oil tankers.
2. Theory and operation of Power, resistance, propulsion and propeller and rudder theory.

Syllabus Contents:

1. **Geometry of ship & hydrostatic calculation:** Ships lines, Displacement Calculation, First and Second moment of area, Simpsons rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rue, Tchebycheff's rule and their applications, Tonnes per Cm. Immersion. Coefficient of form, Wetted surface area, Similar figures. Centre of gravity, effect of addition and removal of masses, Effect of suspended mass.
2. **Stability of Ships:** Statical stability at small angles of heel, Calculation of B.M, Inclining experiment, Free surface effect, stability at large angles of heel, curves of statical stability, dynamical stability, angle of loll; stability of a wall sided ship, movement of centre of gravity, list and its correction.
3. **Resistance & Power:** Frictional, Residuary & Total resistance, Froude's Law of comparison, Effective power calculations, Ships correlation Factor (SCF), Admiralty co-efficient, Fuel Coefficient and Fuel consumption. Effect of viscosity and application of ITTC formula.
4. **Longitudinal Stability and trim:** Longitudinal BM, Moment to change trim one cm. Change of trim, change of L.C.B. with change of trim, Change of trim due to adding or deducting weights, alteration of draft due to change in density, Flooding calculations, Floodable length curves, M.O.T. method for determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability. Pressure on chocks.
5. **Propulsion & Propellers:** Definitions, apparent and real ship wake, thrust, relation between power, relation between mean pressure and speed, measurement of pitch, cavitation, propeller types, fixed pitch, Variable Pitch, ring propeller, Kort nozzles, Voith Schneider propeller, theory, Blade element theory, Law of similitude and model tests with propellers, propulsion test, Geometry and geometrical

properties of screw propellers, ship model correlation ship trials.

6. **Rudder Theory:** Action of the Rudder in turning a ship, force on rudder, Torque on stock, calculation of force torque on non-rectangular rudder, angle of heel due to force torque on rudder, Angle of heel when turning. Types of rudder, model experiments and turning trials, Area and shape of rudder, position of rudder, stern rudder Bow rudders.

9.3.5 ME 2117: Marine Boiler & Steam Engineering

3.00 Credit, 3 hrs. /wk.

Aims:

To provide the competences concerned with the operation, maintenance and troubleshooting of steam boilers problems

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Marine Boiler Construction
2. Boiler Mountings and Steam Distribution
3. Marine Boiler Operation
4. Steam Boiler Fuel Atomization and Combustion
5. Steam turbine
6. Boiler water treatment

Syllabus Contents:

1. **General Considerations governing the design of Boilers:** Types of marine boilers, comparison of smoke tube and water boilers; Destructive and Nondestructive tests on plates, rivets, welded seams, classification society requirements for boilers construction.
2. **Smoke Tube Boilers:** Various types in marine use, Principal dimensions and staying of flat surface of multi-tubular cylindrical Boilers. Vertical Auxiliary Boilers.
3. **Water Tube Boilers:** General description with sketches of principal types of boilers in marine use, Super-heater, Economizer, Air pre-heater & steam pre-heater; circulation and use of Unheated Down comers in highly rated boilers; Superheat temperature control, Attemperators and De-superheaters.
4. **Waster heat boilers**: Waste heat recovery calculation, Lamont exhaust gas boiler, Scotch composite Boiler, Cochran exhaust gas and composite boiler, spanner marine exhaust gas and Composite boiler. Forced Water Circulation boiler, Double evaporation Boiler.
5. **Boiler Mountings:** 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 valves, Retractable type Soot blower etc.
6. **Operation, Care & Maintenance:** Pre-commissioning procedures, Hydraulic, steam raising and operating procedures, Action in the event of storage of water. Blowing down of boiler, laying up a boiler; General maintenance. External and internal tube cleaning. Tube renewals, etc. maintenance, inspection and survey of boilers.
7. **Refractory:** Purposes of refractory, types of refractory and reasons for.
8. **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.

9. **Boiler and Associated Auxiliaries, and Steam Systems**: precautions and necessary measures to be taken when getting up steam, soot blow including the function of soot blowers, malfunctions /troubles likely happen to boiler on its operation, precautions for opening high temperature steam valves, how to keep boiler in cold condition while it is out of service, correct procedures for operating steaming boilers in parallel on load, the correct procedures for checking the water level in steaming boilers, the danger of oil entering a boiler with the feed-water, what is meant by "blow-back", how blow-back can be avoided, the need for, and the use of, soot blowers, why the temperature of boiler exhaust gases should be maintained above a minimum value
10. **Boiler Maintenance:** the need for cleaning the fire side of a boiler and how to do it, how to inspect the fire side of a boiler and repair/maintenance, the need of cleaning up the water side of a boiler and how to do it, how to inspect the water side of a boiler and the repair/maintenance
11. **Boiler water treatment:** Fundamentals; Acidity/Alkalinity; corrosion; Water testing and treatment; effects of salts and gases in feed water;
12. **Marine Steam Turbine:** Rankine cycle; Basic construction; Operation principles; the impulse turbine; the reaction turbine; Force on blades.

9.3.6 ME 2119: Fluid Mechanics & Hydraulics

3.00 Credit, 3 hrs. /wk.

Aims:

The objective of this course is to give students an understanding of the nature of the fluid and introduce basic law and explain the behavior of fluid and flow as well as gas dynamics. Dimensional analysis, hydraulic and pneumatic power system will also be introduced.

Learning outcomes:

On successful completion of this unit, students should be able to:

10. appreciate and understand the influence of fluid mechanics in design
11. correlate relevant daily events/machines to mechanics of fluids
12. describe the principles of model testing
13. analyze and solve related problems

Syllabus Contents:

Fluid properties; Fluid statics and kinematics; Continuity; Energy and momentum principles; Energy and hydraulic grade-lines; Laminar and turbulent flows; Control volume & Control surface; Euler‘s equation, Bernoulli‘s equation and its applications; Flow rate measurement-Venturimeter, Orifice meter & Pitot tube. -Compressible flow: - velocity of sound, mach no & mach cone .Introduction to boundary layers, drags and wakes; Friction and flow through pipes; Impact of jets; Dimensional analysis; Principles of similitude and model testing; Aero foil and its application; Fundamentals of hydraulic and pneumatic power system; Hydraulic machines: reciprocating and centrifugal pumps; Cavitation.

Hydraulic Turbines:

Impulse reaction turbine, pelton wheel, Francis propeller& Kaplan turbine, effective head, available power & efficiencies for above turbines, draft tube, specific speed of turbine, cavitation, performance

characteristics of turbines.

Gas Dynamics:
One Dimensional steady flow of compressible fluids, isentropic flow, Effect of Friction, Flow through Nozzles and Differ. Critical condition, Mach number, Subsonic, Sonic and Supersonic Flow. Flow of steam through Nozzle and Diffuses

9.3.7 ME 2121: Machine Drawing-II

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an advanced understanding of the technical aspects of engineering drawing including the General drawings of various machinery components.

Learning Outcomes:

On completion of this course, trainees will be able to carry out:

1. Assembly of sectional, outside and plan views of parts fitted, removed & in functional order.
2. Marine auxiliary equipment dismantled; to conceptualize in assembly and lay out as working & functional parts.

Syllabus Contents:

Marine machinery components and auxiliary equipment dismantled; to be conceptualized in assembly and laid out as working & functional parts. Sectional views in elevation & plans executed. Part sectional views depiction. Such auxiliary equipment to include:

1. Connecting rod
2. Crank shaft
3. Pump coupling
4. Keyed joints
5. Nuts & Bolts
6. Shaft supports
7. Holding bolts
8. Thrust block
9. Main Bearing
10. 4-stroke piston

9.3.8 ME 2106: Maintenance of Machineries-I

1.50 Credit, 3 hrs. /wk.

Aims:

To provide the principles of the practical maintenance of main propulsion & other Auxiliary machineries as installed in the training establishment. They will then be further prepared for training in similar work in real life situations on board ship.

Learning Outcomes:

The students will have sufficient skill on the maintenance and repair such as dismantling, adjustments and reassembling of main machinery components such as cylinder liner, piston, bearings, fuel injection pump, valves, turbocharger & other auxiliary machineries like Boiler , Air compressor etc.

