

**SYLLABUS**  
**FOR**  
**THE TRADE**  
**OF**  
**MARINE FITTER**

**GENERAL INFORMATION**

1. Name of the Trade : **Marine Fitter.**
2. N.C.O. Code :
3. Duration of Craftsmen Training : 2 Year.
4. Duration of Apprenticeship Training :
5. Entry Qualification : Passed in 10<sup>th</sup> class examination under 10+2 system of education with 50% marks in Math. & Science or its equivalent.
6. Rebate to Ex-Craftsmen Trainee :
7. Ratio of Apprentice to workers :

Week No.		Trade Practical	Trade Theory	Engineering Drawing	W/S Cal. & Science	Gen.English/ Social Study	On Board Practical
NCVT	CIFNET						
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
1.		Visit to different sections of the Institute. Demonstration on elementary first aid. Artificial respiration etc.	Familiarization with the Institute and Trade. Safety precautions to be observed in the trade during theoretical as well as practical classes. Elementary first aid.	Concept of Standard & Standardization.	Revision of elementary methodical process.		
2		<b>Fitting Section</b> Chipping  Understanding on the construction of engine.	<b><u>MARINE ENGINE</u></b> <b>Fundamentals of Internal Combustion engine</b> Terminology- Classification of internal combustion engine – Working principles of four stroke and two stroke engines – Cycle of Operations – Four stroke diesel cycle – Two stroke diesel cycle indicator diagram – engine indicator- Valve timing diagram – Port timing diagram – Relation between valve timing and port timing diagrams.	<b>Introduction for Machine Drawing</b> Introduction , meaning and usefulness of machine drawing.	<b>Arithmetic –</b> Simple problems on the first four rules	<b><u>Basic Grammer</u></b> Parts of speech –Noun subjective	Nil

3		Filing	<p>Comparison of working principle of four stroke engine with indicator, valve and port timing</p> <p>diagrams – Scavenging – Cross flow, loop flow and uni flow scavenging – Difference between two stroke and four stroke engines.</p>	Instruments and materials used for drawing.	-DO- Calculation of efficiency.	Pronoun, Verb, Adverb, Preposition, Conjunction, Interjection.	Nil
4		-Do-	<p>Advantages and disadvantages of two stroke and four stroke engines – Difference between spark ignition and compression ignition engines – Heat balance – Thermal efficiency – Mechanical efficiency – Mean effective pressure- Volumetric efficiency.</p>	-DO- PV diagram, indicator diagram, valve timing diagram, port timing diagram,	Fractions	Definition and example of tense use of tenses.	Nil

5		Making male and female joints – ‘T’ joint, ‘L’ joint, ‘V’ joint	<b>Components of Diesel Engine –</b> Bed plate – Crank shaft – Counter weight – Crank pin – Crank Journal – Crank web – Main bearing – Connecting rod bearing – Connecting rod bolt and nut- Crank case or sump Vibration Damper – Timing gear .	Code of practice for Engineering Drawing (IS 696-1972)	Decimals	Use of tenses, <b>Kinds of sentences -</b> Simple complex and compound	Nil
6		-Do-  Identification of parts or diesel engine	Thrust bearing – Cylinder block – Cylinder liner – Piston – Piston rings – Connecting rod- Gudgeon pin (or) Pinson pin-Gudgeon pin Bush-water jacket- Air Fins-Cam shaft- Cylinder head-Cylinder head studs and nuts, cylinder head packing or gasket.	-DO-  Sketching of all parts with emphasis on liner, piston, connecting rod etc.	The unitary method	Assertive, interrogative, imperative, negative & exclamatory sentences.	Nil
7		<b>Dovetail joint.</b>	Valves – valve guide	Scale , lines,	Time and	<b>Transformation of</b>	Nil

			bush-valve seat-valve collets-valve spring- valve rotator-push rod- rocker arm-rocker arm cover-rocker arm adjusting bolt and nut inlet manifold- exhaust manifold –air starting valve – De-compression leaver –fuel injector- injector nozzle – air filter-silencer – materials used.	lettering, titling, dimensioning, tolerance.	distance	<b>Sentences -</b> Active Voice Passive voice	
8		<b>Gas cutting/welding/ brazing/ soldering</b> Adjustment of flame setting for different Gas cutting  Servicing of fuel pump, fuel injector, governor	<b>System of Diesel Engines –</b> Frame system-energy generating system- Power transmission system-Intake and Exhaust System-Valve Mechanism System- Fuel System – Lubrication system- Cooling System- Starting system. <b>Fuel System –</b> Main fuel oil tank-Fuel transfer pump-Daily service tank. Fuel filter- water oil separator- purifier-clarifier-Fuel pumps-Regulation of fuel supply-Fuel injector-Fuel	-DO-  Schematic diagrams of all systems.  Fuel pump, fuel injector, sketching of a schematic diagram	-DO-  Fuel consumption	Degrees with comparison	Nil

			Consumption. Governors-Direct acting governors-Relay governors-Sensitivity- Stability-Hunting. Power-Full load speed- Idling Speed- Instantaneous speed change-Permanent speed change.				
9		Gas cutting  Acquainting with the parts of cooling system	<b>Cooling System –</b> Necessity of cooling- Indirect cooling using beat exchanger-Indirect cooling using keel cooler – Direct cooling by sea water- accessories-water pump-heat exchanger- overboard valves- trainers-sea chest- thermostatic valves.	<b>Plane geometry –</b> Terms and definition used – construction and division of lines, angles, triangles, quadrilaterals, polygons, circles and tangents.	Square root	Transformation of sentences in part – II.	Nil
10		Welding/Brazing/ Soldering - practice of arc welding on a surface  Acquainting with the parts of cooling system	<b>Lubrication System –</b> Lubrication-Lubricating oils-Methods of lubrication-Lubrication of marine diesel engines-Equipment used in lubrication system.	-DO-  Sketching the Schematic diagram	Logarithms	Direct Speech	Nil
11		-Do-	<b>Starting System –</b> Hand starting-electrical	-DO-	-DO-	Indirect Speech	Nil

