PAKISTAN MARINE ACADEMY

SCHEME OF STUDIES
ASSOCIATE DEGREE PROGRAMME IN
MARINE ENGINEERING (ADME)
INTRODUCTION TO THE PROGRAMME & DETAILS

Name of the Programme : Associate Degree in Marine Engineering (ADME)

Programme Nature : Full time (Residential)

Offered at : Pakistan Marine Academy, Karachi

Eligibility Criteria for Admission:

i) Must be unmarried male citizen of Pakistan

ii) At least 45% marks in HSSC(Pre-Engineering)/equivalent examination with Physics, Mathematics & Chemistry

iii) Maximum 20 years of age by 31st December of the year when application is submitted. One (01) year relaxation for candidates belonging to FATA, Gilgit /Baltistaan and Azad Kashmir

iv) Must have qualified the defined pre-admission entry test

v) Medically fit as per the criteria approved by the Ministry of Ports & Shipping

vi) Merit will be based on 50% Entry Test + 50% HSSC %age

Intake: Once a year; 75 on open merit and 10 on self finance

Commencement: First semester- Spring January, 2016

Duration of the Programme: 2 years/4 semesters
# SCHEME OF STUDIES
for
ASSOCIATE DEGREE PROGRAMME IN MARINE ENGINEERING

## 1st Year

### Semester-I

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Cr Hrs</th>
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SUMMARY OF THE PROGRAMME

- Total number of Credit Hours: 116
- Duration of the Associate Degree: 2 years
- Semester Duration: 20 weeks
- Semesters: 4
- Course Load per Semester: 28-30 Cr Hrs
- Average number of Courses per Semester: 14 Courses/Semester
COURSES FOR ASSOCIATE DEGREE PROGRAMME IN MARINE ENGINEERING

SEMESTER-I

ED-101    English-I

Oral communication
• Participation in small and large group or class discussion: strategies for turn taking, polite expressions for agreeing/disagreeing/presenting one’s ideas or viewpoint; giving examples, taking simple notes for connecting further points with prior discussion

Study Skills
• Dictionary Skills: Reading pronunciation symbols (IPA international phonetic alphabets) for correct pronunciation and syllable stress
• Note taking: using annotation symbols while reading, methods for summarizing class lectures and readings such as Cornell method

Grammar
• Morphology: Derivation (root, suffixes, prefixes for word classes i.e. noun/verb/adverb/adjective
• Tenses (All types): exercise from oxford practice grammar
• Preposition, Articles: exercises from oxford practice grammar

Advanced Reading Comprehension
• Skimming & Scanning
• Speed Reading
• Practice of PQ3R / SQ3R
• Contextual clues: looking for synonyms, repeated or extended ideas, key terms used etc
• Vocabulary enhancement: passage based reading of target words and usage through practice worksheets

Recommended Books

ED-102    Pakistan Studies

Pakistan Movement – Brief; The importance of Gwadar Port; Exclusive Economic zone (EEZ) of Pakistan; The Salient Features of the Constitution of 1973; Constitutional amendments: A brief account of the constitutional crisis of 1971; Economic survey of Pakistan with a focus on present situation; International conventions on environmental pollution related to sea; Pakistan’s relations with neighbours; Pakistan’s relations with superpowers; Pakistan and the Muslim world; Pakistan and International Maritime Organisation (IMO); Human Rights; Islamic Perspective (The last sermon of the Holy Prophet P.B.U.H.); Western Perspective (UN Charter); The issue of Piracy.

Recommended Books:
2. Shahid Amin M., 2000, Pakistan’s Foreign Policy: A Reappraisal, Oxford University Press

**ED-103**  
**Physics(Th)**

**Mechanics:** Vector algebra and its applications, Line and Surface Integrals and their applications, Gradient, Curl, Divergence and applications, Newton’s laws and their applications, Motion in two dimension, Moment of inertia, Angular momentum and its conservation, Work, energy and power Efficiency, Work done by a variable force.

**Properties of Matter:** Elasticity Bulk Modulus, Modulus of Rigidity, Young’s Modulus, Poisson’s ratio, Torsion Pendulum, Bending Beams, Fluids, Liquids and Gases, Hydrostatic Pressure, Hydrostatic Pressure due to Liquid Column, Manometer, Viscosity, Coefficient of Viscosity, Variation of viscosity with Temperature, Molecular Forces, Surface Tension, and its variation with Temperature.

**Heat and Thermodynamics:** Simple kinetic theory of gases and the Ideal Gas Law. Heat, temperature and temperature scales. Heat transfer: conduction and conduction equation, convection and radiation: thermal expansion; specific heat capacity. 1st IInd and IIIrd law of thermodynamics, Entropy Entropy and IInd law of thermodynamics, heat Engines, Maxwell’s Thermodynamic relations.


**ED-105**  
**Physics(Pr) - I**

**Experiments:**
1. Value of ‘g’ using compound pendulum.
3. To determine the coefficient of viscosity by Stoke’s method.
4. To determine the thermal conductivity of a poor conductor by Lee’s method.
5. To find the moment of inertia of a flywheel.
6. To determine the mechanical equivalent of heat by using Callender and Barns apparatus.
7. To determine the frequency of an electrically maintained tuning fork by Melde’s apparatus.
8. To determine the vertical distance between two points using sextant.
9. To determine the wave length of sodium light using a grating spectrometer.
10. To determine the high resistance of the order of 10 Ohms by using neon flash circuit.

**Recommended Books:**
   ISBN 9780321696892, June 2010, @2011
3. Schaum’s Outline of Vector Analysis by Murray R. Spiegel
4. B.Sc. Practical Physics by CL Arora S Chand Limited, 2001

**ED-104**  
**Mathematics-I**

**SPHERICAL TRIGONOMETRY**  Logarithm to any base, Calculations involving multiplication & division by logarithm, Power & Roots, Exponential equations, Properties of spherical
triangles, Napier’s Rules of circular parts, Solution of right angled & quadrantual spherical triangles. Solution of oblique spherical triangles.

