

**BHARATHIAR UNIVERSITY: COIMBATORE 641 046.****DIPLOMA IN MARINE SCIENCE**

(For CPP/CPOP students admitted from the academic year 2013-2014 &amp; Onwards)

## Scheme of Examinations

Course Title	Ins.hrs / week	Dur.H	Total
<b>SEMESTER – I</b>			
1.1. General English & Applied Mathematics	5	3	100
1.2. Engineering Chemistry	5	3	100
1.3. Physics	5	3	100
1.4. Introduction to Graphics	5	3	100
1.5. General Shipping Knowledge	5	3	100
<b>SEMESTER - II</b>			
2.1. Marine Engine	5	3	100
2.2. Marine Fitting	5	3	100
2.3. Marine Advanced Welding	5	3	100
2.4. Marine Electricals & Electronics	5	3	100
2.5. Workshop practice	5	3	100
<b>TOTAL</b>	-	-	<b>1000</b>

**Eligibility for admission:** Candidates for admission to the course shall be required to have passed the Higher Secondary examinations (Academic or Vocational).

**Duration of the course:** The course shall extend over a period of One Year comprising of Two semester.

**Medium of instruction and examinations:** The medium of instruction and examinations shall be in English.

**Other requirements:** LIVE Event trainings as and when suggested by Institute is to be completed within the duration of the course followed by submission of the report and Presentation on Event Management.

## 1.1 GENERAL ENGLISH AND APPLIED MATHEMATICS

### UNIT I

General English Basic Grammar: Parts of speech-noun, adjective pronoun, verb, adverb, preposition, conjunction and interjection, definition and examples of Tense-uses of tenses. Kinds of sentences: Simple complex, compound, assertive, interrogative, imperative, negative & exclamatory sentences. Direct speech, indirect speech, comprehension, letter writing, precise writing, and easy writing

### UNIT II

COMMUNICATIVE ENGLISH: The phrase ‘Communicative English’ refers to that English which helps us to communicate effectively with people using language functions. Language functions are the purposes for which we use specific expressions /utterances / phrases when we speak or write. Some examples of language functions are: Asking someone for his/her likes and dislikes, expressing our thanks to one who has helped us, etc.

### UNIT III

APPLIED MATHEMATICS/ARITHMETIC AND MENSURATION: Applied mathematics is a branch of mathematics that concerns itself with mathematical methods that are typically used in science, engineering, business, and industry. MENSURATION : Area of two dimensional plane figures, three dimensional solids,-volume, lateral surface, area and total surface, area-cube, cuboids, cylinder, cone and sphere.

### UNIT IV

ALGEBRA AND TRIGONOMETRY: Quadrilateral equations, simultaneous equations, problems or equations. Algebra can essentially be considered as doing computations similar to that of arithmetic with non-numerical mathematical objects. TRIGONOMETRY: Trigonometrical ratios, compound angles, multiple and sub multiple, angles formula , height and distances. Trigonometry basics are often taught in school either as a separate course or as part of a precalculus course.

### UNIT V

DESCRIBING MOTION: Definition of speed, velocity and acceleration, different formulas on speed, velocity and acceleration. Many of the objects we encounter in everyday life are in motion or have parts that are in motion. Motion is the rule, not the exception. The physical laws that govern the motion of these objects are universal, i.e. all the objects move according to the same rules.

### REFERENCE:

Introduction to Applied Mathematics, Gilbert Strang, Jan 1, 1986  
Applied Mathematics, J. David Logan, Apr 21, 2006

## 1.2 ENGINEERING CHEMISTRY

### UNIT I

Chemical Thermodynamics : Concept of thermodynamic system. Introduction of First law of thermodynamics Internal energy and enthalpy. Cp and Cv, Adiabatic charges. Application of First law of Thermodynamics to chemical processes (Hess's Law and Kirchoff's Law), JouleThompson and throttling processes, Evaluation of entropy, work functions and free energy in the light of thermodynamics. Condition of spontaneity and equilibrium.