Syllabus contents:

[Minimum Seven (07) jobs/Experiment needed based on the under mentioned topics]

1. **Diesel Engine**: Dismantles and inspects all parts for wear and deterioration, and assembles including: pistons; rings; liners; bearings; valves; cooling passages; crankshaft alignment; lubrication system; cylinder heads; exhaust valves; air-start valves; fuel injector; relief valve; fuel injection pump; Checks timing and ascertains freedom of movement; Checks condition of lubrication oil; Purges air from fuel system.
2. **Turbocharger (Supervised Student Activity)**: Dismantles: air filter; air casing; inducer (if fitted); impeller; volute; diffuser; gas inlet grid; nozzle ring; rotor; bearings. Examines all parts for wear and deterioration, paying particular attention to: erosion in the air side; erosion in the turbine nozzles and in the blades; corrosion of the gas casing; hard deposits; damage to balding; condition of bearings; condition of labyrinths; obstructions in the bleed and sealing passages; lubrication system; Reassembles and checks clearances.
3. **Boiler (Supervised Student Activity**): Explains the need for cleaning the fire side of a boiler and how to do it; Describes how to inspect the fire side of a boiler and repair/maintenance; Explains the need of cleaning up the water side of a boiler and how to do it; Describes how to inspect the water side of a boiler and the repair/maintenance; Describes how to restore the boiler after prolong shut down.
4. **Air Compressors (Supervised Student Activity):** Dismantles, examines and replaces or repairs as found necessary: suction and delivery valves and seats; piston and rings; glands/seals; relief valves and bursting discs coolers and cooling passages; lubricating oil system; drains
5. Thrust block, Stern tube, Shaft bearings, and Shaft sealing equipment.

9.3.9 ME 2108: Marine Workshop Practices-III

1.50 Credit, 3 hrs. /wk.

Aims:

To provide a theoretical & practical knowledge on lathe, shaper, drill machine, gas cutting & brazing, etc.

Learning Outcomes:

The trainees will acquire skills on

1. The use of lathes and shaping machines;
2. The correct procedure for setting up and securing work for given machining operations;
3. Selecting the appropriate machine tools and machining sequence for any given task.
4. Hand on skill on gas cutting & brazing

Syllabus Contents:
(Study the necessary theory on lathe, shaper, drill machine, gas cutting & brazing, etc. & safety issues about them)

List of Jobs/ Experiments: [Minimum 3 (three) Jobs /experiments must be carried out from the following topic /lists.]

1. **Bolt & Nut:** To make bolts and nuts on lathe machine. The work involve measuring of MS shaft as per given measurement and scribing; cutting of the shaft by power hacksaw machine; to fit the shaft on lathe machine chuck; continue to work on lathe machine.

2. **Flange:** To fabricate a flange using lathe machine and welding equipment. The job involve measuring of MS plate as per given measurement and scribing; cutting of the plate and GI pipe by hacksaw; to fix the plate on lathe machine chuck; welding of the GI pipe to the plate; polishing by emery cloth.
3. **Gear:** Making of gear teeth by lathe machine. The work involve measuring of MS shaft as per given measurement and scribing; cutting of the shaft by power hacksaw machine; to fit the shaft on lathe machine chuck; continue work on the lathe machine

9.4 Year-2, Semester-2

9.4.1 CHEM 2201: General Chemistry

3.00 Credit, 3 hrs. /wk.

Aims:
To learn about chemistry for marine engineering with application (various aspects of water chemistry, energy sources and Nano chemistry, etc.)

Learning Outcomes:
On Completion of the course the Students are expected to
1. Have a thorough knowledge of Boiler Chemistry and Feed Water Treatment methods.
2. Have a knowledge of various Water Hardness analysis procedures
3. Have a basic concept on Nano chemistry.

Syllabus Contents:
1. **Water Technology:** Water and it's impurities - Significance and estimation - turbidity, color, pH, acidity, solids, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese, DO, BOD, COD, nitrogen, grease, volatile acids.
2. **Water Treatment Processes:** Lime and Soda treatment, zeolites process and ion exchange (demineralization) - pH treatment, salinometer, use of litmus paper, test for partial, total alkalinity, chloride, sulphite, phosphate test, caustic soda treatment, condensate lime treatment. Desalination of water, reverse osmosis and electro dialysis, and control, effects of salts and gases in feed water.
3. **Boiler Chemistry:** Purpose of water treatment in boilers, scale and sludge formation and prevention, priming and foaming- Boiler corrosion – fretting, pitting corrosion, corrosion fatigue, atoms and ions, electro chemical corrosion, hydrogen and hydroxyl ions, types and causes of corrosion and it's control ; chemical and mechanical deareation, methods of chemical deareation, dezincification, stress corrosion.

4. **Water Hardness Analysis:** Hardness, units of hardness, estimation of hardness by EDTA method, treatment for hardness, total dissolved solids, dissolved oxygen test, use of coagulants, typical test valves for smoke and water tube boilers.
5. **Energy Sources And Nano chemistry:** Introduction - Properties (Electrical, Mechanical and vibration) – carbon nano tubes -Applications in fuel cells, catalysis and use of gold nano particles - batteries – secondary batteries - alkaline batteries –lead acid, Ni – Cd and Li batteries, principles and applications of solar cells, fuels cells – Hydrogen and methanol.

9.4.2 ME 2223: Marine Internal Combustion Engine-II

3.00 Credit, 3 hrs. /wk.

Aims:

(i) To provide an in-depth knowledge on smaller bore, 2-stroke marine diesel engines, its maintenance etc.
(ii) To develop an idea on the causes of vibration & balancing.
(iii) To provide the knowledge on Fuel oil, lubricating oil & cooling water system & Power balancing etc.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Construction and operational principles of four stroke marine diesel engine components.
2. Maintenance and repair of 2-stroke marine diesel engines.
3. Performance monitoring and troubleshooting of 2-stroke marine diesel engines.

Syllabus Contents:

1. **Basic Construction of large-bore two-stroke engines:** Discussion on the major components of large bore marine diesel engines including the bedplate, a main bearing, an 'A' frame and entablature, guides, a liner, cooling-water jacket, a cylinder head, diaphragm, turbocharger, scavenge trunk, air cooler, crankshaft, connecting rod, crosshead, piston, bottom end bearing, top end bearing, camshaft, push rod, rocker, exhaust valve or port, air-inlet port, chain or gear train driving the camshaft.
2. **Maintenance:** Maintenance, repair and overhauling of medium and high speed marine diesel engines.
3. **Vibration and Balancing:** Fluctuation of energy, Purpose of the flywheel, Simple harmonic motion, static balance and dynamic balance, critical speed and bared speed range, operation of vibration damper.
4. **Cooling of I.C. Engines:** Various cooling media used; their merits and demerits, cooling of pistons, cylinder heads, coolant conveying mechanism and systems, maintenance of coolant and cooling system.
5. **Fuel oil system of IC engines:** IC engine fuel oil supply and circulation system from fuel oil tanks to engines.
6. **Lubrication Systems:** Lubrication arrangement in diesel engines including Coolers & filters Cylinder, Lubrication etc.
7. **Indicator diagrams; and power calculations:** Construction details of indicator instrument. Significance of diagram Power Calculations, fault detection, simple draw cards and out of phase diagrams. Power balancing, Performance characteristic Curves, Test bed and Sea trials of diesel engines.

9.4.3 ME 2225: Machine Drawing-III

3.00 Credit, 3hrs. /wk.

Aims:

To provide an advanced understanding of the technical aspects of engineering drawing including the assembly drawings of main and auxiliary machinery components.

Learning Outcomes:

On completion of this course, trainees will be able to carry out:

1. Assembly drawings of main machinery, sectional, outside and plan views of parts fitted, removed & in functional order.
2. Marine auxiliary equipment dismantled; to conceptualize in assembly and lay out as working & functional parts.

Syllabus Contents:

Marine machinery components and auxiliary equipment dismantled; to be conceptualized in assembly and laid out as working & functional parts. Sectional views in elevation & plans executed. Part sectional views depiction. Such auxiliary equipment to include:

1. Reducing valve
2. Bilge suction strainer
3. Crane hook
4. Four ram steering gear
5. Oil fuel strainer
6. Gear pump

Marine engine components dismantled. Assembly drawings of main machinery. Sectional, Outside and plan views of parts fitted, removed & in functional order. Such drawings should include:

1. Fuel Control lever
2. Air inlet valve
3. Cylinder relief Valve
4. Starting air pilot valve

9.4.4 ME 2227: Applied Heat

3.00 Credit, 3 hrs. /wk.

Aims:

The objectives of this subject are to develop the fundamental principles and laws of heat transfer and to explore the implications of these principles for system behavior; and to develop the problem-solving skills essential to good engineering practice of heat transfer in real-world ship design applications.

Learning outcomes:

On successful completion of this unit, students should be able to:

1. understand and describe the fundamental concepts of various heat transfer methods
2. build the necessary theoretical background to understand the heat transfer cases in ship design

Syllabus Contents:

Introduction: steady and unsteady state conduction in one dimension, cases of single and composite walls, cylinders and spheres, fins of uniform cross section; Transient heat transfer: system with negligible internal resistance; Hiesler charts; Introduction to two and three dimensional heat conduction.

Convection: forced and natural, basic mechanism, methods of evaluation, non-dimensional parameters, empirical and semi-empirical methods.

Radiation: fundamental laws, black and gray bodies, form factors, evaluation of form factors.

Heat exchangers: parallel flow and counter flow. LMTD relationship; Heat transfer cases in ship design: insulation in bulkheads, refrigerated spaces, and fish holds in trawlers.

9.4.5 ME 2229: Marine Fuels & Lubricants

3.00 Credit, 3 hrs. /wk.

Aims:

To provide a foundation for the appreciation of the properties, use, maintenance of fuels, lubricants and Purifiers.