MENSURATION OF AREAS & VOLUMES Basic formulae for area of regular figures & applied problems, Surface areas & theorem of Pappus; Simpson’s and mid ordinate rule, Volume of prism, pyramid and sphere, Simpson’s rule applied to volume; center of gravity, Flow of liquid through pipes and valves.

MATRIX THEORY Basic concepts, definition, notation, Algebra of matrices, Special matrices, Elementary row & column operations; reduced echelon form, Rank of a Matrix, Inverse of a Matrix, Determinate of a square matrix; expansion & general properties of determinants, Cramer’s Rule, Determinant & Inverse matrix.

ALGEBRAIC EQUATIONS Homogeneous & Non-Homogenous system of linear equations, Solution set and admissible operations, Gaussian elimination method, Gauss Jordan Methods, Consistency criterion, Eigen Values & Eigen Vectors.

COMPLEX NUMBER Complex Numbers and its properties, Argand Diagram, De Moivre’s Formula & its applications, Root of polynomial equations, Standard functions (exponential, circular and hyperbolic), Inverse trigonometric & hyperbolic functions.

STATICS Composition and resolution of forces, Principle of moments, Stress and strain, Simple machines, Lever; screw jack; pulley systems, Velocity ratio and efficiency, Pressure in liquids.

DYNAMICS Composition and resolution of velocities and accelerations, Newton’s laws of motion, Motion under gravity, Work, power; kinetic and potential energy, Momentum, Friction.

Recommended Books
1. Calculus with Analytic Geometry by Howard Anton (Seventh Edition), Willey, 1980
2. Elementary Linear Algebra by Howard Anton (Tenth Edition), 2010
4. Reed’s mathematics for Engineers by W. Embleton, 1981

EG-151 General Engineering Knowledge-I

CORROSION: Principles of corrosion, Electrolytic corrosion, Cathodic protection, Sacrificial anodes, Boiler defects (deformation, wastage cracks etc).

BOILERS: Various types of boilers(Scotch, water tube economizers etc), Boiler Mountings, Package Boiler, Boiler Combustion, Starting of Boiler from cold, Boiler Water Test, Water treatment, Steam distribution system. Construction of boiler gauge glass. Maintenance and repair of boiler.

TURBINE THEORY: Convergent and divergent theory, Impulse and Re-action turbine, Gas turbines, gearing

Recommended Books
4. Various other reference books, periodicals and magazines.
INTRODUCTION TO MANUFACTURING PROCESS: Machine or process selection, Basic Concepts of manufacturing Processes, Basic concepts of Engineering Materials


PATTERNS FOR CASTINGS: Type of Patterns, Patterns Allowance, Patterns colors. Material used in making pattern

Recommended Books

BENCH WORK: Filling and drilling, Methods of metal cutting, Riveting, Tapes & dies

GRINDING: Grinding flat surfaces, Grinding of cutting tools

Recommended Books
2. General Engineering Workshop practice, Paramount
3. Models, Jobs as per drawing. Various

STATICS: Resultant and equilibrate, triangle of forces, polygon of forces. Concurrent and parallel forces, Bow’s Notation, component of a force, non coplanar forces. Slings, jib cranes, reciprocating engine mechanism.

KINEMATICS: Speed, linear velocity and acceleration, velocity time graph, angular velocity and acceleration, relative velocity, instantaneous centre. Projectiles.

DYNAMICS: Mass, weight, force of gravity, Newton’s laws of motion. Interia, acceleration force Atwood, machine, Fletcher’s trolley, Impulse and momentum, turning moment.

Recommended Text Book
1. Reeds Applied Mechanics for Engineers (V0l. II) by William Embleton, 1994

UNITS AND COMMON TERMS: Mass, Force, weight, Works, Power, Energy, Volume, Specific volume, density, Pressure, absolute pressure, Gauge pressure, Temperature, absolute temperature, System, boundary and surroundings

HEAT: Heat and work energy, Inter conversion, Mechanical equivalent of heat, Specific Heat of solids and liquids, Calorimetry, Latent Heat, fusion and evaporation,

THERMAL EXPANSION: Expansion of metals, Linear, superficial, cubical expansions, Expansion of liquids, apparent, cubical expansion, Restricted thermal expansion.

**Recommended Books**

**Text**  
Heat and Heat Engines for Marine Engineers by W. Embleton, (Reeds Series Vol. III), Thomas Reed, 1982

**Reference**  
Basic Engineering Thermodynamics by Rayner & Joel, 1996

EG-155 Electro Technology-I

ELECTRIC CIRCUITS AND OHM’S LAW: Nature of electricity, Conductors and insulators, Resistance, Units of Resistance, Internal Resistance circuits, Law of Resistance and ohm’s law

**SOURCES OF ELECTRICITY, ELECTRICAL UNITS WORK, POWER, ENERGY:** Thermocouple, Photoelectric effect photocell, Absolute and gravitational units, M.K.S. system, Work power and Energy.

ELECTRIC CIRCUITS NET WORK THEOREMS: Conductance, Conductivity-effect of Temperature on resistance, Value of ALPHA at different temperature, Resistance with temperature, Rheostat, Potentiometer, Kirchhoff’s Current, Law – Kirchhoff’s voltage law.

ELECTRIC CURRENT AND CIRCUITS: Division of currents in parallel, Circuits Grouping of cells-theory of shunt, Ammeters-sources of currents, Parallel, circuits complex circuits, Whetstone bridge

**Recommended Books**

**Text:**  
Reed’s Basic Electro Technology for Engineers by Edmund G. H. Kraal, (Vol. VI.), 1996

**Reference:**  
1. A Text Book of Electrical Technology(S.I.Units) by B.L. Theraja, S. Chand & Company Ltd, 2012

1. Reed’s Instrumentation and Control System by L. Jackson & Thoman D. Morton, 1999

EG-156 Machine Drawing-I


ISOMETRIC PROJECTIONS: Conception of isometric projection. First Angle and third angle view.