		Acquainting with the parts of cooling system	starting-air starting-construction and working-maintenance of starting system-safety devices on air starting system-air starting valves.	Sketching the Schematic diagram			
12		<p><b>Joining</b> of two surfaces, 'V' Joints welding, practice of Soldering/ Brazing</p> <p>-</p> <p>Checking of valve tappet clearance.</p>	<p><b>Valve Mechanism System</b></p> <p>Functioning-Valve tappet clearance – Checking of valve tappet clearance –</p> <p><b>Intake and exhaust system –</b></p> <p>Natural aspiration-forced aspiration-intake system-inlet elbow-air filter-exhaust system-exhaust elbow-exhaust pipe-silencer-tail pipe-supercharging system-principles of turbo charging-inter cooler-purpose, Construction details, Components, routine maintenance, alignment.</p>	<p>-DO-</p> <p>Sketching the Schematic diagram</p>	<p><b>Mensuration –</b></p> <p>Area of 2 dimensional plane figures</p>	Comprehension	Nil
13		<p><b>Smithy section</b></p> <p>Forging operation-Hexagonal bolt,</p>	<p><b>Engine Handling &amp; Maintenance –</b></p> <p>Operation-Preparations</p>	<p>-DO-</p> <p>Sketching the</p>	-DO-	Comprehension	Nil

		hexagonal nut Acquainting with the parts opening of turbo charger and inter cooler	before starting-Watch keeping the performance while running watch keeping system-Operating the watch-Handing over and taking over the watch-Precautions for stopping	Schematic diagram			
14		-DO-  Starting procedures watch keeping overhauling. Mock up arrangements for understanding trouble developed.	Maintenance-guidance for scheduled maintenance-Condition based planned maintenance-Preventive maintenance-Top overhauling-Major overhauling <b>Trouble Shooting of Diesel Engines</b> – Starting-Power variations-Speed variation-Abnormal smokes.	<b>Solid Geometry</b> – Angles generally used and solid geometry, method of first angle and third angle projection and definitions.	-DO-	Letter Writing	Nil
15		<b>Carpentry</b> Sawing, planning, making male and female joints – ‘T’ Joint, ‘L’ joint, ‘V’ joint, Dovetail joint.	Abnormal pressure- Abnormal temperatures-Abnormal Sound <b>Power development</b> – Indicated Horse Power, Brake Horse Power-Frictional Horse Power- Shaft horse power-effective horsepower	-DO-	Three-dimensional solids, volumes.  Calculation of power	Precise writing	Nil

			Rating of engines Testing of engines Testing of propulsive machinery.				
16		-DO-  Identification of parts opening of the OBM for understanding the principles.	<b>Selection of Engines –</b> Fuel and lubricant – Reliability and durability- Strokes/Cooling methods-Running characteristic – Maintenance-Vibration- Size-Weight-Power requirement. <b>Outboard Motors –</b> Prime mover- Transmission system- Trouble shooting.	-DO-	-DO-	Essay writing	Nil
17		Safety measures to be taken while working on live electrical line/system. First aid for Electric shock and born. An introduction to Indian Electricity rule. Identification of Electrical tools and their uses.  Verification of ohms	<b><u>WORKSHOP TECHNOLOGY</u></b> <b>Introduction of the Subjects</b> <b>Metals and Heat Treatment –</b> Metals – ferrous metals and alloys – non-ferrous metals and alloys.	-DO-	Lateral surface area -cube, cuboids, cylinder, cone and sphere	General essays practice	Nil

		law. Identifying the Difference between series and parallel circuits					
18		Identifying the parts of a cell. Measuring of specific gravity using a Hydrometer. Use of Cell tester to determine battery condition. Connecting batteries in series or parallel or a Combination of both. Charging of the battery. Maintenance and handling of Lead Acid Battery. Wiring practice. Fuse and circuit breakers and its uses. Purpose of earthing and its importance. Methods of wiring. Wiring of one lamp controlled by one switch, two lamps, one socket, three switches by switch box wiring. Testing of wiring insulation.	Heat treatment of iron and steel. Description and purpose of Heat treatment – Principle methods of Heat treatment and its purposes. <b>Mechanical working of metals</b> – Mechanical working process and purpose – Hot working.	-DO-	-DO-	Communicating English	Nil
19		Carrying out job	Principal method of hot	Projection of	Total surface area	<b>Social Science</b>	Nil

		<p>works of smithy and forging.</p> <p>Carrying out job works on welding, field visit on special welding.</p> <p>Identify the parts of D motor and D.C. generator. To find out the series field and shunt field by measuring ohmic values. Earth leakage test for windings. Maintenance routine on motors. Dismantling and assembling of D.C.machines.</p> <p>Dismantling and defect rectification of starter. Motor and</p>	<p>working-cold working- Principle of cold working.</p> <p><b>Smithy &amp; Forging</b> – General description of smithy and its tools. Forge – types of forges. Smiths tools for hand forging.</p> <p><b>Welding</b> – General description of welding. Use and methods of welding.</p>	<p>simple solids (construction) conventional representation and sectioning.</p>	<p>- cube, cuboids, cylinder, cone and sphere</p>	<p>Development of industry ;through five year plans Introduction of five year plans and their importance in the national economy, industrial development and employment generation with stress on current plan. New Economic Policy – Salient points</p>	
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		engine starting system.					
20		Measuring instruments. Ohm meter, volt meter, Ammeter and Multimeter/AVO meter and their use. Use of megger for insulation test. Identify the types of AC motors. Identify the parts of a rotating field Alternator. Fault finding and routine maintenance on AC motor/Alternator.	ARC, Gas, TIG, , MIG, Submerged welding, defects in welding- crack, porosity, deformation etc., adjustment of the flame, selection of correct nozzle. Soldering and brazing – uses, tools for operation, guides of solders, different between soldering and brazing.	-DO-	-DO-	<p><b>Civics –</b></p> <ul style="list-style-type: none"> <li>* Silent feature of the constitution of India</li> <li>* Preamble and directive principles</li> <li>* Fundamental rights and responsibility of a citizen</li> </ul> <p><b>Population Growth &amp; socio economic inspection –</b></p> <p>Employment, Housing, Food, Educational, Clothing, Transport, Environment, Ecological System.</p>	Nil
21		Carrying out job works on pattern making and foundry.  Use of starter. Use of DOL and start delta starter. Motor winding connection in star And Delta.  Measurement of current in star and Delta connection.	<p><b>Pattern making and foundry works.</b></p> <p>General description, casting processes, types of pattern, moulding sand. How to make mould, defects in casting.</p> <p><b>Fastenings –</b> General description – classification of fastening-Rivets and riveting – keys - different types and</p>	-DO-	-DO-	<p><b>Salience feature of programme and series -</b></p> <ul style="list-style-type: none"> <li>*Temporary and permanent methods of contraception with same knowledge of anatomy and physiology of human reproductive system.</li> <li>* NCH services including immunization and nutritional deficiency diseases. Dehydration</li> </ul>	Nil