Learning Outcomes:

The student will be able to apply perform, describe, explain, discuss and analyze:

1. Existing and potential future maritime energy related legislation for shipping, ports and shipyards
2. Innovation theory and life-cycle analysis as well as payback analysis
3. Technological innovation in the maritime industry.
4. Ship design and energy efficiency
5. Ship operation and energy management and efficiency
6. Renewable energy and alternative fuels

On completion of this course and mandatory sea service, trainees will possess sufficient basic knowledge of fuels and lubricating oils to understand and follow instructions which might be given to a watch keeping engineer officer regarding the testing and treatment of fuels and lubrication oils.

Syllabus Contents:

1. **Fuels**: Source of supply, Study of Primary Fuels, Coal, petroleum, natural gas, classification of fuels. Treatment of fuels for combustion in marine I.C.E. and steam plants, Composition of petroleum**,** The distillation process**,** Testing of liquid fuel: Density; viscosity; viscosity scales; temperature; flush point; calorific value; pour point; carbon residue; water in oil; fire point; acidity or alkalinity; octane number; cetane number, ISO specification of marine fuel**,** Combustion of fuel**,** Oil fuel additives**,** Clean air act; Viscosity control.
2. **More about Fuels:**
   a. Fuel oil supply and circulating system
   b. Fuel oil filters: Strainers and filters, types of marine filters, auto-cleaner and Duplex filters, Static

filters, Priming and core maintenance of filters.

c. Fuel Pump: Types of fuel pump, construction and description, maintenance, safety devices; Fuel pumps and metering devices: Jerk and Common rail systems; Helical groove and spill valve type fuel pumps.
d. Fuel Valve: Drawing and operational principle, atomization, penetration and turbulence; maintenance and testing of injectors.
e. Viscotherm and heater: Operational principles and maintenance; System for burning heavy oil in slow and medium sped marine engines.
f. Fuel pump timing including variable injection timing
g. Combustion of fuels in I.C. Engines; Grades of suitable fuels, Preparation of fuels for efficient Combustion, Design aspects of combustion chamber.
h. Cams and hydraulic actuator: Types of cams and followers, Specified motion of followers. Uniform acceleration & deceleration, S.H.M. and uniform velocity Graphical construction of cam-profile.

3. **Lubricants:** Manufacture of lubrication oil, Theories of Lubrication, Types of Lubricants and their Properties suitability of Lubricants for various uses; solid and fluid lubricants. Additive Oils and their specific use, Terminology used in Lubrication systems. Loading pattern of various bearings in marine use and Lubrication system adopted. Different types of bearings used for marine machineries, Factors affecting hydro-dynamic lubrication, Shipboard lubricating oil test; Microbial degradation of lubricating oil, grease.
4. **Oil Purification:** Theory of oil Purification, Principles of operation and construction of different Centrifuges for fuel oil, Principles of operation and construction of different Centrifuges for lubricating oil.
5. **Energy-Efficient Ship Design and Operation:** Technological innovation related to energy management in the maritime industry; the basic process of onboard power generation and principal energy consumers; energy-saving measures in both ship design and operation; ship design and energy efficiency through ship resistance reduction means and propulsion efficiency improvement technologies; ship operation and energy efficiency through operational measures requiring the integration of port/ship duo.
6. **Energy management:**
   a. Triggers for shipping innovation and Innovation models in maritime industry and life-cycle analysis
   b. Ship design and innovation
   c. Energy efficiency and emissions
   d. IMO relevant legislation and onshore facilities related rule governance for energy management
   e. Sulphur reduction targets and abatement technologies, SECA and ECA
   f. Energy efficiency and ship resistance; hull form optimization, air lubrication, patterned surfaces
   g. Energy efficiency and ship propulsion; Hull-propeller interaction, PIDs, propeller coating, flow improvement devices
   h. Advanced marine vehicles; Hydrofoils, SWATHs, Catamarans
   i. Energy consumption onboard a ship
   j. Energy efficient ship operations; trim optimization, weather routing, ballast water management, systems planning, e-navigation
   k. Solar and wind energy and their applications
   l. Alternative fuels (biofuels, LNG) and fuel cell

9.4.6 ME 2231: Turbocharger & Scavenging Technology

3.00 Credit, 3 hrs. /wk.

Aims:

To provide an understanding on the operation, maintenance and trouble-shooting on turbocharger, scavenging and associated systems of main and auxiliary engines.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Main and auxiliary engine turbocharger construction, operation, maintenance and trouble shooting.
2. Two and four stroke engine scavenging system
3. Construction, operation and maintenance of main and auxiliary engine air cooler, scavenge and exhaust manifold.

Syllabus Contents:

1. **Turbocharger:** Construction, operation, maintenance, water and washing, lubrication, surging, breakdown, temporary and permanent repair
2. **Scavenging System:** Scavenging arrangements in 2-stroke engines; Air charging and exhausting in 4-stroke engines; Various types of Scavenging in 2-stroke engines; Uni-flow, loop, cross loop and reverse loop scavenging, their merits and demerits, Scavenge pumps for normally aspirated engines; under piston scavenging, Scavenge manifolds, scavenge valves, non-return valves, auxiliary blowers.
3. **Supercharging arrangements:** Pulse and constant pressure type; their relative merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders.
4. **Air cooler:** Construction; Cooling arrangement and maintenance.
5. **Exhaust and scavenge manifold:** Inspection and maintenance.

9.4.7 CHEM 2202: General Chemistry Sessional

1.50 Credit, 3 hrs. /wk.

Aims:

1. To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
2. To acquaint the students with the determination of molecular weight of a polymer by viscometery.

Learning Outcomes:

The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

Syllabus Contents:

[Minimum 7 (Seven) experiments must be carried out from the following lists.]

List of Experiments:

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.

5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline/ thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conduct metric titration of strong acid vs strong base.
17. Others experiments (if needed) based on the theory subject "Engineering Chemistry"

9.4.8 DEV 2202: Industrial Visit

1.50 Credit, 1wk/Semester.

Aims:

This course will help the students relate theoretical knowledge in practical fields.

Learning outcomes:

On successful completion of this unit, students should be able to demonstrate an understanding of the maritime field and Marine engineering/offshore industries of abroad.

Syllabus Contents:

Study tour to various abroad maritime field and Marine Engineering/offshore industries for example marine design firms, shipyards, dry-docks, ports, oil and gas companies, maritime educational organization, Power plant etc. in abroad.

9.4.9 ME 2210: Maintenance of Machineries-II

1.50 Credit, 3 hrs. /wk.

Aims:

To provide the principles of the practical maintenance of main propulsion & other Auxiliary machineries as installed in the training establishment. They will then be further prepared for training in similar work in real life situations on board ship.

Learning Outcomes:

The students will have sufficient skill on the maintenance and repair such as dismantling, adjustments and reassembling of auxiliary machineries like various pumps, valves, heat exchangers, refrigeration system & Deck machineries, etc.

Syllabus contents:

[Minimum Seven (07) jobs/Experiment needed based on the under mentioned topics]

1. **Centrifugal Pumps (Supervised student activity)**: Dismantles casing; impeller; wearings; shaft; bearings; gland/seal; air pump; float chamber; Examines and measures all parts for wear and deterioration; Re-fits, checking, clearances; Replaces and adjusts seals
2. **Reciprocating Pumps (Supervised student activity)**: Dismantles cylinders; piston/buckets; rings; valves; joints; glands; relief valves; Measures wear in cylinders, neck rings and rods; checks ring gaps; Machines and/or grinds in valves and seats; Removes gland packing; Selects and fits new gland packing.
3. **Screw and Gear Pumps (Supervised Student Activity)**: Dismantles rotors and gears; seals; bearings; relief valve; Examines for wear and deterioration; Re-fits, checking end clearances and backlash; Replaces and adjusts seals.
4. **Valves (Supervised Student Activity)**: Examines seats, valves, spindles, glands; Machine valves and seats; Beds in valves on seats, using grinding paste; Removes old gland packing; Selects correct gland packing; Repacks glands.
5. **Heat Exchangers (Supervised Student Activity)**: Dismantles and examines for leakage; for corrosion; for erosion; for fouling; Checks provision for tube expansion:; de-scales; replaces tubes; plugs tubes; secures tube tightness in tube plates; checks means of reducing corrosion.
6. **Refrigeration Maintenance (Supervised Student Activity)**: Compressors; Evaporator; Condenser; Expansion valve; Oil separator.
7. **Oils Fuels and Lubricating System Maintenance (Supervised Student Activity)**: Filters; Purifiers; Bearings; Settling-tanks; Tank contents gauges.
8. **Deck Machinery Maintenance (Supervised Student Activity)**: Lifeboat davits and gear; Mooring winch; Windlass; Winch; Crane.

9.5 Year-3, Semester-1 & 2

9.5.1 ME 3002: On-Board Training

12.00 Credit, 12 months/2 semesters

An approved seagoing service of not less than 12 months as part of an approved training programme which includes onboard training that meets the requirements of section A-III/1 of the STCW Code and is documented in an approved Training Record Book.