### UNIT II

Atoms and Molecules :Particles in a box illustrating energy, quantization, angular momentum, quantization, radial and angular parts of H atom, wave functions / orbital's, probability and charge distribution. Homonuclear and heteronuclear diatomic, covalent bonds, ionic bonds and electronegativity concepts, hybridization and shapes of molecules. Non-covalent interaction ( Van der Waals and hydrogen bonding).

### UNIT III

Solid State Chemistry: Brief discussion of stoichiometric defects (Schottky & Frenkel) and non stoichiometric defects (Metal excess and metal deficiency). Role of Silicon and germanium in the field of semiconductors, transistors, rectifiers and photovoltaic cells. The process for preparing micro. Miniaturized semiconductor devices : Integrated circuits.

### UNIT IV

Instrumental Methods of Analysis and Reaction Dynamics, Transition and Metal Chemistry: Experimental methods of structure determination using spectroscopic techniques such as IR, UV-Vis, NMR and Mass Spectrometry. Rate laws, mechanisms and theories of reaction rates (collision and transition state theory). Lasers in Chemistry Structures of coordination compounds corresponding to coordination numbers up to 6.Types of ligands . Isomerism (geometrical, optical, ionization, linkage and coordination). Theories of bonding in coordination compounds, viz. crystal field theory, valence bond theory.

### UNIT V

Organometallic Chemistry and Catalysis, Structure and Reactivity of Organic Molecules: Structure and bonding in organ metallic complexes, the sixteen and eighteen electron rules. Homogeneous catalysis, the role of metals in catalytic cycles during some chemical reactions ( e.g Hydro formulation , hydrogenation etc. ) . Role of metals in biology; oxygen carrier, electron transfer. Inductive effect; resonance, hyper conjugation, electromeric effect.

### REFERENCE:

1. Chemistry for Engineering Students, Larry Brown and Tom Holme, Jan 1, 2010
2. Engineering Chemistry, A. Pahari and B. Chauhan, Jun 30, 2007

## 1.3 PHYSICS

### UNIT I

The Basics of Physics, all aspects of physics including motion, work, energy, heat, matter, light, and electricity

### UNIT II

Mechanics: Relative velocity and its application to radar plotting, boat sailing etc, review of Newton's law of motion, projectiles, circular motion, centripetal and centrifugal forces, law of gravitation, work power and energy potential and kinetic energy, conservation of energy, conservation of linear momentum, impulse collision-direct and oblique impact.

### UNIT III

Hydrostatics: Archimedes principle, up thrust buoyancy, pressure at a depth floating objects, Ships, submarines, floating dock, iceberg, balloon, hydrometer, atmospheric pressure, barometer.

### UNIT IV

Engineering Materials : Materials- Structure property relationship. Selection of materials for engineering advance modern materials, crystal structure, miller indices, packy factor, space lattices, x-ray diffraction.

### UNIT V

Practical Demonstration of block and tackle arrangements, Moment of inertia of flywheel and frictions torque, Wave length determination using grating by spectrometer, Young's modules by non uniform bending, Young's modules uniform bending.

### REFERENCE:

1. The Physics Book: From the Big Bang to Quantum Resurrection, 250 Milestones in the History of Physics, Clifford A. Pickover, Nov 1, 2011
2. Just Enough Physics, Rhett Allain and Khandan Simmons, May 25, 2011
3. The Basics of Physics, Rusty.L 2006

## 1.4 INTRODUCTION TO GRAPHICS

### UNIT I

Introduction for Machine Drawing: Introduction meaning and usefulness of machine drawing, instrument and Materials used for drawing code of practice. For Egg Drawing (1896-1972) Scale, lines, lettering, titling, dimensioning, tolerance. Plane Geometry- Terms& definition used- construction and divisions of lines, Angles, triangles, Quadrilateral polygons, circles & tangents.

### UNIT II

Solid geometry : Angles generally used on solid geometry Method of first angle & third angle. Projections, definitions, Projections of simple solids, (construction), conventional representation & sectioning, Fastening, construction of nuts, bolts, rivets, screw thread, shaft keys, cotters Spur gear.