		Changing over load from one Alternator to another in vessel. Location of Pumps and Servicing of their motors in the vessel. Connection of HP MV and Sodium vapour Lamp. Fault finding in lighting circuit and defect rectification in a given model circuit.	purposes, cotter joint - different types of purposes, pin joints - different types and purposes, Nuts and Bolts – different types and purposes.			therapy	
22		Carrying job on his trade	<b>Carpentry</b> – General description of carpentry tools – types of carpentry tools and uses – common varieties of Indian Timber -. Carpentry processes – different types of carpentry joints. <b>Power Transmission</b> – Types of Belt drive – types of pulleys – jockey pulleys or rider pulley.	-DO-	<b>Algebra</b> – Quadratic equations	*Family welfare services available at primary health centers and sub-centres, urban family welfare centre and dispensaries. ESI, Rly.Hospital and Dispensary. <b>Awareness, cause and prevention of AIDS/HIV + STD</b>	<b>Onboard practical</b> – on all engineering system operation and maintenance.
23			Chain drive – types of clutches – types of Gear drives – Cam drive – rope drive . <b>Bearings</b> – General description – different	-DO-	-DO-	<b>Awareness and prevention from drug addiction.</b> <b>Role of craftsmen/Craftswomen In motivating to adopts</b>	-DO-

		Taking measure and all gages.	<p>kinds of bearings and purposes – material of each bearings.</p> <p><b>Measuring Instruments and Gauges</b> – Scriber – material, uses and types of scribes. Dividers – materials uses and types</p> <p>Calipers – description, material, uses, types of calipers.</p>		Calculation of least count etc.	<p><b>small family norm.</b></p> <p>* By adopting contra septic technique himself or herself</p> <p>* Acting as motivator in the community and educating fellow craftsmen and craftswomen for adopting contractive technique to adhere to small family norms</p> <p><b><u>POPULATION</u></b></p> <p><b><u>EDUCATION</u></b></p> <p><b>National Welfare programme</b></p> <p>* Population problem in India</p> <p>* Population objection in India till the year 2000 AD and onwards. Facts and figures about world population in comparison to India . Recovery of waste heat re-cycling of waste materials. Linkage of lack of energy conservation and environmental pollution.</p>	
24		Nil	Vernier caliper – Description, material, uses and types.	-DO-	-DO-	Concept of environmental and ecological balance. The effect of over	-DO-

			<p>Vernier bevel protractor- description, material, uses and types. Micrometer – description, material, uses and types.</p> <p>Combination set – description, material, uses. Depth gauge – description, material, uses. Depth micrometer – description and uses.</p> <p>Telescopic gauge – description, material and uses. Feeler gauge – description, material uses. Screw pitch gauge – description, material and uses. Radius gauge – description material and uses. Wire gauge – description, material and uses.</p>			<p>exploitation of natural resource and industrialization.</p> <p>Inter relationship between men and his environment and need for replacement of earth resources like soil, ground water, forest, river, sea and wild life.</p> <p><b>Elements of environments planning and management</b></p> <ul style="list-style-type: none"> <li>- Conservation of national sources</li> <li>- Conservation of wild life</li> <li>-Creation of parks and Sanctuaries</li> </ul>	
25		Working with the tools	<p><b>Bench work, fitting and fabrication –</b></p> <p>Filing – general description of a file, classification of files, cut, grade, shapes of files, common types of filing and important points to be remembered while filing, Care,</p>	-DO-	-DO-	<p>a. Type of pollution and its sources</p> <p>b. Effect of pollution and environment and on humanity, plant, animal, machine, health and thus on energy conversation.</p> <p>c. Remedial steps to control pollution</p> <p>d. Environmental laws</p> <p><b><u>ENERGY</u></b></p>	-DO-

			<p>maintenance of a file.  Filing – types of fitting work scrapers, types of scrapers, checking &amp; finishing of flat surfaces by scraping and bearing setting., material of the tool.  Chipping – method of chipping, direction of cuts channel cutting, half round key way cutting, angle of chisel cut, angle of chisel.  Description of chisel, types of chisel and the material of the tool.  Marking off – methods of marking off, marking of tools, straightedge – materials and uses.  Checking of tri-square.  Surface plate – types of surface plate, materials, uses. Vee blocks – types of Vee blocks, material uses and method of folding of work, marking block, material, types of blocks, methods of marking, parallel block, material, method of using the tool.</p>			<p><b><u>CONVERSATION AND ENVIRONMENT MANAGEMENT</u></b>  Concept of energy. Non conventional sources of energy like solar wind, bio-gas etc. Energy crises and energy scarcity.  <b>Principal of energy conversation with special reference to –</b>  Domestic appliances and cooking gas – transport – industries including industrial lighting-heating, ventilation and air conditioning.</p>	
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26		Nil	<p>Striking devices – Hammer-types of hammer, materials of a hammer and the uses of the hammer. Cutting – hacksaw – general description, use and method of operation-types of hacksaws – material of the tool, length of the blade, tooth sizes, shape of saw tooth, selection of the correct saw blade, how to use a hacksaw.</p> <p>Chisels- already explained under chipping. Punches and drifts – material and uses. Types of punches and drifts and how to use. Holding devices – vices – types of vices, material uses, selection of correct size of vice, method of holding of work, fabrication of pipes, flanges etc.</p>	-DO-	Simultaneous equation	<p><b>Working conditions and workers education</b></p> <p>i) Preliminary knowledge about the social security legislation as covered by the following Acts</p> <p>a) Factory Act-1948</p> <p>b) Workmen compensation Act-1923</p> <p>c) ESI Act –1948</p>	-DO-
27		Taking measurement with all gauges	<p><b>Screw threads -</b> General description of threads – types of threads of uses. Important parts of a threads – major</p>	-DO-	-DO- Calculation on pitch etc.	<p>d) Employment standing Order – 1946</p> <p>e) Payment of wages Act- 1936</p> <p>f) Minimum wages Act-</p>	-DO-