9.5.2 ME 3004: Alternative to On-Board Training (Maritime Apprenticeship)

12.00 Credit, 12 months/2 semesters

Students have to perform 12 months apprenticeship in a ship management company, port authority, Ship Yard, Dry-dock, Power plant, Marine workshop, Engine manufacturer and distribution company or any other similar organization approved by Bangabandhu Sheikh Mujibur Rahman Maritime University (BSMRMU), Bangladesh.

9.6 Year-4, Semester-1

9.6.1 HUM 4105: Maritime Law & Policy

3.00 Credit, 3hrs. /wk.

Aims:

To provide the essential knowledge and understanding and gives in-depth appreciation and advanced

knowledge of the law and policy related to international maritime transport.

Learning Outcomes:
The student will be able to describe/identify/explain/discuss/analyze:

1. The basic principles of maritime law within the wider context of law and legal systems
2. The basics of public international law, including law of the sea and the law of treaties
3. The legal framework of regulatory and private maritime law including the general law of contract, tort, property and remedies, and commercial maritime law, ship acquisitions, ownership and mortgages

Syllabus Contents:

1. **Principles of Maritime Administration and International Institutions:** The role of government in policy formulation and the administration of maritime affairs. An overview of the various international institutions involved in shipping and maritime affairs, including UN agencies and inter-governmental and non-governmental organizations and their interrelationships.
2. **Law of the Sea:** The international legal framework for the oceans, including the regimes of maritime zones under the UN Convention of the Law of the Sea (UNCLOS) from the perspective of maritime administrations and their particular interests.
3. **Maritime Security:** The importance of maritime security in the current context and to afford an understanding of the developing regime under different initiatives taking place under the aegis of IMO instruments and UNCLOS.
4. **Maritime Human Element:** The relevant IMO and ILO instruments, including the MLC2006, relating to maritime labour and welfare, and in particular the rights and expectations of seafarers in relation to occupational safety.
5. **Maritime Commercial Law:** Commercial law and policy, including marine insurance and general average, carriage of goods by sea under charter parties and bills of lading, and international trade law. To provide an understanding of the law relating to the maritime claims and their enforcement, arrest of ships, and liens and mortgages.
6. **Law and Policy Related to the Marine Environment:** The public and private law of marine pollution including UNCLOS and various public, regulatory and private law conventions, the penal law of marine pollution, and the laws of wreck and salvage, towage and pilotage.

9.6.2 EEE 4105: Marine Electrical Installation & Instrumentation

3.00 Credit, 3hrs. /wk.

Aims:

This course aims to gain theoretical knowledge on Marine Electrical Installation and Instrumentation

Learning Outcomes:
The student will be able to describe/identify/explain/discus:

1. Marine/ industrial and Domestic electrical services;
2. Marine Wiring system design, drafting, and estimation;
3. Design for illumination and lighting;
4. Electrical installations system design: substation, BBT and protection, air-conditioning, heating

and lifts. Design for intercom, public address systems. Design of security systems, fire Alarm, smoke detector, burglar alarm, and sprinkler system that used in marine domain.

Syllabus Contents:

Marine Electrical/Electrical Installation and Instrumentation related to

1. **High voltage installation:** Definition of high voltage, characteristics, generation, uses, installation, safety issues.
2. **Lighting installation:** principle of incandescent lamp, fluorescent lamp, tungsten-halogen lamp, gas discharged lamp, etc.; installation of various lamps. General requirements for places of urgent light, requirements of circuits of navigation lights.
3. **Wiring and Cable installation:** Distribution and Cable system-D.C. & A.C, Electrical wiring, types of electrical wiring installation, types of cable, material, superconductor, insulation system, insulation handling, dependence of insulation on various parameters, protection, installation of various types of cables, Cable fault diagnosis, flexible cords and cables, means to reduce radio interference, cable runs, joints, splices, etc.
4. **Ear thing and Lightning installation:** Ear thing, different types of ear thing, insulated and earthed neutral system, Earth faults, earth fault protection, lightning, lightning installation.
5. **Battery installation:** Principle, Design of D.C loads, Battery handling, installation, precautions.
6. **Transducer:** Electro-pneumatic, Electro-hydraulic transducing system, closed loop and open loop system, Wheatstone bridge system as transducer, variable inductance and capacitance transducer, I-V transducer.
7. **Measuring system:** Instrument transformer, Clamp meter, Insulation resistance, Megger system, Earth resistance measuring, R.P.M measuring, Continuity test, Multi tester, continuity testing, Multimeter, Diode Test, Live line Tester, etc.
1. **Electrical Drawing:** Necessary marine Electrical Drawing& diagrams
2. **Electrical hazards and safety issues:** Review of Electricity act, electrical hazards, safety issues, etc., Explosion Protection--- flame proof, increased safety, intrinsically safe, pressurized, non-sparking, special protection, dangerous or hazardous spaces. Pump room and battery room lighting, protection of electrical equipment in gas hazardous space. Electrical testing in hazardous area.
3. **Others**: Knowledge on intercom, public address systems, security systems, fire Alarm, smoke detector, burglar alarm, and sprinkler system.

9.6.3 ME 4133: Deck Machineries & Bridge Equipment

3.00 Credit, 3hrs. /wk.

Aims:

To provide an understanding of the basic concepts, working principles and processes relevant to deck machinery, cargo equipment and basic seamanship.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Hydraulic system construction, operation and maintenance i.e. windlass, winch, cranes, remote control valve etc.
2. Operation, maintenance and maintenance of cargo handling equipment
3. Basic seamanship skill.

Syllabus Contents:

Deck Machinery:

1. Hydraulic System: Main Components, Accumulator, Centralised hydraulic powersystem, Axial piston variable stroke pump, Controller & power supply, Spool valve with shut off and direction control, RAM & Rotary Vane Actuators, Open & Closed loop systems, Hydraulic fluid
2. Windlass, winch, Gypsy, Capstan, Hydraulic Cranes
3. Remote control valve
4. Anchors, their use, dropping and weighing anchor, Cable stopper, Air whistle

Cargo Handling Equipment:

1. Operation and maintenance of Crane, hatch cover, Cargo stowage.
2. Mooring and unmooring

Basic Seamanship

1. Rope Knots: Types of knots. Practice of knot formation, Materials of ropes, Strength, Care and maintenance, use of mooring line, heaving line, Rat guards.
2. Practical: Knots, bends and hitches, Ropes splice

9.6.4 ME 4135: Maneuvering & Associated Systems

3.00 Credit, 3hrs. /wk.

Aims:

To provide a basic understanding on the concepts, principles and processes in maneuvering and associated systems.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. The construction, working principle and maintenance of air compressors, air reservoirs, and air starting system.
2. Fully conversant with the maneuvering system
3. Operation of governors and automation in diesel engine plants.

Syllabus Contents:

1. **Air starting system:** Preparing the vessel for maneuvering**;** Classification society requirements regarding air starting system
2. **Air compressor:** Two and three stage; effects of clearance; volumetric efficiency; filters; pressure relief valves; lubrication; defects; automatic drain, air vessels; cooling systems; distilled water; lubrication oil.
3. **Air Reservoir:** Classification society requirements, construction, Maintenance and safety.

4. **Air supply system including control air.**
5. **Maneuvering diagrams:** Description of the system; location and purpose of various filters, valves and actuators; Starting and reversing systems of different Marine Diesel engines with safety provisions; starting air overlap; firing interval; starting air valves; air distributor; general reversing details; lost motion clutch.
6. Safety devices incorporated in maneuvering system.
7. Diagnosis and rectification of fault in the maneuvering system.
8. **Governors:** Functions of governor; various types of Governors; Centrifugal and inertia types of Governors, Sensitiveness; Stability and Hunting of Governors; Governor effort and power Consideration of friction in governors.
9. **Automation in modern diesel engine plants:** Remote operation, Alarm and fail safe system, Governors and their basic functions. Constant speed and Over speed governors. Constructional details and hunting of governor.

9.6.5 ME 4137: Ship Construction & Repair

3.00 Credit, 3hrs. /wk.

Aims:

To provide an understanding of the basic concepts, principles and processes relevant to ship Dry-docking and ship building technology.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. The basic principles in dry-docking including all the activities carried out in dry-dock and floating berth.
2. Ship building technology including mechanical and electrical works carried out in ship-yard.

Syllabus Contents:

Dry-docking:

1. Purpose and types of dry-docking
2. Docking plans
3. Types of blocks
4. Time period and budget for dry-docking
5. Safe dry-docking procedures
6. Lay period and list of repairs
7. Docking and undocking meetings
8. Vessels stability
9. Incident, accident, risk assessment and emergency preparedness
10. Role of Classification society in dry-dock

Ship Building Technology:

1. Type of ships: Commercial Vessel, Govt. Vessel, Research vessel -Their functions and geometric property.
2. Ship design: GA, Lines plan, Stability, Longitudinal stability, Transverse Stability, Tank model test, speed, etc.