### UNIT III

Introduction to computer drafting: Basics of CAD, MACHINE drawing, .Machine Parts, wall brackets (5 types), shaped blocks (5nos), Ci Blocks (5 nos), monkey for scribing block. Split muff coupling, flanged coupling, Fork for hooks coupling, bushed bearing, bracket with split bearing, Footstep bearing, open bearing, plumber block, stepper pulley, pipe vise body screw jack, stuffing box.

### UNIT IV

OBJECT DRAWING : Piston, cylinder head valves, valve guide springs, rocker arm, injector, connecting rod, fuel pump, crank shaft, cross head, cylinder liner, reverse reduction gears, clutch, cooling system, Engine room layout, workshop layout, air starting valve, Free hand stretching of valves, cocks, pumps, governor.

### UNIT V

ASSEMBLY DRAWING: Piston, cylinder head valves, valve guide springs, rocker arm, injector, connecting rod, fuel pump, crank shaft, cross head, cylinder liner, reverse reduction gears, clutch, cooling system, Engine room layout, workshop layout, air starting valve, Free hand stretching of valves, cocks, pumps, governor

### REFERENCE:

1. Introduction to Graphics Communications for Engineers (B.E.S.T series) (Basic Engineering Series and Tools), Gary Bertoline (Apr 14, 2008)
2. An Introduction to Ethics in Graphic Design: Ethics of Graphic Design, Lucienne Roberts (Nov 15, 2006)

## **1.5 GENERAL SHIPPING KNOWLEDGE**

### **UNIT I**

Names Of Various Parts Of Ship, Name And Timings Of Watch, Types Of Merchant Navy Vessels, Sea Terms, Look Out Compass Points, Classification Of Ships For Life Saving Appliances, LSA Requirements For Cargo Ships.

### **UNIT II**

Life Boat :Description of Life Boat, Construction And Parts Of Life Boat, Different Clauses Of Life Boats Used, Determining, Thee Carrying Capacity Of A Life Boat, Equipment, Ration And Discussed Signals, Type Of Boat. Dovits and Their Method Of Operation.

### **UNIT III**

Life Raft: Inflatable and Rigid, Construction And Parts Of Life Raft, Repairing Leaks And Puncture, In To A Life Raft. A life raft is a piece of safety equipment which is used to provide emergency transportation to get people away from a sinking or endangered vessel. Life rafts are at least partially collapsible, in contrast with life boats, which are solid.

### **UNIT IV**

Lifebuoy : Description Of A Life Jacket Buyout Materials Used In The Correct Method Of Putting On A Life Jacket And Jumping Into Water. A lifebuoy, ring buoy, lifering, lifesaver, life preserver or lifebelt, also known as a "kissy ring" or "perry buoy", is a life saving buoydesigned to be thrown to a person in the water, to provide buoyancy, to prevent drowning. Some modern lifebuoys are fitted with one or more seawater-activated lights, to aid rescue at night.

### **UNIT V**

Fire Fighting Appliances, Safety Devices and Accidents: Fire Hydrants and Hoses, Types of Connection, International Shore Connections, Types Of Nozzles. Description of Portable Fire Extinguishers, Various Types and Their Suitability For Different Types Of Fires.

### **REFERENCE:**

1. Ships, Sailors and the Sea, J. Miles, Caroline Young and C. King Apr 1989
2. Ship Knowledge: Ship Design, Construction and Operation, Klaas Van Dokkum 2008

## **2.1 MARINE ENGINES**

### **UNIT I**

**FUNDAMENTALS OF INTERNAL COMBUSTION ENGINE Terminology:** Classification of internal combustion engine, working principles of 4 stroke and 2 stroke engines. Cycles of operation 4 stroke diesel cycle; two stroke diesel cycles, indicator Diagrams, Engine indicator diagrams. Scavenging-cross flow-loop flow and uni flow scavenging. Difference between 2 stroke and 4 stroke engines, Advantage & disadvantage of 2 stroke & 4stroke engines,- difference between spark ignitions and compression ignitions engine- heat blame thermal efficiency- mechanical efficiency Means effective pressure- volumetric efficiency.