		<p>Taking measurement with all gauges</p> <p>Taking measurement with all gauges</p> <p>Taking measurement with all gauges</p>	<p>Diameter minor Diameter, pitch, lead, root, crest, left hand thread, right hand thread, internal thread, external thread.</p> <p><b>Taps</b> - Description of a tap – material and how to use the tool.</p> <p><b>Dies</b> – Description – Material, types of dies and stocks and how to use the tool.</p> <p><b>Drills</b> - Description – material, types of drills, feed, speed, cutting speed. Cutting speed of drill in various material, rate of feeds, method of holding the drills, parts of drill, angle of the drill, care and maintenance of a drill, checking and angle of the drill.</p>			<p>1948</p> <p>g) Industrial dispute Act-1947</p> <p>h) Contact labour regulation and abolition Act-1970</p> <p>i) Employees provident fund and payment of gratuity Act-1952</p>	
28		Taking measurement with all gauges	<b>Reamers</b> - Description –Material, types of	<b>Fastening</b> – Construction of	-Do-	ii) Occupational hazard and safety measures =	-DO-

		<p>Taking measurement with all gauges</p> <p>Carrying out job works</p> <p>Carrying out job on the machine</p>	<p>reamers, purpose of the tool. Counter boring &amp; spot facing, reaming, method of using the tool.</p> <p><b>Hand Tools</b>-Screw driver – types of screw driver, material and uses.</p> <p><b>Sheet metal</b> - General description, method of operation, types of tools and materials.</p> <p><b>Drilling machine</b> - General description and uses.</p>	<p>nuts, bolts, rivets, screw, threads, shaft, keys, cotters, Spur gear.</p>		<p>a) Causes of accident and safety management</p> <p>b) Theories of accident prevention</p> <p>c) Medical first aid</p> <p>d) Selection and use of personal protection equipment of different types.</p> <p>e) Use of fire safety equipment</p> <p>f) Safety legislation</p>	
29		<p>Carrying out job on the machine</p>	<p>Types of machine, types of drilling machine, feed, mechanism, method of holding the drill, chucks.</p> <p><b>Lathe</b> – General description and uses. Parts of lathe, fit mechanism, tumbler gear mechanism, method of holding the work and attachment, steady rest, follower rest, catch plate and carriers.</p>	-DO-	<p>Problems on equations</p> <p>Calculation of thread cutting, taper turning etc.</p>	<p><b>Human relations and Trade Unions</b></p> <p>a) Organizational structure and employer – employee relation</p> <p>b) Purpose and functional of trade unions with respect to trade union Act and amendments</p> <p>c) Responsibilities and duties of workmen towards – society, orgn., work, vis-à-vis work culture</p>	-DO-
30			Different lathe tools,	-DO-	-DO-	<b>ENTREPRENEURSHIP</b>	-DO-

		Carrying out job on the machine  Carrying out job on the machine	different methods of taper turning. <b>Grinding Machine</b> – General description, uses and method of operation- precautions. <b>Arbor press &amp; Hydraulic press</b> – General description, uses and method of operation.			Need and scope for self-employment with special reference to self-employment schemes and sources of assistance in central and State Govts. Organizations IDIC, SIDA, SISI, NSIC, SIDO, financial instts..of national Banks.	
31		Nil	<b>Care and Maintenance of a Workshop. Engine Room and Workshop Lay out</b>	DO-	-DO-	a) Characteristics of successful entrepreneur and successful enterprises. b) Special objectives of business and entrepreneurship. c) The causes of failure identification of entrepreneurship abilities through self-assessment and other techniques. d) The type of business in different trades and the importance of skills	-DO-
32		Nil	<b><u>MARINE ELECTRICAL TECHNOLOGY</u></b> <b>Introduction to</b>	-DO-	<b>Trigonometry</b> Trigonometrically ratios	Understanding the consumers and market through consumer behaviour. Market survey,	-DO-

			<p><b>electricity</b> – Electricity and its important forms. Classification of electricity-static electricity-current electricity. Effect of electricity – Magnetic effect, Heating effect, chemical effect and physical effect. Electric circuit-open circuit, closed circuit and short circuit.</p> <p><b>Electro kinetics</b> – Electromotive force(EMF), potential difference (PD), Electric current and their units. Eddy (Foucault) current, Current density, Electric flux, Resistance, specific resistance, conductance and their units. Alternating voltage and Alternating current . Joule’s law and Joule’s effect. Electric power. Electric energy and their units, numerical examples.</p>			scope and influence, publicity and advertisement, consumer action forum.	
33		Nil	<b>OHM’S Law &amp; Kirehhoff’s Law –</b>	-DO-	-DO-	-DO-	-DO-

			<p>Ohm's law – definition  – Relationship between the 'Big threes' in electrical circuit- Voltage, current and resistance. Ohm's law triangle. Twelve ohm's law formulae, numerical examples.</p> <p>Kirehhoff's law- Point law or current law. Mesh or voltage law. Wheat stone bridge and its application in Electrical circuits, numerical example.</p> <p><b>Simple electric circuits</b>  – Series circuit- formula, characteristics of series circuit-current remains same in each resistance and in the line, numerical examples. Application of series circuit in wiring.</p> <p>Parallel circuit – formula, characteristics and parallel circuit – voltage remains same in each branch, total current I divides in separate branch, numerical example. Comparison between</p>				
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			series and parallel circuits.				
34		Nil	Application of parallel circuit in wiring. Series and parallel combination circuit, numerical examples. <b>Conductors, Semi conductors and Insulators –</b> Conductors – Definition, Types of conductors and their uses. Conductor and its relationship with length, area of cross section, material and temperature.	-DO-	Compound angles	Product and site selection, finance, account keeping, inventory control, personnel management, business operation and criteria exports.	-DO-
35		Nil	Semi conductors – Definition and their uses. Insulators- definition, types of insulators and their uses. <b>Cells and Batteries –</b> <b>Primary cells –</b> Electric cell-definition, battery-definition, Chemical effect of electric current, principles of electrolysis, Faraday’s laws of electrolysis,	-DO-	-DO_	Case studies and project preparation.	-DO-

			<p>electro chemical equivalent. Principle and description of voltaic cell, its defects and remedies, Leclanche cell, dry cell and their description, working advantages, uses and maintenance.</p> <p>Grouping of cells for forming batteries of different voltage and current.</p>				
36		Nil	<p><b>Secondary Cell</b> Lead acid cell- description, parts, working- discharging and charging capacity – ampere hour(AH) , capacity, watt hour (WH) capacity. Efficiency – ampere hour efficiency, watt hour efficiency, with numerical examples. Battery charging- constant current method, constant voltage method. Precaution to be taken while maintaining the lead acid batteries. Testing instruments</p>	-DO-	Multiple and sub-multiple angles	-DO-	-DO-