3. Detail Production Design: Shop drawings, nesting, modeling, part list, profile bending, material record, and Block division.
4. Fabrication of steel ships: Welding procedure, reading of production drawings, subassembly, assembly, block lifting, erection of blocks, outfitting etc.
5. Quality control: Inspection and test plan, NDT plan, tank test, dimension control etc.
6. Shipbuilding technology: Structural arrangement, Foundations of machineries, Definition of shipbuilding structural items and their construction; Structural strength, Load analysis, Material properties etc.
7. Installation of Ship machineries: Windlass, Capstan, Bollard, Anchor, Mast, gen set, Main Engine, Propeller, shaft, rudder, Steering gear, ventilation, motor, pumps, galley equipment, navigational equipment
8. Paint selection
9. Launching procedure
10. Sea Trial
11. Project management: Ship building project management

9.6.6 ME 4139: Control Engineering & Mechatronics

3.00 Credit, 3hrs. /wk.

Aims:

(i) To provide the basic knowledge and understanding on pneumatic P, PI and PID control system including the measurements and mechanism of sensing process values and relevant instrumentation.

(ii) To provide an understanding on the basic concepts, principles, processes and procedures used in 'Electronic Control Engineering' including design of automation system.

(iii) To provide a comprehensive idea on Mechatronics.

Learning Outcomes:

1. The student will be able to describe/identify/explain/discuss/analyze:
   (a) Various temperature, pressure and level measuring instruments;
   (b) Operational principles of various control systems including positioner;
   (c) Various process control systems including M/E L.O, C.W, Boiler water level control system;
   (d) Maintenance of control system.
2. The student will be able to describe/identify/explain/discuss/analyze the control mechanism in electronic control engineering including relay circuit unit**,** digital sequential control devices**,** Integrated Automation Control and Monitoring System (IACMS)**,** Programmable Logic Controller (PLC)**,** analogue/digital/computer PID Controller and computer programmable controller.
3. The student will be able to describe/identify/explain/discuss/analyze the field of mechatronics.

Syllabus Contents:

1. **Control Engineering:** Introduction to control engineering, Fundamentals of Automatic Control ,Various Automatic Controls ,Electronic Logic Control, ON-OFF Control ,Sequential Control ,Relay, Programmable logic controller (P.L.C),Proportional-Integral-Derivative (PID) Control ,Measurement of Process Value: Temperature; Pressure; Level; flow; General Measurement of Processes,

Transmission of Signals: Transmitters; Controlling Elements- pneumatic, electrical; Manipulator Elements: Pneumatic; Electrical Servomotors; Hydraulic Servomotor; Position control motor; Stepper motor, Flowchart for Automatic and Control Systems, Control Mechanism: Level detector, Flow detection, Electronic Fuel control operation, Motor starting system(star, Delta, N-point starter, reverse forward, auto transformer starter, soft starter, slip ring motor starter, Ward Leonard drive)and control, speed and torque control by changing frequency, voltage.

2. **Mechatronics for Engineers:**
   a. Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors
   b. Introduction to Integrated circuit **(**555 timer I.C, OP-Amp741), Microprocessors, Micro-controllers & Programmable Peripheral Interface.
   c. **P.L.C:** Ladder programming.
   d. **CAD, CAM:** Construction of CAM profile for a radial cam displacement, velocity, acceleration, uniform velocity**.**
   e. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system.
   f. Artificial intelligence; Factory, Office and Home automation; Future trend

9.6.7 ME 4141: Marine Safety & Environmental Science

3.00 Credit, 3hrs. /wk.

Aims:

(i) To provide a foundation for the appreciation of the major international conventions relating to marine environment and to discuss on the operation and maintenance of the anti-pollution equipment installed on board the vessel.

(ii) To provide comprehensive understanding of maritime safety administration activities in the context of IMO and essential management tools required to implement safety, security and environmental protection standards.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. The basics of public international law relating to Marine pollution, including MARPOL, London Dumping Convention, International Convention relating to intervention on the high seas in cases of oil pollution casualties, 1969, International Convention on civil liability for oil pollution damage, 1969.
2. Operation and maintenance of Oily water Separator, Sewage treatment plant, Incinerator, Oil discharge monitoring equipment etc.
3. Policy implementation on maritime safety and security domains, occupational health and safety as well as marine environmental issues;
4. Maritime administration activities in the context of IMO and essential management tools to implement safety, security and environmental protection standards.

Syllabus Contents:

Part-A

1. **International Convention for the Prevention of Pollution from Ships,1973:** Annex I:Regulations for the Prevention of Pollution by Oil, Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk, Annex III: Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form, Annex IV: Regulations for the Prevention of Pollution by Sewage from Ships; Annex V: Regulations for the prevention of pollution by garbage from ships; Annex-VI: Regulations for the prevention of pollution of air from ships.
2. Convention of the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention).
3. International Convention relating to intervention on the high seas in cases of oil pollution casualties, 1969. \
4. International Convention on civil liability for oil pollution damage, 1969.
5. Anti-pollution procedures and associated equipment: Basic knowledge of regulation 26 Annex 1 MARPOL 73/78; Basic knowledge of anti-pollution equipment required by national legislation.
6. Operation, maintenance and troubleshooting of antipollution machinery/equipment such as oily water separator, sewage treatment plant, incinerator, Oil discharge monitoring equipment etc.
7. **Marine Environmental Protection:** Marine environmental protection and coastal and ocean governance in a context broader than shipping and the maritime sector. Sources of pollution, the science, mechanisms and technologies for pollution monitoring and control. The importance of emergency preparedness measures and contingency planning as part of the overall risk management process.

Part-B

1. **Introduction to IMO Member State Obligations:** The role of government in policy formulation and the administration of maritime affairs. To define and examine "maritime administration" conceptually. An overview about IMO member State obligations as flag, port or coastal State under the IMO III Code. To introduce the IMO member State auditing scheme as a tool to assess Member State performance.
2. **Maritime Risk Management:** Safety and risk, including risk assessment, safety and Formal Safety Assessment (FSA). The relationship between risk assessment and maritime casualty investigation. Essential tools for the consideration of all relevant factors involved in the development of maritime accidents, such as human and organizational factors.
3. **Maritime Human Element:** the relevant IMO and ILO instruments, including the MLC2006, relating to maritime labour and welfare, and in particular the rights and expectations of seafarers in relation to occupational safety.
4. **Shipboard Issues in Maritime Safety and Marine Environmental Protection:** Key aspects of design for safety principles and relate them to SOLAS requirements. Marine environmental operational issues and measures necessary to protect the marine environment as required by MARPOL, such as ballast water management, bio-security, anti-fouling systems and the recycling of ships.
5.

9.6.8 ME 4143: Research Methodology

3.00 Credit, 3hrs./wk.

Aims:

This course aims to improve academic writing and to provide an introduction to research methods

Learning Outcomes:

On completion of the course, the student must be able to collect, analyze and present his/her own data using grounded theory or qualitative content analysis

Syllabus Contents:

1. Introduction to The Process of Conducting Research, Research Design Introduction, Steps in the Process of Research, Identifying a hypothesis and/or research problem, specifying a purpose, creating research questions, Reviewing literature, Ethics of research and informed consent
2. Introduction to Qualitative Research: Essence of Qualitative Data, Sampling, Collection Techniques, Biography, Phenomenology, Grounded Theory, Ethnography, Case Study
3. Interpreting Qualitative Data: Qualitative Data Analysis Procedures, Coding, Thematic development
4. Introduction to Quantitative Research: Essence of Quantitative Data, Collection and Analysis Techniques
5. Sampling Concepts: Defining the Target Population, Representative Sample, Potential Consequences of Unrepresentative Sampling (Gaming the System), Over Representative Subgroups / Weighting, Design Effect, Sampling Methods (Cluster, Stratified, Simple Random)
6. Quantitative Data Collection Instruments: Choosing a good instrument, Interval and Ratio Scales
7. Introduction to Applied Statistics: Identifying the dependent and independent variables, Confidence levels, Math that manipulates data
8. Descriptive Statistics: Summarizing and describing a collection of data, Univariate and bivariate analysis, Mean, mode and standard deviation, Percentages and Ratios, Histograms, Identifying randomness and uncertainty in data
9. Inferential Statistics: Drawing inference from data, Modeling assumptions, Identifying Patterns, Regression analysis, T-test, Analysis of Variance, Correlations, Chi-square
10. Introduction to Mixed Methods Research: Advantages, Design Components, Explanatory Mixed Methods Framework, Exploratory Mixed Methods Framework
11. Data Mining –Finding the Patterns and Problems in the World of Data
12. Writing About Quantitative Findings
13. Writing About Qualitative or Mixed Methods Findings

9.6.9 EEE 4104: Marine Electrical Installation & Instrumentation Sessional

1.50 Credit, 3hrs. /wk.

Aims:

To provide a practical understanding on the basic concepts, principles and processes and procedures of electrical installation of equipment and various measuring devices and calibration processes that used in marine domain.