FREE HAND SKETCHING FROM MODELS AND SETTING OUT TEMPLATES: V – Block, Nuts, Bolts and rivets. Various setting out templates.

**Recommended Books**

**Text:**  
Engineering Drawing Book for Marine Engineers by H.G. BECK (Reed’s Vol.III), 1978

**Reference:**  
Mac gibbon pictorial Drawing book by James G Holburn, James Munro, Limited, 1965
GT-161 Computer Familiarization-I

**Computer Concepts:** Computer Basics, Development of Modern Computer, Types of Computers, Data Representation Number System

**Computer System Components Units-I:** Central Processing Unit, Memory Unit, Cache, Virtual Memory, Controller, Chipset, Busses and Expansion Slots, IDE and SATA Technologies, ROM, BIOS, CMOS

**SEMESTER-II**

ED-201 English-II

**Oral communication**
- Interpersonal communication: *talk for socialization and talk for information exchange, admission interviews or employment interview*

**Listening**
- Listening to real life communication: authentic listening text and exercises
  - And/OR
- IELTS-General listening exercises recommended

**Grammar**
- Passive voice: *units from oxford practice grammar (to write sentences with an understanding when action is more important than 'agent', when 'agent' can be absent in a sentence)*
- Direct & indirect speech: *units from oxford practice grammar, paraphrasing*

**Reading**
- Vocabulary enhancement: *extended passages based reading of target words and usage through practice worksheets*

**Composition**
- Pre-writing: exploring internet and other sources, free writing, mind mapping, outlining
- Paragraph writing: writing topic sentence, support with details, using sentence connectors, articles etc. for coherence
- Punctuation: capitalization, apostrophe, colon, comma, exclamation mark, full stop, hyphen, question mark

**Recommended Books**


ED- 202 Islamic Studies/Ethical Behaviour


ISLAM IN THE LIGHT OF QURANIC VERSES AND AHADITH: Toaheed, Risalat and the Day of Judgement, Namaz, Haj, Zakat and Jihad


ROLE OF ISLAM IN THE RECONSTRUCTION OF CIVILIZATION OF MINDKIND: Islam a Retrospect, Middle Nation and Best Nation Slavery, Role of Islam in the World history; Reason and knowledge as Basis of Faith; Contribution of Islam to Sciences.

OUR PROBLEMS AND THEIR SOLUTIONS: Some of the problems facing Pakistan today as corruption, Un-employment, man-power and Literacy, immorality and their solutions. Socio- Economic problems and their solutions.

Recommended Books:
Text: Sirat-e-Mustakeem by Abdul Qayyum Natiq, 2013
Reference:
  1. Islamic Ideology Part I & II by Anwar Hashim
  2. What Islam is? by Muhammad Asif Kidwai
  3. Islamic Education by M.D. Zafar
  4. Riaz-us-Salehee Part- I, by Sharf-uddin Noor
  5. Toward understanding Islam (Diniat) by Abul Alla Maudoodi
  6. The Sealed Nectar by Safi-ur-Rehman Mubarak Puri

ED-202A ETHICAL BEHAVIOUR (Alternate course for Non Muslim students in place of ED-202)

Recommended Books

ED-203 Physics-II

Electricity: Continuous Charge distribution, Force and Electric Field due to Continuous Charge distribution, Capacitors and dielectrics, Electric potential difference, Insulations and insulation, Electric and magnetic fields associated with electric potentials and currents, Electric Current and its heating effect, Power and its relationship with current and resistance, chemical effects, Passage of current through a conducting solution, Primary and secondary cells and batteries, Automating voltage and currents in outline, Frequency phase relationship, peak instantaneous and r.m.s. values, reactance, Impedance, Power dissipation, RLC circuits, Simple A.C and D.C circuits, Fuses and circuit breaker devices, The effects of dirt ad moisture, Principles of electric generations and motors, Outline of shipboard power supplies, Emergency sources, safety precautions for electrical equipment's including spar4s on board.

Semiconductor Physics and Electronics: Intrinsic and Extrinsic semiconductor, Charge carriers in semiconductor, PN Junction, Half and full wave rectifiers, Filters, Transistors and its characteristics, Transistors as a switch, Transistor as an amplifier, Concept of electromagnetic radiation and the need for a high frequency carrier wave, Propagation, Polarization and wavelength/frequency relationship Ground and sky waves Functions of typical marine communications transmitters and receivers. Typical serial system Introduction to Digital Electronics.


ED-205 Physics(Pr)-II
Experiments:
1. To determine ionization potential of mercury using mercury diode tube.
2. To study the behavior of an acceptor circuit and determine the value of the inductance.
3. To study the behavior of a rejecter circuit and determine the value of the inductance.
4. To study the spectral characteristics of photocell.
5. To determine the stopping potential of a given photocell.
6. To draw the characteristics of GM tube.
7. To study the I-V characteristics of forward and reverse biased diode.
8. To study the static characteristics of a transistor.
9. To determine voltage gain of single stage common emitter amplifier.
10. To set up and study various logic gates (AND, OR) using diodes and develop their truth table.

Recommended Books:
3. Schaum’s Outline of Vector Analysis by Murray R. Spiegel
4. B.Sc. Practical Physics by CL Arora S Chand Limited, 2001

ED -204 Mathematics-II

Differential Calculus Functions, Graph of a functions, Limit of function, Continuity of function, Gradient and rate of change, Maximum and minimum points, L’ Hopitals rule, Partial differentiation, Exact differential equations and its application in computing errors, Solution of non-linear equation by using Newton Raphson method, Properties of ellipse and hyperbola of navigational importance.
Integral Calculus Basic techniques of integration, Approximate integration, Application of integration.