			<p>used. General defects and remedies of a lead acid cell. General maintenance and upkeep of lead acid cell.</p> <p><b>Magnetism and Electro Magnetism</b></p> <p>Magnetism – Magnetic properties, principle of magnetism. Magnetic field and magnetic light of force. Magnetization type of magnets, elector magnetism – electricity and magnetism, magnetic field due to current carrying conductors and loops. Right hand grip rules. Cork screw rule. Solenoid and its polarities.</p>				
37		Nil	<p>Magnetic and electric circuits. Residual magnetism and its use. Principle of electro magnetic induction. Faraday’s laws – First and law and second law. Lenz’s law. Types of induced emf- self induced emf. Dynamically induced emf. Fleming’s. Right</p>	-DO-	-DO-	<p><b><u>INFORMATION TECHNOLOGY(IT)</u></b></p> <p><b>Introduction –</b></p> <p>a) Date and information-definitions – difference between information and date-information technology and importance of IT in to-days life. –need of information in business management – need of</p>	-DO-

			hand rule for generators.			information in decision making. b) Over view of IT c) Use of phone, mobile, satellite, telephone, TV, VCR, Computer-Mail, and Fax etc.	
38		Nil	<p><b>D.C.Generators</b> General principle, single loop generator, construction, working, commutator and its function. Practical generator. Types of armature winding emf generated in Armature winding, numerical examples, Classifications of D.C Generators separately excited and self excited generators. Types of D.C.Generator – series generator, shunt generator and compound generator.</p> <p><b>D.C.Motor</b> Function and construction and working principles of DC motor. Fleming's left hand rule of DC motor, motor action.</p>	-DO-	Product formula and identities. Calculation for thread, spur gear etc.	<p><b>Various field of activity and their utilization</b> Application of computer in day-to-day life – Business, office, scientific, education, engineering, ticketing, hotel, medicine, military etc.</p>	-DO-

			Terms used in D.C.motors such as torque speed and back emf. Types of D.C.motors - shunt motors, series motors and compound motor.				
39		Nil	<p>Starting method – three-point starter and four-point starter and their applications. Special D.C.motors used for starting diesel engines. Function of solenoid switch in starter motor.</p> <p><b>Alternating current –</b> Basic concept, alternating current and its behaviour, A.C.cycle, time period, frequency comparison of A.C. &amp; D.C.currents. Root mean square(RMS) value, peak and effective values, A.C.average value. Concept of vector representation, A.C. through ohmic resistance, AC through pure inductance, AC through resistance and</p>	<b>Introduction to computer drafting. Basic of CAD.</b>	-DO-	<p><b>Development of computers –</b> History-first generation computers, second, third, fourth type of computers</p> <ul style="list-style-type: none"> <li>- Super computers</li> <li>-Main frame computers</li> <li>- Mini computers</li> <li>-Micro (home computers, personal computers, lap-top portable computers) – Personal computer (PC)</li> <li>- Stand alone</li> <li>- Intelligent terminal</li> <li>- Dumb terminal – their uses and limitations</li> </ul>	-DO-

			<p>inductance, AC through capacitance, inductance.</p> <p>Power factor, importance of power factor in industrial applications.</p>				
40		Nil	<p><b>Poly Phase system</b> – Importance of poly phase system, generation of two phase system, generation of three system.</p> <p>Interconnections of three phases – Star or Wye connection. Line voltage and line current in star connection.</p> <p>Delta or mess connection. Line voltage and line current in delta connection.</p> <p>Comparison between two phase and three phase systems.</p> <p>Comparison between star and delta connections. Power measurement by two watt meter method .</p> <p>Difference between shore electrical installation and marine electrical installation.</p>	-DO-	Heights & distances	-DO-	-DO-

41		Nil	<p><b>Alternators –</b> Principle of alternators, parts of alternators, emf equation of alternator, rating of alternators. Types of alternators- static of excitation or rotating armature type. Revolving excitation or static armature type, advantage of static armature type alternator, concept of brush less AC generator, its advantages over other system, sits suitability for marine applications.</p> <p><b>A.C. MOTORS –</b> Working principle of AC motors, rotating magnetic field, rotor speed, synchronous speed , slip, torque, slip and torque relation, types of AC motors – synchronous motor, method of starting of synchronous motors.</p>	-DO-	-DO-	<p><b>Components and computer</b> a) ACPU b) Memory (Primary and secondary) c) Auxiliary storage Devices-- Magnetic tape, magnetic disks, compact disks</p>	-DO-
42		Nil	<p>Induction motors, method of Starting induction motors, direct on line(DOL) starters. Star-delta starters.</p>	Revision	<b>Describing motion –</b> definition of speed, velocity and acceleration	<p>d) Input devices – keyboard, mouse, joystick, light pen. e) Out put devices – printers, (impact and non</p>	-DO-

			<p><b>Transformers –</b> Inductance and its properties, self-inductance and mutual inductance. Principle and construction transformers. Types of transformers. Transformation ratio, numerical examples. Advantages of using transformer in AC supply. Principle of transformer in distribution of electrical energy. Transformer in DC supply.</p>			impact printers) – Visual display unit	
43		Nil	<p><b>DC power generation and distribution system</b> Generator. Main circuit breaker and its function. Main switchboard and its function. Functions of circuit breakers and fuses. Ring main system of distribution. Tree system of distribution, parallel operation of generators. Uses of different types of generators.</p>	Revision..	-DO-	Date communications and computer network. Data types, sharing of data, sharing of resources., communication paths, satellites, cables, microwave system and high frequency waves, LAN, WAN etc. and internet.	-DO-
44		Nil	<b>AC power generation</b>	Revision	Different	<b>Operation system –</b>	-DO-

			<p><b>and Distribution system</b></p> <p>Alternator and prime mover. Main circuit breaker, protective devices. Main switchboard – ship’s main supply section. Auxiliary supply section. Inter connection between main supply and auxiliary supply. Automatic voltage regulation. Synchronizing of alternators. Advantages of synchronizing alternators. Condition of parallel operation of alternators. Parallel operation of three phase alternators. Synchronizing with dark and bright lamp method, synchronizing with synchroscope method. Switch board equipments for controlling alternators. Earth testing circuit and its uses. AC distribution system.</p>		Formula of speed, velocity and acceleration	Difference between operating system – common commands of MS, DOS, WINDOWS, How to we interact with computer? Hardware system – application – user.	
45		Nil	<b>Energy Bonds in</b>	Revision	-DO-	Programing language	-DO-