### **UNIT II**

**COMPONENTS OF DIESEL ENGINES:** Understanding on the construction of the engine-bed plate-crankshafts- counter weight—crank pin journal - crank web main bearing - connecting rod-bearing, connecting rod bolt & nut-crank case or sump, vibration damper-timing gear, thrust bearing – cylinder block - cylinder liner, piston, piston rings, connecting rod, gudgeon pin, water jacket, air fins, cam shafts, cylinder head studs & nuts, cylinder head packing or gaskets, valves & valve guide bush, valve seat-valve collect, valve spring, valve rotator, push rod, rocker arm, rocker arm cover, etc.

### **UNIT III**

Systems of diesel engines - Frame system, energy generating system, power transmission system, intake and exhaust system, valve mechanism system, Fuel system, lubrication system, cooling system, starting system.

### **UNIT IV**

Engine Handling & Maintenance: Operation-preparations before starting watch keeping the performance while running, watch keeping system, operating the watch, handling over and taking over the watch, precautions for stopping. Maintenance - Guidance for scheduled maintenance, condition based planned maintenance, Preventive maintenance, Top overhauling, Major overhauling.

### **UNIT V**

#### **TROUBLE SHOOTING OF DIESEL ENGINES**

Starting, Power variations, speed variation ,Abnormal smoke, Abnormal Pressure- , Abnormal Temperature, Abnormal sound. Power – Development: Indicated Horse power, Brake Horse Power, Frictional Horse Power, shaft Horse Power-Calculation of power, Rating of engines, Testing of engines , Testing of propulsive machinery. Selection of Engines – Fuel & lubricant, Reliability and durability stroke/cooling method, Running characteristics, maintenance, vibration, size, weight, power requirement.

### **REFERENCE:**

1. Marine Diesel Engines: Maintenance, Troubleshooting and Repair, Nigel Calder Sep 12, 2006
2. Marine Diesel Engine Basics - A Beginners Guide to Marine Diesel Engine Maintenance, Laurence Burgin and Alison Benjamin (Nov 4, 2012)

## **2.2 MARINE FITTINGS**

### **UNIT I**

Bench work, fitting and fabrication

### **UNIT II**

Screw Thread: General Description of a thread – Types of threads and its uses, important parts of threads, major diameter, minor diameter, pitch lead, root, crest, left hand thread, right hand thread, internal thread and external thread. TAPS – Description of a TAP, material and how to use the tool. DIES – Material, types of dies and stock and how to use the tool.

### **UNIT III**

Fuel and Lubricant, Steering Gear, Power transmission, Pumps and Pumping Systems.

### **UNIT IV**

Pattern making and Foundry work, CARPENTRY

### **UNIT V**

MECHANICAL POWER TRANSMISSION , DRILLING MACHINE , GRINDING MACHINE.

### **REFERENCE:**

1. Marine Diesel Engines: Maintenance, Troubleshooting, and Repair, Nigel Calder Sep 12, 2006
2. Marine Diesel Engine Basics - A Beginners Guide to Marine Diesel Engine Maintenance  
Laurence Burgin and Alison Benjamin Nov 4, 2012
3. Estimator's Piping Man-Hour Manual, John S. Page Jun 7, 1999



## 2.3 MARINE ADVANCED WELDING

### UNIT I

Materials: Various Materials And Alloys – Manufacturing Process – Properties Tensile, Hardness, Marine Applications Of Various Metals. Mechanical Working Of Metals, Mechanical Working Process And Purpose Hot Working Principle Method Of Hot Working - Cold Working – Principle Of Cold Working. Metals And Heat Treatment. Ferrous Metals And Alloys, Non – Ferrous Metals And Alloys, Heat Treatment Of Iron And Steel Description And Purpose Of Heat Treatment. Smithy And Forging. General Decryption Of Smithy And Its Tools Forge.

### UNIT II

Metal Joining: Welding, Introduction, Safety In Welding Shop, Classification Of Welding, Advantage And Limitation Of Welding. Arc Welding – Principles Of Arc Welding, Arc Welding Machines – Dc Generators, Ac Transformers, Advantages And Disadvantages Each. Welding Process – Welding Preparation Of Welding Operation– No. Of Runs – Flat Horizontal, Vertical And Overhead Welding, Welded Joints, Butt, Lap, Corner, Tee Head Joints Welding Symbols As Per Is Code.