Ordinary Differential Equations Introduction, Formulation of ODE’s, General & Particular Solution, Initial Value Problems (IVP) and Boundary Value problems (BVP), First order linear differential equation with applications, Approximate solution of linear differential equations, The Linear Second Order ODE’s (Homogeneous and Non-Homogeneous Cases), Cauchy-Euler ODE’s and their Solution Procedure.

Recommended Books

EG-252 Workshop Theory & Practice-II


HOT WORKING OF METAL: Rolling, Hammer or Smith Forging, Drop Forging, Press & Upset Forging, Pipe & Tube Manufacture.

COLD WORKING OF METAL: Effect of Cold Working, Advantages & Limitation, Cold working processes

Recommended Books
Reference: 1. General Engineering, Paramount W.P

Workshop Practice-II
WELDING, SOLDERING AND BRAZING: Gas Welding, Electric Welding, Tools and methods for Soldering and brazing
DRILLING: Drilling machines speeds and feed, different type of drills and their uses.

Recommended Books
2. General Engineering Workshop practice, Paramount
3. Models, Jobs as per drawing. Various

EG-253 Applied Mechanics-II
WORK, POWER AND ENERGY: Work graphical representation, power, power transmission, Transmission of power by belt, transmission of power by gear. Kinetic and potential energy.


SLIDING FRICTION: Coefficient of friction inclined planes. Parallel forces to pull forces up and down, horizontal and least forces. Efficiency of square thread.
Recommended Text Book

1. Reeds Applied Mechanics for Engineers (Vol. II) by William Embleton, 1994

EG-254 Applied Thermodynamics-II


EXPANSION AND COMPRESSION OF PERFECT GASES: Isothermal, adiabatic Polytropic process, Relationship between pressure, temperature and volume in adiabatic and polytropic processes. Work transfer in non flow process (closed system, Relationship between heat energy supplied and work done.

INTERNAL COMBUSTION ENGINE ELEMENTARY PRINCIPLES: Cycles of operation, 4 stroke and 2 stroke engines Timing diagrams. Indicator diagrams and engine indicator. Mean effective pressure, Indicated and brake power, thermal efficiency and specific fuel consumption.

IDEAL CYCLES: Ideal cycles and ideal thermal efficiency. Constant volume, diesel, dual combustion and Carnot Cycle

Recommended Books
Text Heat and Heat Engines for Marine Engineers by W. Embleton, (Reeds Series Vol. III), Thomas Reed, 1982
Reference Basic Engineering Thermodynamics by Rayner & Joel, 1996

EG-255 Electro Technology-II

ELECTRO CHEMISTRY: Electrolysis, Electrolytic cells, The Electrochemical equivalents, Primary and Secondary cells, the simple voltaic cell. Constructional details of batteries.

MAGNETISM – ELECTROMAGNETISIM: The magnetism and magnetic fields, Flux and flux density, electro magnetism, Magnetic circuits. Permeability, Relative Permeability ($\mu_r$), absolute permeability ($\mu_0$) Laws of Magnetic force, Field strength, Relation between $B$, $H$ and $I$, Weber and Ewing Molecular theory, Diamagnetic para magnetic materials, Magnetic Hysteresis.


Recommended Books
Text: Reed’s Basic Electro Technology for Engineers by Edmund G. H. Kraal, (Vol. VI.), 1996
Reference:

2. A Text Book of Electrical Technology(S.I.Units) by B.L. Theraja, S. Chand & Company Ltd, 2012

2. Reed’s Instrumentation and Control System by L. Jackson & Thoman D. Morton, 1999
EG-256  Machine Drawing-II


DESCRIPTION VIEWS: Sectional view of different, Machinery parts.


Recommended Books

Text:  Engineering Drawing Book for Marine Engineers by H.G. BECK (Reed's Vol.III), 1978

Reference: Mac gibbon pictorial Drawing book by James G Holburn, James Munro, Limited, 1965

GT-261  Computer Familiarization-II

Computer System Component Units-II: Mother Board, RAM, Optical Devices, Expansion Cards, Storage Device(Hard Disk Drive, Solid State Storage, USB Flash Disk, Zip Drive, Thumb Drives, SD Cards etc

Computer Peripherals: Input Devices, Output Devices, Backup Devices, Multimedia Devices

Notebooks: Types of Notebooks, Recovery of OEM/Preinstalled OS in Notebook

SEMESTER-III

ED-301  English-III

Formal Oral Presentations
Developing Persuasive, Informative and explanatory presentations
  o Select presentations topic
  o Collect information about the topic
  o Organize the information: a) Introduction  b) Body  c) Conclusion
  o Rehearse the Presentation
Designing effective electronic presentations
  o Using Templates, Working colours, Building bullet points
  o Adding Multimedia and other effects

Critical Reading
Critical reading strategies (Previewing, Contextualizing, Questioning to understand and remember, Reflecting on challenges, Outlining and summarizing, evaluating an argument, Comparing and contrasting related readings etc.), Practice reading passages.