			<p><b>solids</b> The nature and structure of atom, charged particles, ionization, insulator, semi-conductors and conductors.</p> <p><b>Semi conductor devices and circuits –</b> Intrinsic and extrinsic semi conductors, covalent bond, electron and hole concept, semi conductor material. Donor and acceptor, impurity. ‘P’ type and ‘N’ type semi conductors. Semi conductor diode, forwarded – reverse biasing, diode for half wave and full wave rectifier.</p>			and Multimedia applications.	
46		Nil	<p>Bipolar junction transistor, Biasing of transistor, testing transistor. Simple circuits for transistor in amplifier and oscillator.</p> <p><b>Electronic Conduction in vacuum and gas tubes –</b> Electron emission, vacuum tubes,</p>	Revision	Different Problems on speed, velocity and acceleration	Utility – Security, virus, future of computer – threads in 21 <sup>st</sup> Century what is artificial Intelligence.	-DO-

			conduction in gases, photoelectric devices.				
47		Nil	<b>Electronic components-</b> Registers, capacitors, inductors, tuned circuits and resonance, fuse, transformer, crystals, switches and relays, microphone and headphone, thermistor, frequency spectrum and applications.	Revision	-DO-	Merchant shipping act Marine pollution	-DO-
48		Nil	-DO-	Revision	-DO-	Marine Ecology and environment International conventions- SOLAS, MARPOL, STCW, ILO Conventions.	-DO-
49		Nil	<b>Digital electronics</b> Binary numbers system, basic gates – OR , AND, NOT, NOR, NAND. Half adder, full adder, parity checker/generator, decoder, demultiplexer. Data selector/multiplexed, resister and counters.	Revision	-DO-	Revision	-DO-

50		Nil	<b>Instrumentation</b> Ammeter, Volt meter, Ohm meter, multi meter, power meter, power frequency meter, Synchroscope, mugger. Measurement of temperature, pressure, Flow, RPM (Tachometer)	Revision	-DO-	Revision	-DO-
51		Nil	Principle and operation of smoke detector. Angle and pitch position indicator. <b>Control system</b> Control – Remote control and monitoring of protective systems in main engines installations. Servo control and application and feed back system.	Revision	Revision	Revision	-DO-
52		REVISION, TEST, EVALUATION OF PROGRESS					

**SYLLABUS**  
**FOR**  
**THE**  
**TRADE**  
**OF**  
**MARINE FITTER**  
**SECOND YEAR**

Week No.		Trade Practical	Trade Theory	Engg. Drawing	W/S Calculation & Science	Genl.English/ Social Studies	On Board Practical
NCVT	CIFNET						
53		<p><b>I.C. ENGINES</b>            Engine parts – identification/function.            Dismantling of the engine, two stroke, four stroke, marking of Table with drawers for chart/BDC on flywheel, marking of valve timing diagram. Engine clearance, tappet clearance, butt clearance, skirt clearance, bearing clearance, bumping clearance.            Explanation in detail regarding fuel pump injector, assembling/dismantling the parts, fuel cut off/partial/full supply/parts of fuel ;pump, injector adjustment(pressure), injector test to be carried out with the testing device, injection timing, valve timing adjustment Governor (centrifugal), dismantling/assembling,</p> <p>explanation of parts</p>	<p><b>General Engineering Knowledge Materials –</b>            Various metals and alloys – manufacturing process, properties – testing-tensile, hardness, impact, non-destructive test, marine application of various metals.  <b>Fuel and lubricant –</b>            Refining process – properties and test, density, viscosity, pour point, flash point, fire point, calorific value, octane no. , carbon residue, sediment content, corrosive effect.</p>	<p><b>Machine parts</b>            Wall brackets (5 types) shaped blocks(5 types)            CI blocks (5 nos)            Monkey for scribing block, split muff coupling.            Flanged coupling, fork for hooks coupling, bushed bearing, bracket with split bearing, foot step bearing. Open bearing,            Plummer block, screw jack, and stuffing box.</p>	- Nil -	- Nil-	- Ni 1-

		including function ;of the governor. Piston ring, procedure of removing/assembling, checking of butt clearance. Engine operation. Engine ` maintenance, valve grinding, engine clearance.					
54		-do-  Understanding about the construction	<b>Fuel and lubricant</b> – Base number, clearing property, demulsibility, corrosion inhibition, fome inhibition, water in oil, acidity alkalinity. <b>Boilers</b> – Classification, mountings, constructions features and repairs.	-do-  Free hand drawing on boilers	- Nil -	- Nil-	- Nil-
55		-do-  Field visit to know about the schedules	<b>Marine Corrosion</b> – Prevention – Surface preparation, painting, cathodic protection, impressed current system. <b>Steering Gear</b> – Mechanical steering gear, electro hydraulic steering gear.	-do-	- Nil -	- Nil-	- Nil-
56		-do-	<b>Steering Gear</b> – Automotive	-do-	- Nil -	- Nil-	- Nil-

		Opening the different steering system	hydraulic system, hydraulic arms, types of rudders – Semi balanced, fully balanced – unbalanced – pintle clearance, jumping clearance.	Free hand drawing on schematic diagram steering systems			
57		-do-	<b>Power transmission</b> – Out board motors - in board motors – reduction/reverse gears – epicyclic gear – differential gear.	-do-	- Nil -	- Nil-	- Nil-
58		-do-	Hydraulic gear for fixed pitch propeller – Hydraulic gear for variable pitch propeller – Intermediate shaft – Shaft bearing – Stern tube - propeller – Fixed pitch propeller – Variable pitch propeller.	-do-	-Nil –	- Nil-	- Nil-
59		-do-  Dismantling and assembling of pumps  Field visit to acquaint system	<b>Pump &amp; Pumping systems</b> –Types of pumps – reciprocating, centrifugal, axial, screw, sewage, sludge system, bilge, ballast, piping arrangements.  <b>Remote controls</b> – Need for remote control – mechanical remote control –	-do-  Free hand drawing	- Nil -	- Nil-	- Nil-

			pneumatic control systems.				
60		<p><b>Machine shop</b>  Lathe work – centering/fixing of job, facing plain turning/step turning/taper turning, thread cutting, knurling.  Drilling - drilling/tapping of MS plates, enlarging of hole with drilling method, reaming operation of enlarged holes.  Grinding – sharpening of the tool in the grinding machine. Shaper – surfacing, keyway slot cutting.  Milling – surfacing, parting, bolt head cutting, gears cutting.  Power hacksaw – cutting.  Measuring tools – vernier caliper, outside micrometer, inside micrometer, depth micrometer, telescopic gauge, thread pitch</p>	<p><b>Instrumentation, meters and gauges and control</b> –  Instruments – sensors and measuring elements for temperature, pressure, flow, level, speed etc., control systems – diaphragm valve, electric telegraph fluid temperature control, unattended machinery space.</p>	-do-  Free hand drawing on the circuit	- Nil -	- Nil-	- Nil-