Learning Outcomes:

The student will be able to describe/identify/explain/discus with practical demonstration that used in marine domain:

1. Marine/ industrial and Domestic electrical services;
2. Marine Wiring system design, drafting, and estimation;
3. Design for illumination and lighting;
4. Electrical installations system design: substation, BBT and protection, air-conditioning, heating and lifts. Design for intercom, public address systems. Design of security systems, fire Alarm, smoke detector, burglar alarm, and sprinkler system that used in marine domain;
5. Design problem on a ship.

Syllabus contents

List of Experiment: [Minimum Seven (07) jobs/Experiment needed from the list of experiment]

1. Familiarization with different types of tools and their use.
2. Familiarization with different kinds of wire, wire joint.
3. To learn about wire size estimation and calculation.
4. To learn about different types of installation of wiring system.
5. To learn about different types of lighting accessories.
6. To learn about different types of protective devices and their working principle.
7. To learn about electrical earthling and neutral wiring system.
8. To learn about electrical lightning system.
9. Familiarization with the symbol of electrical wiring, fitting and fixture and conduit layout.
10. To learn about a system drawing and load calculation -1
11. To learn about a system drawing and load calculation -2
12. Demonstration of various types of transducer of Engine, Alternator, Boiler.
13. Demonstration of measuring devices and measuring techniques.
14. Others experiments/Job (if needed) based on the theory course “Marine Electrical Installation and Instrumentation”.

9.6.10 ME 4112: Engine Room Simulator Sessional

1.50 Credit, 3 hrs. /wk.

Aims:

This Course is essentially a practical one, consisting of a series of exercises structured around the operation of a ship's machinery installation and carried out in conjunction with an engine-room simulator.

Learning Outcomes:

The student will be able to describe/identify/explain/discus with practical demonstration:

1. Engine room equipment familiarization
2. System layout and flow diagrams
3. Control system and automation, Alarm and safety system
4. Watch-keeping and troubleshooting
5. Emission control and fuel economy management
6. Energy management
7. Emergency operations
8. Vessel resource management

Syllabus contents

Simulator Experiments: [Minimum Seven (07) jobs/Experiment needed from the list of experiment]

1. Description of basic engine functions and their simulation study of Engine running under simulated conditions.
2. Manual method of engine operation from engine room station.
3. Engine Operation from Remote stations -i.e. engine control room and Navigation bridge.
4. Safety and interlocks in UMS-ships and effect of malfunction of main engine auxiliaries.
5. Electronic logic circuits in remote control stations. Simulation of engine functions in logic circuits. Study and adjustments of logic circuits for remote control operation of main engine and trouble shooting. Interfacing input/output interfacing and pneumatic interfacing in the system.
6. Role of classification societies with reference to UMS-ships.
7. Trouble shooting of engine malfunctions.
8. Other experiments as required.

[ME 4000- Project & Thesis: Project & Thesis work will start from 4th year 1st semester & it has to be completed at the end of 4th year 2nd semester. Credit will be counted at the end of 4th year 2nd semester.]

9.7 Year-4, Semester-2

9.7.1 HUM 4207: বাংলা ভাষা (Bangla Language)

3.00 Credit, 3 hrs. /wk.

Aims:

The objectives of this course is to increase the knowledge of the students related to grammar and literature of Bangla language and its use.

Learning Outcomes:

- বাংলাদেশের সামাজিক, ঐতিহাসিক ও সাংস্কৃতিক অনুষঙ্গের সঙ্গে বাংলা সাহিত্যের সংযোগ স্থাপন করতে পারবে।
- বাংলাদেশ এবং বাঙালির ইতিহাস ও সংস্কৃতি সম্পর্কে সচেতন হবে।
- দৈনন্দিন জীবনে শুদ্ধরূপে বাংলা প্রয়োগ করতে সক্ষম হবে।

- প্রমিত বাংলা উচ্চারণে কথা বলার দক্ষতা বৃদ্ধি পাবে।
- শিক্ষার্থীদের মধ্যে বাংলা ভাষা সম্পর্কে আস্থা সংযোজিত হবে।

Syllabus Contents:

<u>প্রথম খন্ড - ভাষা</u>

1. **বাংলা ধ্বনি/ বাগ ধ্বনি** (Phone/ Speech Sound); **বর্ণ** (Letter); **অক্ষর** (Syllable)
2. **বাংলা ধ্বনির উচ্চারণ স্থান ও রীতি** (Point of Articulation & Manner of Articulation)
3. **বাংলা উচ্চারণ-প্রমিত** (Standard), **আঞ্চলিক** (Dialectal), **বৈচিত্র** (Variation)
4. **অপিনিহিত, অতিশ্রুতি, স্বরসঙ্গতি, শ্বাসাঘাত** (Strees accent), **স্বরভঙ্গি/ স্বরতরঙ্গ** (Intonation);
৫. **বাংলা ও ইং-রজির তুলনা**
6. **বাংলা লিখন দক্ষতা: সাধু/চলিত রীতি। বিরাম চিহ্ন প্র-য়াগ। প্রমিত বাংলা বানা-নর নিয়ম (বাংলা একা-ডমি)**
৭. **ব্যাবহারিক বাংলা: সংক্ষিপ্ত আ-লাচনা**
৮. **একুশে ফেব্রুয়ারি, মুক্তিযুদ্ধ, বাংলাভাষা, বিশ্বায়ন, বাংলার উৎসব, ষড়ঋতু, বাংলা নববর্ষ, আধুনিক তথ্য - প্রযুক্তি, বাংলার লোক সংস্কৃতি, মানবতা ও নৈতিকতা।**

<u>দ্বিতীয় খন্ড - সাহিত্য</u>

কবিতা:

১. **আবদুল হাকিম - নূরনামা**
২. **মাইকেল মধুসুধন দত্ত - বঙ্গভাষা**
৩. **লালন সাইঁ- খাচার ভেতর অচিন পাখি**
৪. **রবীন্দ্রনাথ ঠাকুর- নির্ঝরের স্বপ্নভঙ্গ**
৫. **কাজী নজরুল ইসলাম- আজ সৃষ্টি - সু-খর উল্লা-স**
৬. **জীবনান্দ দাশ- রূপসি বাংলা**
৭. **হাসান হাফিজুর রহমান- অমর একু-শ**
৮. **আলাউদ্দিন আল আজাদ- স্মৃতি স্তম্ভ**
৯. **শামসুর রহমান- তোমা-ক পাওয়ার জন্য হে স্বাধীনতা**
১০. **সৈয়দ শামসুল হক - পরিচয়**

প্রবন্ধ:

১. **বঙ্গিম চন্দ্র চট্টোপাধ্যায়- বাঙ্গালা ভাষা**

২. রবীন্দ্রনাথ ঠাকুর- সভ্যতার সংকট

৩. হরপ্রসাদ শাস্ত্রী- তৈল

৪. প্রমথ চৌধুরী- -যীব-ন দাও রাজটিকা

৫. কাজী নজরুল ইসলাম- বর্তমান বিশ্বসাহিত্য

৬. মুহম্মদ আবদুল হাই- আমা-দর বাংলা উচ্চারণ

৭. কবীর চৌধুরী- আমা-দর আত্ন পরিচয়

-ছাটগল্প অন্যান্য রচনা:

১. রবীন্দ্রনাথ ঠাকুর- পোষ্ট মাস্টার

২. -রা-কয়া সাখাওয়াত হো-সন- অব-রাধ বাসিনী

৩. বিভূতিভূষণ ব-ন্দাপাধ্যায়- পুঁইমাচা

৪. সৈয়দ ওয়ালীউল্লাহ- নয়নচারা

৫. জাহানারা ইমাম- একাত্তরের দিনগুলি

৬. হাসান আজিজুল হক- ঘর-গরস্থি

৭. আখতারুজ্জামান ইলিয়াস- অপঘাত

নাটক:

১. কবর- মুনির চৌধুরী

9.7.2 HUM 4209: Bangladesh Studies

3.00 Credit, 3 hrs. /wk.

Aims:

The objectives of this course is to introduce the students with the key concepts like socio-economic, geo-political, institutional, social organizational, context of origin and development of Bangladesh. Socio-political and economic context of Liberation War of Bangladesh and the importance of Bay of Bengal will also be introduced here.

Learning outcomes:

On successful completion of this unit, students should be able to:

1. address different contemporary issues of modernization in context of Bangladesh ;
2. demonstrate an understanding of the key concepts like socio-economic, geo-political, institutional, social organizational, context of origin and development of Bangladesh
3. identify the role of foreign investors and development partners in private sector development
4. demonstrate an understanding of the importance of Bay of Bengal

Syllabus Contents:

Brief geo-political and socio-economic history of Ancient Bengal The nature of origin and development of Bengal Civilization

The socio-political and economic context of Liberation War of Bangladesh and the background of the emergence of Bangladesh as an Independent Country.