Essay Writing
Descriptive, narrative, expository and process Essays
  o Provide students with at least four essays of each type
  o Help them read and analyse the essays ( according to each type)
    a. Find out thesis statement, topic sentences and supports etc.
  o Help students :
    a) Decide a topic
b) Collect information about the topic (brain storming, mind mapping etc.)
c) Encourage them write first draft of the essay
d) Give feedback on content, organization and language of the essay
e) Peer feedback( if teacher finds appropriate for the group)
f) Help them write many drafts

Recommended Books

ED-302 Personal & Organizational Management

Managing Self
1. Self awareness & Self Esteem[strengths, weaknesses, talents, values, preferences, setting goals]
2. Motivation
3. Prioritization
4. Time Management
5. Stress Management
6. Professional Attitude & Ethics
7. Personality & Non verbal communication [first impressions, personal appearance, body language, postures, gestures. Manners/etiquettes]

Managing Team and collaboration
8. Interpersonal Communication [Ethics, principles and problems]
9. Intercultural communication/Multicultural communication [basic norms/principles]
10. Avoiding and managing conflict

Managing Organization
11. Management Function: Planning, organizing and controlling
12. Resource Management
13. Leadership and decision making

ED-303 Chemistry

Gases: Gas laws ,Vanderwaal’s equation, gas equation, critical phenomenon, liquefaction of gases, specific heat (molar heat capacity)

Liquid and solutions: surface tension, viscosity, ph, colloidal chemistry , osmosis, reverse osmosis, spectrophotometer, liquid crystal (smectic , nematic, cholesteric)

Thermodynamics: first law, second law, calorimeter, specific heat of solid and liquid, thermochemistry.
Electrochemistry: ohms law, thermocouple, photoelectric effect, work power and energy, electrolysis, electro chemical cell, electrolytic cell, electroplating.

Corrosion: theories, inhibition and protection, mechanism of electrochemical corrosion, cathodic and anodic protection, steel manufacturing, classification of steel and stainless steel, type of alloy

Water and sewage treatment: Hardness, quality of water, water purification, sources of water, water analysis.
Experiment

1. Estimation of acidity in water sample
2. Estimation of alkalinity in water sample
3. Estimation of ferrous iron by redox titration
4. Estimation of hardness of water by EDTA method
5. Determination of chlorine in water sample.
6. Determine the surface tension of a liquid using drop weight method.
7. Determine viscosity of given liquid (density to be determined).
8. Determination of Sulphate by Turbidimetric Method

Recommended Books

Text Book:

Reference Books:
2. B.S.Bhal, G.D. Tulli, Avum Bahl, Essential of Physical Chemistry (Multi Colour Edition)
4. S.S.Dara, Introduction to Chemical Engineering, S Chand 2008

ED-304 MATHEMATICS-III

PLANE CURVES-I: Equation of 2nd degree; Pair of straight lines, Parabola, ellipse & hyperbola; translation of taxes, Rotation of taxes, Equations of Tangents & Normal

PLANE CURVES-I: Maxima & Minima, Polar coordinates and parametric representation of curves,
Length of arc, Area under a curve, Curvature; center of curvature; evolutes.

THREE DIMENSIONAL SPACE: Rectangular coordinates system in 3-dimensional space, Direction Cosines, Equation of Plane, Equation of Straight Line, Equation of Qibla.

STATISTICS: Discrete and continuous data, Construction of frequency distribution & presentation of data, Measure of Central Tendency and Dispersion

PROBABILITY: Permutation and combination, Concept of probability and its basic theorem, Conditional probability, Random variables and probability distribution, Mean & Variance of distribution, Binomial & Poisson distribution, Normal distribution curves; standardized normal curve

RECOMMENDED BOOKS

2. Elementary Linear Algebra by Howard Anton (tenth Edition)

EG-351 General Engineering Knowledge-III

PNEUMATIC SYSTEM: Basic methods of air compression, Reciprocating, rotary vane, rotary Screw type of air compressor. Condition of air, oil removal, Moisture separators, Vortex Type, Directional Change Type, Coagulating Type. Uses of high-pressure and low pressure air, General Principles of Pneumatic Control, Flapper Nozzle, Booster relay, Control Valves, Diaphragm Motor

STEERING GEARS: Steering and receiving telemotors. By pass valve, Telemotor fluid, charging system, Steering rules, Heleshaw pump, Electro Hydraulic steering gears(four Ram Systems), All electric steering gears

Recommended Books


Reference:  
4. Various other reference books, periodicals and magazines.


THREAD & THREAD CUTTING: Types of screw Threads, Methods of making Threads, Cutting Threads on a Lathe, Taps & Dies

GRINDING & GRINDING MACHINE: Introduction to Grinding, Introduction to Abrasive, Manufacture of Grinding Wheels, Bonding Processes, Grinding Wheel Selections, Grinding Machines, Honing and Lapping

Recommended Books


Reference:  
1. General Engineering, Paramount W.P  


**Recommended Text Book**

1. Reeds Applied Mechanics for Engineers (V0l. II) by William Embleton, 1994

** EG-354 Applied Thermodynamics-III **


STEAM: Saturation pressure and temperature of steam, effect of pressure on saturation temperature. Dry saturated steam, wet steam, dryness fraction. Calculation of specific enthalpy and specific. Superheated stream, use of steam table to determine properties of superheated steam. effect of throttling, determination of dryness fraction after throttling, use of throttling and separating calorimeter to determine dryness fraction.


**Recommended Books**

**Text**  Heat and Heat Engines for Marine Engineers by W. Embleton, (Reeds Series Vol. III), Thomas Reed, 1982

**Reference**  Basic Engineering Thermodynamics by Rayner & Joel, 1996

** EG-355 Electro Technology, Instrumentation & Control Systems-III **

**Electro Technology(70 % )**

CAPACITANCE – INDUCTANCE: Inductance, Inductive, Reactance, Circuit with Pure resistance, Inductor In series-inductor in Parallel. Capacitive Reactance, type of Capacitors – Circuits with Pure capacitance, Capacitors in parallel, Charging and discharging of capacitors-time constant.AC.


THE D.C. MACHINES: General construction. The D.C. generator etc. Characteristics and Current effect. Types of generators Permanent magnet and self excited type, series wound
Generator-Shunt Wound Generators-Compound wound Generator-Separately Excited Generators-Load Characteristics. Electrical distribution system D/C.