		gauge, wire gauge.					
61		-do-  Identification of all gauges        Field visit and onboard training in dry dock.	<b>Turbines</b> Impulsive and reaction turbines – gas turbines, steam turbines, water turbines, construction and working principle. <b>Dry docking procedures -</b> Dry docking procedures – preparation before docking and undocking – preparation of defect list-safety procedure fore entering and working in confined spaces/welding/ Cleaning etc.	-do-        Free hand sketches on working of turbines		- Nil-	- Nil-
62		-do-	<b>Hydro statistic</b> – Density – relative density – pressure exerted by a liquid – load on an immersed plane – centre of pressure – load diagram-sheering force on bulk head stiffeners.  <b>Displacement, TPC, Coefficient of form</b> – Archimedes principle – displacement – tonne per cm immersion.	-do-	Calculation on hydro pressure, low etc.	- Nil-	- Nil-

63		-do-  Class room practical sketch a cross section of ship and mark various stability parameters	<p><b>Displacement, TPC, Coefficient of form</b> – Coefficient of form – wetted surface area – similar figures – sharing force and bending movement.</p> <p><b>Centre of Gravity</b> – Centre of gravity – effect of addition of mass – effect of movement of mass-effective of suspended mass.</p> <p><b>Stability of ships</b> - Statical stability at small angles of heel – calculation of MB – metacentric diagram – inclining experiments – free surface effect – stability of large angles of heel – stability of a vessel – sided vessel centre of gravity, centre of buoyancy.</p>	-do-	Calculation of displacement, TPC, coefficient W.S.A. etc.	- Nil-	- Nil-
64		-do-  On board sketch the effect of the propellers and show how the fishing vessels turn in a short round	<p>Equilibrium of ships. Angle of loll metacentre, metacentric height, righting lever, righting movement, lock coefficient, reserve buoyancy, effect of density</p> <p>of draft, basic problems related to draft and density, TPC, FWA.</p> <p><b>Manoeuvring</b> – Types of manoeuvres, Effect of manoeuvres, Shallow water effect, turning</p>	-do-		- Nil-	- Nil-

			a vessel in a short round, squat. <b>Introduction of fishing crafts.</b>				
65		-do-  Carpentry joints  Plotting  Construction of model board	<b>Boat Building materials</b> – Steel, fiberglass, other composite materials, wood, characteristics of Boat Building Timbers. <b>Terms in boat building</b> – General descriptions <b>Importance of lofting in boat building</b> –  <b>Construction</b> –Backbone assembly building stock, making the moulds.	-do-  Free hand drawing	- Nil -	- Nil-	- Nil-
66		<b>Electrical</b> As per the syllabus furnished in Marine Electrical Technology paper.	Rabbit building of wood, hull planking-different types framing and longitudinal, deck beans and carlings knees, riders and pointer,  deck planning, floor timbers and engine bearers, stern tube arrangements, bulkhead. <b>Caulking and stopping</b>	-do-	- Nil -	- Nil-	- Nil-
67		-do-	<b>Wheel house and other superstructures, rigging</b> –	-do-	- Nil -	- Nil-	- Nil-

			<p align="center"><b>Sheathing- Underwater fittings- Painting and varnishes- Engine installation, alignment Tanks and plumbing work- Deck fittings.</b></p>				
68		-do-	<p><b><u>SHIP CONSTRUCTION</u></b>  <b>Stresses in ship structure-</b>  Longitudinal bending in still  water and waves-transverse  bending-stresses when  docking-pounding – panting  <b>Bottom and side framing –</b>  Double bottom-internal  structure-side framing-tank  side bracket-beam knees –  web frames.  <b>Shell and decks</b>  Shell plating – bulwarks-  deck plating-beams-deck  gurdurs and pillars  discontinuities-hatches-hatch  corners.    <b>Bulk heads –</b>  Water tight bulk head, water  tight doors-non water tight-  bulkhead.</p>	-do-	- Nil -	- Nil-	- Nil-

69		<p align="center"><b>Field visit</b></p> <p align="center">Reading of drawings</p>	<p><b>Fore end arrangements –</b> Stem plating-anchor-cable arrangement</p> <p><b>Aft end arrangement –</b> Transom stern - stern frame and rudder-ship tunnel – Kort nozzle – fixed pitch propeller – variable pitch propeller.</p> <p><b>Fish hold –</b> Insulated fish hold.</p> <p><b>Reading drawing on various constructional stages of a ship.</b></p>	<p align="center">-do-</p> <p align="center">Free hand sketches</p>	<p align="center">- Nil -</p>	<p align="center">- Ni l-</p>	<p align="center">- Ni l-</p>
70		<p align="center"><b>Revision</b></p>	<p align="center"><b><u>HYDRAULICS,</u></b> <b><u>PNEUMATICS AND</u></b> <b><u>DECK MACHINERIES</u></b></p> <p><b>General description –</b> Fundamentals, S.I.Units, base, supplementary and derived, pressure of fluids, PASCAL's law, atmospheric pressure, pressure head, pressure gauge, pressure measuring instruments, properties of liquids, static head, vapour pressure, mass</p> <p>density, weight density, specific volume, specific gravity , compressibility, cohesion adhesion, surface tension, capillary action, viscosity, temperature with</p>	<p align="center">-do-</p> <p align="center">Free hand sketches of the experiments</p>	<p align="center">Flow of fluid velocity, volume, discharge time etc. calculation.</p>	<p align="center">Nil</p>	<p align="center">- Ni l-</p>

			density, viscosity, flow of fluid, method of flows, radial flow, axial flow, velocity, speed, venturimeter, hydraulic press, hydraulic torque.				
71			<b>Hydraulic devices –</b> Pumps, motor – control system, types of valves, tank, strainer, filter, and breathers, piping.	-do-	- Nil -	- Nil-	Onboard practical on all Engg. System operation and maintenance.
72		Dismantling and assembling of all pumps	Types of hydraulic pump, mechanical working arrangement, fluid operation, dynamic pressure, positive displacement, fixed and variable displacement, reciprocation pump, gear pump, vane pump, piston type pump, centrifugal pump.	-do-  Free hand sketches of all pumps and accessories.	Discharge capacity, power of pumps calculations, operational level.	- Nil-	-do-
73		Dismantling and assembling of all motor	<b>Motors –</b> Hydraulic motors, types, working arrangement, high speed low torque, low speed high torque motors, vane motors, gear motors, radial piston motor, axial piston motor, internal gear motor, power and efficiency.	<b>Object drawing and assembly drawing.</b> Piston, cylinder  head valves, valve guide springs, rocker arm, injector, connecting rod, fuel pump, crank shaft, cross head,	Power and capacity calculation operational level	- Nil-	-do-