The major Socio-Economic and Cultural Features of Bangladesh

Agricultural Development and the contribution of agricultural sector to the national economy and society of Bangladesh; An overview of agricultural policies of Bangladesh

The Process of Industrialization in Bangladesh: The evolution of industrial growth in Bangladesh; sector wise development of industries; the role of private and public sectors in industrial development; An overview of industrial policies of Bangladesh

Private Sector Development in Bangladesh: The contribution of Private Sector in the economy of Bangladesh; An overview of private sector development policy in Bangladesh; The opportunities and Challenges of private sector development; The role of Foreign Investors and Development Partners in Private Sector Development

The Health and Demographic Features of Bangladesh: An overview of Fertility, Mortality, Marriage, Migration, Primary Health Care Services, Family Planning, Reproductive Health, Youth and Development etc.

Culture, Tradition and Heritage of Bangladesh: An overview of the development of Art, Literature, Folk Culture, Music, Traditional Food Habit, Dresses, Architecture, Monument, Objects of Civilization, Song, Paintings, Classic, Traditional and Modern Songs and integration of Western Culture

Rural Development: The notion and evolution of Rural development; BARD as a Model of Rural Development; Challenges and Constraints of Rural Development; The Role of NGOs, Go and Development Partners in Rural Development

The Political and Governmental system in Bangladesh: The forms of Government; Bureaucracy as a system of Administration; The role of Political parties in sustaining modern democracy

Bay of Bengal: Introduction to Bay of Bengal; Geostrategic and economic importance of Bay of Bengal.

9.7.3 HUM 4211: Maritime Economics

3.00 Credit, 3hrs. /wk.

Aims:

To provide an understanding of the basic concepts, principles and processes used in Economics that is particularly necessary to perform managerial functions.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze basic economic theory and analytical tools that can be used in decision making problems. Moreover the course will impart the students with the knowledge of economic concepts, direct managerial applications, and analytical skills through integrating the knowledge of economic theory with decision making process and practices.

Syllabus Contents:

1. **Introduction to Micro to Managerial Economics:** Definition of Economics, Micro and macroeconomics – an Overview, relationship between economic theory and managerial decision, the nature and objectives of firms, the concepts of profit, alternative objectives of firms, the decision making model, and constraints of decision making.
2. **Basic tools:** Functional relationship, Economic model, Calculus and optimization regression analysis.
3. **Demand theory and analysis:** Individual and market demand, total and marginal revenue, elasticity of demand: price, income and cross elasticity of demand.
4. **Demand estimation:** development of model, data collection, choice of functional form estimation and interpretations using regression techniques. Problems with regression analysis: Omitted variables, identification and Multi-co linearity.
5. **Production theory:** Production function, short run production and law of diminishing returns, long run production, least cost factor combination, expansion path, returns to scale, economies of scale and scope, estimation of production function.
6. **Cost theory:** The economic concept of cost, short and long-run cost function, marginal and average costs, profit contribution analysis; operation leverage and estimation of cost function.
7. **Profit maximization under different market structure:** market structures, perfect competition, monopoly, monopolistic competition, oligopoly, profit maximization in short and long runs, evaluation of markets.
8. **Pricing decisions:** Pricing of goods and services, price discrimination, pricing of multiple products, product bundling, peak-load pricing, cost plus pricing, pricing of inputs, pricing under different market structures, economic rent, labour unions, minimum wages laws.
9. **Decision making under uncertainty:** The concept of risk and uncertainty, risk and decision making, adjusting business decision for risk, decision tree analysis.

9.7.4 EEE 4207: Power System Protection

3.00 Credit, 3 hrs. /wk.

Aims:

To provide a foundation for the appreciation of electrical power system protection device used on board the ship in line with operational level certificate of competency.

Learning Outcomes:

The student will gain sufficient understanding on 'Power System Protection' in regards to switchgear, fuse & relay, circuit breakers and breaker ratings; transformer, generator, motor, bus and transmission line protection; static, digital and numerical relay.

Syllabus Contents:

1. **Introduction to Switchgear**: Purpose of power system protection, Introduction to Switchgear, circuit interruption and protection. Criteria for detecting faults and requirements of protective devices,

Terminologies and general characteristics of relays and circuit breaker

2. **Fuse & Relay**: Fuse and its types, Relays: over-current, differential, directional, distance. Electromechanical relay.
3. **Circuit breakers**: control systems, Trip circuit, arc extinction methods, Types of circuit breaker, Different types of protective devices used in Switchgear.
4. **Circuit breaker ratings**: circuit breaker ratings, recovery voltage, TRV, Switching in a capacitive circuit, Current chapping. Air, Oil, air blast, SF6, vacuum and high voltage DC circuit breaker, Selection criteria, testing of circuit breakers.
5. **Transformer protection**: Different types of faults in Transformer, different types of protection scheme in transformer, Buocholz Relay etc. Integrated HV transmission line protection, Combined Transformer and Bus bar protection.
6. **Generator and Motor protection**: Introduction, Different types of faults in Generator and motor, different types of protection scheme, Overload protection—thermal relays, magnetic relays, temperature sensing devices—Thermistor, thermocouple, thermostat, Single phasing, 3.3KV motor and 6.6 KV motor, High vacuum contractors.
7. **Bus and Transmission line protection**: Bus bar arrangement, Pilot-wire and carrier current protection, different types of Bus and Transmission line protection scheme, Over voltage protection, lightning and lightning arresters, Grounding.
8. **Static and digital/numerical relay**: definition, features, Operation, application, Block diagram and types, Microcontroller and Microprocessor based protection.

9.7.5 ME 4245: Fuel Combustion System & Energy Efficiency

3.00 Credit, 3hrs. /wk.

Aims:

(i) To provide a foundation for the appreciation of the fuel combustion process including its energy efficiency. Construction, operation and maintenance of the equipment relevant to fuel combustion process will also be discussed.

(ii) To develop knowledge and general understanding of basic energy management and efficiency, renewable energy and innovation concepts relevant to shipping, ports, shipyards and offshore.

Learning Outcomes:

The student will be able to describe/identify/explain/discuss/analyze:

1. Fuel oil supply and circulating system to the engines.
2. Construction, operation, maintenance of filters, fuel valves, fuel pumps, hydraulic actuator, viscotherm etc.
3. Process in the fuel combustion system
4. Existing and potential future maritime energy related legislation for shipping, ports and shipyards
5. Innovation theory and life-cycle analysis as well as payback analysis
6. Technological innovation in the maritime industry
7. Ship design and energy efficiency
8. Ship operation and energy management and efficiency
9. Renewable energy and alternative fuels

Syllabus Contents:

Fuel Combustion System:

1. Fuel oil filters: Strainers and filters, types of marine filters, auto-cleaner and Duplex filters, Static filters, Priming and core maintenance of filters.
2. Fuel Pump: Types of fuel pump, construction and description, Jerk and Common rail systems;
3. Fuel Valve: Drawing and operational principle.
4. Viscotherm and heater: Operational principles.
5. Fuel pump timing including variable injection timing
6. Combustion of fuels in I.C. Engines; Grades of suitable fuels, Preparation of fuels for efficient Combustion.
8. Cams and hydraulic actuator: Operational principles

Energy-Efficient Ship Design and Operation:

1. Triggers for shipping innovation and Innovation models in maritime industry and lifecycle analysis
2. Ship design and innovation
3. Energy efficiency and emissions
4. IMO relevant legislation and onshore facilities related rule governance for energy management
5. Sulphur reduction targets and abatement technologies, SECA and ECA
6. Energy efficiency and ship resistance; hull form optimization, air lubrication, patterned surfaces
7. Energy efficiency and ship propulsion; Hull-propeller interaction, PIDs, propeller coating, flow improvement devices
8. Advanced marine vehicles; Hydrofoils, SWATHs, Catamarans
9. Energy consumption onboard a ship
10. Energy efficient ship operations; trim optimization, weather routing, ballast water management, systems planning, e-navigation

9.7.6 DEV 4204: Seminar/Workshop

1.50 Credit, 3 hrs. /wk.

Aims:

This course will help the students on developing their presentation & personal communication skills.

Learning outcomes:

Syllabus Contents:

1. Techniques/tools of well presentation/modern presentation.
2. Techniques/tools of good communication/modern communication
3. Related theory study on presentation & communication.

9.7.7 ME 4214: Control Engineering & Mechatronics Sessional

1.50 Credit, 3hrs. /wk.

Aims:

1. To provide a practical understanding on the basic concepts, principles, processes and procedures used in 'Electronic Control Engineering' including design of automation system.
2. To provide a general understanding to verify practically the theories learned in Basic Mechatronics.