**Instrumentation And Control Systems-I(30 %)**


TEMPERATURE MEASUREMENT: Bimetallic Thermometer, Resistance Thermometer, Thermistor Thermocouple Transducers.

PRESSURE MEASUREMENT: Water Manometer, Mercury Thermometer, pressure Gauge (Bourdon) Piezo electric Transducers.

LEVEL MEASUREMENT: Capacitor Level Gauge, Igema, Remote water level indicator, Pneurnator Level indicator.

**Recommended Books**

**Text:** Reed's Basic Electro Technology for Engineers by Edmund G. H. Kraal, (Vol. VI.), 1996

**Reference:**

1. A Text Book of Electrical Technology(S.I.Units) by B.L. Thrawja, S. Chand & Company Ltd, 2012

2. Reed’s Instrumentation and Control System by L. Jackson & Thoman D. Morton, 1999

**EG-356 Machine Drawing-III**

TYPICAL FIRST ANGLE ORTHO-GRAphIC PROJECTION ASSEMBLY OF VARIOUS PARTS:

**Recommended Books**

**Text:** Engineering Drawing Book for Marine Engineers by H.G. BECK (Reed’s Vol.III), 1978

**Reference:** Mac gibbon pictorial Drawing book by James G Holburn, James Munro, Limited, 1965

**EG-357 Internal Combustion Engines Knowledge(ICEK)-I**


SCAVENGING AND SUPER CHARGING: Scavenging and supercharging. Comparison of Scavenging Process of Four & Two Stroke Diesel Engines, Types of super charging
Exhaust gas turbo charger, Basic Principles, Various parts, Function/Operation.


CONTROLS: Function of Governor. Bridge control and unattended Machinery.

Recommended Books

Text: 1. Reed’s Motor Engineering Knowledge by Thomas Morton, 1994
2. Marine Diesel Oil Engines Southern by Southern, 1968

EG-358 Naval Architecture & Ship Construction I

Naval Architecture

HYDROSTATICS: Density, relative density, Pressure exerted by liquid. Load on an immersed plane, Centre of Pressure


CALCULATION OF AREA AND VOLUME: Simpson’s First Rule.


STABILITY OF SHIPS: Righting moment and righting lever. Transverse Metacentre, Metacentric Diagram, Inclining Experiment

TRIM: Change in mean draught due to change in density. Change in mean draught due to bulging.


Recommended Books

Text: Reed’s Naval Architecture For Marine Engineers by E.A Stoke, 1991

Ship Construction

SHIP TYPES AND TERMS: Passenger and Cargo Ships oil tankers, bulk carriers, colliers and container ships, Terms in general use.

STRESS IN SHIP: Structural stresses, Hogging and sagging. Local stresses, docking, Panting and pounding.
WELDING AND SECTIONS USED: Electric arc Welding and Riveting, Welding positions and sections used

BOTTOM AND SHIPS FRAMING: Double bottom constructions, duct keel and bilge keel. Frames and Beams

SHELL AND DECKS: Deck and Shell planting, Hatchways and hatch overs.

BULKHEADS AND DEEP TANKS: Water Tight doors and bulkheads, Non Water Tight bulkhead and pillars.

FORE-END ARRANGEMENTS: Steam plating and arrangements, To resist painting. Bulbous bow. Anchor and cable arrangement.

AFTER AND ARRANGEMENTS: Transom stern and stern frame. Rudders. Spectacle frame and propeller frames. Different types of propeller

DIFFERENT TYPES OF SHIPS: VLCC Tankers and liquid petroleum gas carries. OBO (ORE/Bulk/Oil) carriers and colliers


**Recommended Books**
**Text:** Reed’s Ship Construction for Marine Engineers by E.A. Stoke, 1999
**Reference:** Ships Construction Sketches by Kemp and Young, Butter Worth1997

GT-361 Computer Familiarization-III

**Software:** Software and its Types, Operating System, Functions of Operating System(Process Management, Memory Management, File/Data Management, Device Management etc)


**Security Essentials:** User Access Management, Malicious Software and Strategies for dealing with it, Antivirus and Firewall.

**SEMESTER-IV**

ED-401 English-IV

**Letter writing, memos and emails**
- Letter, memo and email formats
- Appropriate language and style
- Using elements and formats correctly and developing Word Documents using MS Office
- Writing Routine official messages and correspondence using memo or letter formats
- Using email for routine official correspondence
Writing short reports/ briefs/ progress updates
- Formats for short reports (Informative and Analytical)
- Writing Informative reports (for various situations)
- Writing analytical reports (for various situations)
- Writing brief progress reports or status updates
- Developing reports/ updates/ briefs using visuals (tables, lists, diagrams, charts, graphs, pictures etc)
- Sending digital reports through emails

Recommended Books

ED- 402 International and Legal Maritime Studies (ILMS)


Legal Aspects Of Ship Ownership And Operation: Ship Construction, Ship Ownership, Ship Sale And Purchase, Ship Registration, Securities And Liens, Master Crew And Other Maritime Labour, General Maritime Safety

Legal Aspects Of Navigation And Safety At Sea: Marine Collisions, Other Marine Accidents, Marine Pollution, Marine Salvage, General Damage Liability.


Master And Crew: Master’s Authority, Master’s Liabilities, Master’s Power Of Arrest, Presence On Board Ship, Relationship with Deck and Engineer Officers, Responsibility For Cadets, Master’s Duties, Succession To Command In Emergency.

Manning: Manning And Certification, Power To Exempt From Manning Requirements, Prohibition Of Going To Sea Undermanned, Unqualified Persons Going to Sea as Qualified, British Certificates Issued Abroad, Certificates Of Service.

United Nations Convention On The Law Of The Sea (Unclos): General Information and Provision, Limits Of The Territorial Sea, Passages and Zones,

International Maritime Organization (IMO): Brief History, IMO Conventions, Structure Of IMO Bodies.