### UNIT III

Selection Of Welding Electrodes: Electrode Coatings Current Voltages, The Function Of Electro Coating. Gas Welding – Oxy – Acetylene Welding – Major Advantages And Limitations – Types Of Flames. Function And Operations Of Oxy-Acetylene Cylinders Pressure Regulators, Welding Regulators, Welding Torch, Nozzle.

### UNIT IV

Gas Welding Procedure : Preparation Of Job, Selection Of Filler Rod And Flux. Gas Pressure And Nozzle Size, Angle Of Rod And Blow Pipe And No. Of Runs. Brief Expansion Of Oxy-Hydrogen Submerged Arc Welding .Tungsten Inert Gas Welding (Tig). Metal Inert Gas Welding (Mig).  $\text{Co}^2$  Welding, Atomic Hydrogen Welding, Termite Welding Brief Description Only. Defects In Welding – Causes And Remedies Of The Defects Porosity, Poor Penetration, Warping Undercut, Destruction, Crack, Poor Appearances.

### UNIT V

Testing And Inspection Of Weld Joints: Brief Description Of Visual Inspection, Destructive Test, Tensile And Bend Test, Non Destructive Test, Magnetic Test, Electric Testing And X-Ray Testing. Soldering And Brazing – Application Of Soldering And Brazing Advantages And Limitations.

### REFERENCE:

1. Adhesives in marine engineering (Series in Welding and Other Joining Technologies  
Jan Weitzenbock Jun 28, 2012

## **2.4 MARINE ELECTRICAL & ELECTRONICS**

### **UNIT I**

Basic Electronics & Instrumentation: Energy Bonds In Solid, The Nature And Structure Of Atom Charged Particles, Ionisation, Insulation, Semi-Conductions, And Conductor. Semiconductor Devices and Circuits. Intrinsic And Extrinsic Semiconductor, Covalent Bonds, Electron And Hole Concept, Semi Conduction Materials, Donor And Acceptor Impurity, P Type And N Type Semiconductors, Semiconductor Diode, etc..

### **UNIT II**

Basic Fuse and Circuit Breaker Theory, Fuse Types and ratings, Circuit breaker types and ratings, Trip causes.

### **UNIT III**

Electronic Components and Control System

### **UNIT IV**

Introduction to Electricity, Electro Kinetics, Ohms Law & Kirchhoff Law, Self And Batteries Primary Cells, Secondary Cell, Magnetism And Electro Magnetism: Magnetism.

### **UNIT V**

Generator - Main Circuit Breaker and Its Function, Main Switch Board and Its Function, Function of Circuit Breakers and Fuses, Ring Main System of Distribution, Tree System of Distribution, Parallel Operation of Generators, Uses of Different Types of Generators, AC Power Generation And Distribution System.

### **REFERENCE:**

1. Advanced Marine electrics and electronics, Edwin Sherman (Oct 23, 2012)
2. Powerboater's Guide to Electrical Systems, Second Edition, Edwin Sherman (Jul 23, 2007)

## **2.5 WORKSHOP PRACTICE**

### **UNIT I**

Different Tools and Equipments and Their Uses in Carpentry, Sheet Metal Work, Fittings, Electrical and Electronics Lathe Machines, Engines, Pumps, Valves, Refrigeration And Air Condition, Etc.

### **UNIT II**

Fittings : Study Of Various Categories Of Tools Such As Holding Tools, Marking And Measuring Tools, Cutting Tools, Finishing Tools, Miscellaneous Tools. Practice Work – Measuring, Marking, Cutting, Fitting, Etc. Making Of Different Types of Joints Such As - Square Fitting, V-Fitting, Dove-Tail Fitting, Half-Round Fitting, Tee-Fitting, Etc. Sheet Metal Work. Marking, Measuring, and Cutting Of Sheets. Bending Punching Sheets. Making Rivet and Screw Joint, Square Tray, Rectangular Tray, Funnel Cone, Etc.

### **UNIT III**

Welding and Machines Shop

### **UNIT IV**

Marine Engines and Engine Parts.

### **UNIT V**

Marine Electrical and Electronics.