Learning Outcomes:

1. Students will perform experiments to verify practically the theories and concepts used in 'Electronic Control Engineering' & students will design simple systems using the principles learned in 'Electronic Control Engineering'.
2. The student will be able to describe/identify/explain/discuss/analyze practically the engineering technologies, such as mechatronics, robotics and automation, which presume professional abilities to integrate, conduct and lead complex engineering projects integrating ICT and hardware technologies for solving practical problems

Syllabus contents:

List of Experiments: [Minimum Seven (07) jobs/Experiments needed from the list of experiment]

1. Familiarization with necessary resources of Digital Electronics Sessional.
2. Familiarization with different Logic Gates and Implementation of basic logic gates by diodes, transistor sand resistors.
3. Implementation of Boolean function by basic logic gates.
4. Introduction to P.L.C and Relay switching.
5. Familiarization with counter circuit.
6. A stable operation of pneumatic piston.
7. Automatic Synchronizing and Interlocking operation of pneumatic piston.
8. P.L.C Micro-controller based hydraulic and pneumatic devices operation demonstration.
9. Tachometer based speed control.
10. Automatic boiler control process design by P.L.C/Microcontroller.
11. Rudder angle control by P.L.C/Microcontroller.
12. Introduction to Simulation Software.
13. Study of various types of transducers.
14. Study of hydraulic, pneumatic and electro-pneumatic circuits.
15. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
16. Speed control of DC motor.
17. Stepper motor interface.
18. Servo motor interface.
19. Lift control mechanism.
20. CNC machine operation.
21. CNC machine control system.
22. Ignition system control of engine.
23. Automobile controlling system.
24. Different types of links and joints used in robots.
25. Sensors interfacing to a device.
26. Electronic governor control as per load.

27. Others experiments/Jobs (if needed) based on the theory course "Control Engineering & Mechatronics".

9.7.8 ME 4216: Welding Technology

1.50 Credit, 3hrs. /wk.

Aims:
To provide the theoretical and practical knowledge on different types of welding technology including metal arc welding, gas tungsten arc welding, gas cutting.

Learning Outcomes:
After successful completion of this course the students will have theoretical and practical knowledge on:

a. Shielded Metal Arc Welding (SMAW) on tee, lap, corner, and butt joints to trade specifications in the flat, horizontal, vertical, and overhead positions.
b. Gas Tungsten Arc Welding (GTAW) on tee, lap, corner, and butt joints in flat and horizontal positions with applicable filler rod on mild steel, stainless steel, and aluminum.
c. Gas Metal Arc Welding on tee, lap, corner, and butt joints in flat, horizontal, and vertical positions using various filler wires on mild steel, stainless steel, and aluminum.
d. Different type of welding defect.
e. Theoretical and practical Knowledge about Cutting Process

Syllabus contents:

1. Different types of welding and their equipment & Welding principle
2. Types of power sources and their characteristics
3. Welding methods: MMAW, GMAW, SAW, Electro-slag welding, TIG
4. Types of welding joints. Welding symbols
5. Welding sequence in shipbuilding
6. Common defects in ship welding
7. Welding distortion monitoring and control
8. Inspection and testing of welded specimen.
9. Non-destructive testing. Methods and principles of cutting

9.7.9 ME 4000: Thesis

8.00 Credit

Aims:
In-depth study on maritime topics to demonstrate skill in research, writing and analysis

Learning Outcomes:
The students will gain hands-on research experience through completing a research project, starting with hypothesis development (if applicable), literature searching, experimental design, data collection, analysis, and interpretation. Students will also gain experience in written and oral scientific communication by submitting several written components including a research proposal, a progress report, and final thesis for evaluation as well as presenting the results of their research in a public oral presentation

Syllabus Contents:
1. Students will engage in independent research, to produce an original thesis on maritime topics.

This may take the form of a paper or report with supporting documentation, images and notes. Research may consist of archival investigation and/or fieldwork, including personal interviews, site reports, and condition assessments.

2. The process of writing and submitting a thesis will provide students with understanding and competence in research and writing about conservation and preservation issues, which will be of use in the professional field.
3. Students will be assigned a thesis advisor/supervisor, with whom they will meet regularly.
4. The thesis should be sufficient pages of text, with supporting documentation, images and notes. Research may consist of archival investigation and/or fieldwork, including personal interviews, site reports, and condition assessments. Students must consistently use a citation format of their choice.
5. A small panel of 2 or 3 markers, which will include the student's advisor/supervisor, will decide the thesis grade. Students will meet with this panel for a Final Discussion. This will be a 30-minute conversation about the thesis where students will be given feedback and a chance to discuss future plans. The discussion will not impact the student's grade.
6. There should be schedule and deadline including progress report and progress meeting to submit the thesis paper advising by the panel and research supervisor.

9.8 Year-4, Semester-2 (Optional Courses)

9.8.1 ME 4247: Fishing Vessel Technology

3.00 Credit, 3hrs. /wk.

Aims:

The objective of this course is to familiarize the students with fishing vessel technology.

Learning Outcomes:

On successful completion of this unit, students should be able to understand the technologies associated with fishing vessel

Syllabus Contents:

Types of sea fish for human consumption. Fishing methods and gear types: active and passive gears, advantages and disadvantages. Fish finding and communication equipment. General arrangement and space requirement of fishing craft. Stability, propulsion systems and sea keeping characteristics of fishing craft. Fish hold architecture. Fish processing and preservation. Fishing harbor design. Fisheries economics.

9.8.2 ME 4249: Recycling of Marine Structure

3.00 Credit, 3hrs. /wk.

Aims:

This course will teach the students science, technology and engineering that is involved in marine structure recycling. The international and national regulations regarding ship and offshore structure recycling will

also be taught in this course.

Learning Outcomes:

On successful completion of this unit, students should be able to:

1. stay abreast of the international and national regulations regarding ship and offshore structure recycling
2. understand the science, technology and engineering that is involved in marine structure recycling
3. acknowledge the importance of implementing green ship recycling in Bangladesh

Syllabus Contents:

International and national regulations and their enforcement, industry guidelines and voluntary codes of practice; The IMO's work on ship recycling; Shore based ship recycling; The standard contract for recycling of ships; Ship recycling in Bangladesh; Knowledge data base to support establishment of ship recycling; Safety and health in ship breaking; Safer ship dismantling facilities; The use of ship lift systems in recycling yards; Recycling high speed ferries and ideas for the future; Recycling of ships made of glass reinforced polyester; Environmental friendly recycling of FRP-sandwich ship hulls.

The Green Passport: Its implementation and important safety issues; Putting procedures into practice

9.8.3 ME 4251: Power Plant Technology

3.00 Credit, 3hrs. /wk.

Aims:
To provide a foundation on 'Power Plant and Electrical Energy' in regards to working principle, construction, characteristics and economics of different types of Power Stations.

Learning Outcomes:
The student will be able to describe/identify/explain/discuss/analyze:

1. Importance of Electrical Energy over Any Other Types;
2. Schematic Arrangement, Equipment, Efficiency and Site Selection of different types of Power Station;
3. Important Terms and Factors of Power Station and
4. Power Plant Economics in regards to cost of Electrical Energy Determination, Tariff for Consumers, Importance of Power Factor Improvement and Economics of Power Transmission.

Syllabus Contents:

1. **Introduction:** Importance of Electrical Energy, Generation of Electrical Energy, Sources of Energy, Comparison of Energy Sources, Units of Energy, Relationship among Energy Units, Efficiency, Calorific value of fuels, Advantages of Liquid Fuel over Solid Fuels, Advantages of Solid Fuels over Liquid Fuels
2. **Generating Stations:** Schematic Arrangement, Equipment, Efficiency and Site selection for Thermal Power Station, Hydroelectric Power Station, Diesel/HFO based Power Station, Nuclear Power Station and Gas Turbine Power Station, Comparison of the Various Power Stations
3. **Variable Load on Power Stations:** Structure of Electric Power System, Effects of Variable load on Power Station, Plotting and Analysis of Load Curves, Load Duration Curve. Connected Load, Maximum Load, Demand Factor, Average Load, Load Factor, Diversity Factor, Plant Capacity Factor, Plant Use

Factor. Types of Loads, Load Forecasting and Selection of Generating Units, Load Shearing, Base Load and Peak Load Power Plants, Use of Load Curves to Distribute Load among Units.

4. **Power Plant Economics:** Cost of Electrical Energy, Methods of Determining Depreciation, Importance of High Load Factor.
5. **Tariff:** Desirable Characteristics of Tariff, Tariff Design
6. **Power Factor Improvement:** Power Factor, Power Triangle, Causes and Disadvantages of Low Power Factor, Power Factor Improvement Equipment, Calculation of Power Factor Correction, Importance of Power Factor Improvement, Most Economical Power Factor
7. **Supply Systems:** Typical AC Power Supply Scheme, Advantages of High Transmission Voltage, Elements of Transmission Line, Economics of Power Transmission, Economic Choice of Conductor Size and Transmission Voltage

9.9 Degree ++

The department/faculty shall offer/arrange Certificate Courses in the relevant field. Each student shall have to register minimum 3 (Three) degree++ courses as a part of requirement of the degree. Registration & other fees will be applicable for these certificate courses. A list of probable degree++ courses are given below:

- Maritime ancillary courses training
- Additional Workshop training
- Ship Design Software Training
- Supply Chain Management
- E-procurement
- Project Management
- Maritime English
- Others training(if needed)

……The End……..……