Recommended Books:

ED-403  Chemistry

Fuels: classification, gross and net calorific value, storage of fuel, flash point, limit of flammability, explosive limit, fuel as a source of energy
Metal and alloy: properties and general composition such as iron, copper, aluminum, chromium, zinc used in engineering field. Inorganic engineering materials(cement and glass) organic engineering materials(polymers, rubber, plastic and paint, semi conductors and dielectric materials)
Lubricants: classification, purification and refining of lubricants, mechanism, testing of lubricants,
Oil purification: microbial degradation of lubricating oil, gravitation, separation, filtration of fuel and lubricating oil
Pollution: types of sphere, air pollution, water pollution, soil pollution, solid waste management.

Experiment

1. Determination of the percentage of moisture in a sample.
2. Determine the heat of neutralization of strong acid with strong base.
3. Determination of the amount of copper in the copper ore solution
4. Determination of Wavelength of Maximum Absorbance
5. Verification of Beer-Lambert’s law and determination of concentration of metal ions spectrophotometrically
6. Acid-base titration by Potentiometric method.
7. Spectrophotometric determination of chlorine in water sample.
8. Determine the amount of Oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.

Recommended Books
Text Book:

Reference Books:
7. B.S.Bhal, G.D. Tulli, Avum Bahl, Essential of Physical Chemistry (Multi Colour Edition)
9. S.S.Dara, Introduction to Chemical Engineering, S Chand 2008

ED-404  MATHEMATICS-IV

Infinite Series: Introduction, Convergence of a series, Comparison Tests, Root Test, Ratio Test and Raabe’s Test
Fourier series: Introduction to Fourier series, Euler Fourier formulae, Application of Fourier series, Fourier transforms
Laplace transforms: Laplace transforms of some elementary function, First and Second translation or shifting theorems, Laplace transform of the nth order derivative, Laplace transform of integrals, Laplace transform of functions t^n F(t) and F(t)/ t, Inverse Laplace

**Advanced Calculus:** Limit of double integration, Change of order, Area, centroid and moment of inertia, Triple Integration & its application

**Vector Calculus:** Vector differentiation (Gradient, Divergence & Curl), Vector Integration (line, surface & volume integrals), Green’s, Divergence & Stoke’s theorems with applications

**RECOMMENDED BOOKS**

**Text:**
1. Advanced Engineering Mathematics by Erwin Kreyszig, Seventh Edition
2. Calculus & Analytical Geometry by Howard Anton Seventh Edition

**EG-451 General Engineering Knowledge-IV**

**PNEUMATIC SYSTEM:** Basic methods of air compression, Reciprocating, rotary vane, rotary
Screw type of air compressor. Condition of air, oil removal, Moisture separators, Vortex Type, Directional Change Type, Coagulating Type. Uses of high-pressure and low pressure air, General Principles of Pneumatic Control, Flapper Nozzle, Booster relay, Control Valves, Diaphragm Motor

**FUEL TECHNOLOGY:** Solid fuels, Liquid fuels and fuel plant technology, Testing of liquid fuels and oils(Specific gravity, viscosity, calorific value, flash point, classification of dangerous fuels, limits of flammability, explosive limit, HEL, LEL, TLV, Fire point etc. Viscometer, viscosity of fuel controlled automatically. Theory of combustion of fuel, Air for Combustion, Clean Air Act. Precautions while fuel oil bunkering, Oil in Navigable Waters Act. Requirements for I.O.P.P. certification

**STEERING GEARS:** Steering and receiving telemotors. By pass valve, Telemotor fluid, charging system, Steering rules, Heleshaw pump, Electro Hydraulic steering gears(four Ram Systems), All electric steering gears

**PUMPS AND PUMPING SYSTEM:** Types of pumps, Reciprocating, Centrifugal, Screw, Rotary Vane, Gear pump), Emergency bilge pump, Bilge injection valve, Suction Head and Cavitations, Oily water Separator, Bilge and Ballast System, Domestic water hydrosphere system. Centralized priming system. Centralized cooling system. Rules for Bilge & ballast system. Maintenance and repair of pumps

**SHAFTING AND LUBRICATION:** Stern tubes oil and water lubricated. Thrust Block, its lubrication, film lubrication, and boundary lubrication

**REFRIGERATION:** Theoretical Principles, Properties of actual Refrigerant. Various compression system, Condenser, evaporator, valves, Insulations, Air conditioning, Humidity and Dew point, Maintenance and repair of refrigeration plant

**FIRE:** Principle, prevention and Precaution of fires different types of fire extinguishing medium Systems used in extinguishing fire. Fire detection system. Fire man out fit. Breathing Apparatus set

**OIL PURIFICATION:** Microbial degradation of lub. Oil, Gravitation, separation filtration of oil fuels and Lubricating oil, Various fitting on services & Setting tanks

**Recommended Books**

**Text:** Reed’s General Engineering Knowledge, Volume-VIII, by Leslie Jackson, 4th ed, 1986

**Reference:**
4. Various other reference books, periodicals and magazines.

EG-452 Workshop Theory-IV


INSPECTION MEASURING INSTRUMENTS AND GAUGES: Introduction to quality control, Types of fits, Tolerance & allowance, Classification of Measuring Instruments, Linear, Angular Measurement, Surface measurements, Classification of gages, Statistical quality control

HEAT TREATMENT OF STEEL: Introduction to heat Treatment process. Annealing & Normalizing, Hardening & its classification, Tempering, Engineering applications.

Recommended Books

Reference: 1. General Engineering, Paramount W.P
2. Manufacturing Processes by My RON L Beggeman

Workshop Practice-IV

MAINTENANCE AND REPAIR OF MARINE MACHINERIES: Repair of Valves and pipe Fitting, Repair of pumps, Repairs of diesel Engines, Boiler and Boiler mountings, Dismantling & Assembly of Diesel Engine (Group Task).

Recommended Books
2. General Engineering Workshop practice, Paramount
3. Models, Jobs as per drawing. Various

EG-453 Applied Mechanics-IV


TORSION OF SHAFTS: Fundamental torsion equation, Relationship between torque, Stress and power. Torsional resilience. Maximum and mean Torque. Coupling bolts. Reciprocating engine mechanism


Recommended Text Book
1. Reeds Applied Mechanics for Engineers (Vol. II) by William Embleton, 1994

EG-454 Applied Thermodynamics-IV


NUMERICAL PRACTICE: Numerical practice.

Recommended Books
Text Heat and Heat Engines for Marine Engineers by W. Embleton, (Reeds Series Vol. III), Thomas Reed, 1982
Reference Basic Engineering Thermodynamics by Rayner & Joel, 1996

EG-455 Electro Technology, Instrumentation & Control Systems-IV

Electro Technology(70 %)


TERMIONIC AND SEMI CONDUCTOR DIODE: Thermionic devices – semi conductor, Diode, static characteristic, Diode as rectifier, intrinsic, Conductivity, Extrinsic conductivity, N-type Ge, P-type Ge, the Pn-Junction, forward bias, Reverse bias, Zener diode Transistor.

Instrumentation And Control Systems-II(30 %)

OTHER MEASUREMENT: Speed, techogenerator, photo electric cell, photo transistor, oil in water Sensor, smoke density detector, flame Gas analysis, oxygen analyzer, different Devices and instruments used in Automation, hydraulic, electric and Electronic circuits.

TELEMETERING: Force balance transducer (pneumatic), Electro pneumatic transducers, Variable contact resistance Transducer.

CONTROL THEORY FUNDAMENTALS: Automatic control system, types of Actual bridge control, oil purification System, instrumentation, calibration Testing and adjustment. Operation testing and fault rectification of automatic control system and alarm panel.
**Recommended Books**

**Text:**  Reed’s Basic Electro Technology for Engineers by Edmund G. H. Kraal, (Vol. VI.), 1996

**Reference:**
1. A Text Book of Electrical Technology (S.I. Units) by B.L. Thrawja, S. Chand & Company Ltd, 2012
2. Reed’s Instrumentation and Control System by L. Jackson & Thoman D. Morton, 1999

**EG-456 Machine Drawing-IV**


**Recommended Books**

**Text:**  Engineering Drawing Book for Marine Engineers by H.G. BECK (Reed’s Vol.III), 1978

**Reference:**  Mac gibbon pictorial Drawing book by James G Holburn, James Munro, Limited, 1965

**EG-457 Internal Combustion Engines Knowledge (ICEK)**

VARIOUS SYSTEM IN DIESEL ENGINE: Jacket cooling water system, Piston cooling water system, Sea water cooling system, Lubricating oil system, Fuel oil system

FUEL OIL PROPERTIES, PURIFICATION STORAGE ETC.: Various physical and chemical properties of diesel and heavy fuel oil used on board. Purification and clarification of fuel oil. Maintenance and repair of purifiers. Storage of fuel on board.

STARTING AIR COMPRESSORS: Starting air compressors two stage and three stage. Parts of starting air compressor. Air Reservoir & mountings. Maintenance and repair of air compressor.

MEDIUM SPEED DIESEL ENGINES: Maintenance of Medium speed Diesel Engines. Developments of medium speed emergency procedure of diesel engines.


**Recommended Books**

**Text:**  1. Reed’s Motor Engineering Knowledge by Thomas Morton, 1994

**Reference:**
2. Marine Diesel Oil Engines Southern by Southern, 1968

**EG-458 Naval Architecture & Ship Construction**

**Naval Architecture**

HYDROSTATICS: Density, relative density, Pressure exerted by liquid. Load on an immersed plane, Centre of Pressure

CALCULATION OF AREA AND VOLUME: Simpson’s First Rule.


STABILITY OF SHIPS: Righting moment and righting lever. Transverse Metacentre, Metacentric Diagram, Inclining Experiment

TRIM: Change in mean draught due to change in density. Change in mean draught due to bulging.


**Recommended Books**

**Text:** Reed’s Naval Architecture For Marine Engineers by E.A Stoke, 1991

**Ship Construction**

SHIP TYPES AND TERMS: Passenger and Cargo Ships oil tankers, bulk carriers, colliers and container ships, Terms in general use.

STRESS IN SHIP: Structural stresses, Hogging and sagging. Local stresses, docking, Panting and pounding.

WELDING AND SECTIONS USED: Electric arc Welding and Riveting, Welding positions and sections used

BOTTOM AND SHIPS FRAMING: Double bottom constructions, duct keel and bilge keel. Frames and Beams

SHELL AND DECKS: Deck and Shell planting, Hatchways and hatch overs.

BULKHEADS AND DEEP TANKS: Water Tight doors and bulkheads, Non Water Tight bulkhead and pillars.

FORE-END ARRANGEMENTS: Steam plating and arrangements, To resist painting. Bulbous bow. Anchor and cable arrangement.

AFTER AND ARRANGEMENTS: Transom stern and stern frame. Rudders. Spectacle frame and propeller frames. Different types of propeller

DIFFERENT TYPES OF SHIPS: VLCC Tankers and liquid petroleum gas carries. OBO (ORE/Bulk/Oil) carriers and colliers


**Recommended Books**

**Text:** Reed’s Ship Construction for Marine Engineers by E.A. Stoke, 1999
Reference: Ships Construction Sketches by Kemp and Young, Butter Worth 1997

GT-461 Computer Familiarization-IV

Networking Essentials: Data Communication, Networking Technologies, Wireless and Broadband Technologies, Internet

Office Automation: Microsoft Word, Microsoft Excel, Microsoft Power Point, Microsoft Access