				<p>air starting valve. Free hand sketching of valves, cocks, cylinder relief valve, pumps, governor, cylinder liner, reverse reduction gears, clutch, lub. oil circuit, cooling system, engine room layout, workshop lay out .</p> <p>Free hand sketches of all motor and accessories</p>			
74		<p>Dismantling and assembling .</p> <p>Dismantling and assembling of all filters</p>	<p><b>Control system –</b> Direction control, pressure control, volume contrail, pressure relief valve, brake valve, rotary valve, spool control valve, pressure regulator, check valve, solenoid valve.</p> <p><b>Other devices –</b> Tank and accessories, piping strainers, oil seals, filters, oil cooler.</p>	<p>-do-</p> <p>Free hand sketch</p>	- Nil -	- Nil-	-do-

75			<p><b>General –</b> Hydraulic circuit, chose system, open system, power units, desirable properties of hydraulic oil and its grades, loss of head, cavitations, air purging.</p> <p><b>Deck machineries –</b> Trawl winch, wind lass, net drum, purse seine winch, triplex winch, power block, line hauler.</p>	-do-  Free hand sketch	- Nil -	- Nil-	-do-
76			<p>Cargo winch, gun whale roller, side thrusters, construction, working principle, circuit diagram.</p> <p><b>Trouble shouting –</b> Cause and remedies.</p>	-do-	Power and capacity calculation, operation level	- Nil-	-do-
77			<b>Maintenance of all systems</b>	-do-	-Nil –	- Nil-	-do-

78			<p><b>Introduction to pneumatics</b> Pneumatic system and physical units. Basic requirements for pneumatic system. Air compress sure, pneumatic cylinder and air motor valves, circuits, hydro pneumatics.</p>	-do-	- Nil -	Nil-	-do-
79		Local visit(fishing village and fishing harbour).	<p><b><u>FISHING TECHNOLOGY</u></b> <b>Operation of fishing gear –</b> A brief introduction about various types of gear now being used. <b>Fishing without gear –</b> Method of using, knife shovels and picks for catching, molluses and crabs.</p>	-do-	- Nil -	- Nil -	
80		- Nil -	<p><b>Wounding gear –</b> Harpoon, spear, blowpipe and bow and arrow. <b>Stupefying –</b> Dynamiting, poisoning and electric fishing. <b>Code of conduct for responsible fishing –</b> Selective fishing gear and practices, environmentally, eco-friendly gear and enhancement of resources.</p>	-do-	- Nil -	- Nil-	-do-

81		- Nil -	<p><b>Fish Traps –</b> To catch fishes by attracting them to the desired cages. Fyke net, plunge basket, crab pot.</p> <p><b>Traps for jumping fishes –</b> Changadam, raft, etc.</p> <p><b>Bag nets with fixed mouth –</b> Dol net(Bombay) Stake net (Kerala back waters)</p>	-do-	- Nil -	- Nil-	-do-
82		- Nil -	<p><b>Dragged gear –</b> Beam trawl, otter trawl bull trawl.</p> <p><b>Surrounding gear –</b> To catch shoating fishes, purse seine and ring net.</p>	-do-	Nil -	- Nil-	-do-
83		- Nil -	<p><b>Encircling gear –</b> To catch shoaling fishes purse seine and ring net.</p> <p><b>Dip or lift nets –</b> Hand dip net, Chinese dip net.</p>	-do-	- Nil -	Nil-	-do-
84		- Nil -	<p><b>Falling nets –</b> Cast nets, with strings and string less.</p> <p><b>Gill and tangle nets –</b></p>	-do-	- Nil -	- Nil-	do-

			To catch fishes by gelling and entangling. Set and drift gill nets. Trammel nets.				
85		- Nil -	<b>Energy conservation –</b> Fishing gear and methods, vessel technology.	-do-	- Nil -	- Nil-	-do-
86		- Nil -	<b><u>FISH FINDING EQUIPMENTS.</u></b> <b>Elementary Acoustics</b> Sound waves and propagation of sound. Velocity, wavelength, reflection, echo, ultrasound, range, measuring distance by sound.	-do-	- Nil -	- Nil-	-do-
87		- Nil -	<b>Fish finding equipments –</b> Principle of Echo sounding. Block diagram of echo sounder, operation, main parts of echo sounder, controls, video echo sounders and features, SONAR and NET SOUNE Errors of Echo sounder.	-do-	- Nil -	- Nil-	-do-
88		- Nil -	<b><u>SEAMANSHIP AND NAVIGATION</u></b> <b>Parts of ship</b> Principal dimensions. ;Port, star board, beam, bow	-do-		- Nil-	-do-  Identification of parts onboard the fishing vessels

			<p>quarter free board draft Bulwark etc.</p> <p><b>Rope works, types of ropes, care and maintenance of synthetic and wire ropes.</b> Knots and splices, breaking strength, working load, and problems connected therewith.</p>				<p>and make sketches. Class room</p> <p>Practical on making different types of knots and splices such as eye splice, short splice, back splice and long splice</p>
89		- Nil -	<p><b>Blocks and purchases –</b> Types of blocks, frictional resistance and problems connected therewith. Different types of tackles, safety practices to be followed, care and maintenance of blocks and tackles.</p>	-do-	- Nil -	- Nil-	<p>-do-</p> <p>Identifications of blocks and tackles, practical on marking different tackles and to calculate safe working load.</p>
90			<p><b>Chart, Latitudes, longitudes, fixing position on the chart, setting course and finding the distance.</b> Abbreviations and symbols.</p> <p><b>Lead lines –</b> Deep sea lead line and hand lead line.</p>	-do-	- Nil -	- Nil-	<p>-do-</p> <p>Using chart, fix the vessels position on a navigational charts and measure the course and distance between two given position.</p>

							Identification of various symbols and abbreviation on chart. Fabricate a handle lead line on a given rope and make proper markings
91		- Nil -	<b>Sea anchor, fire fighting</b> – Fire muster, fire drill, care and maintenance of fire fighting appliances. Principles of fire fighting. Fire triangle. Engine room fire etc. Prevention of fire, principles of fire fighting, fire extinguishers and fire hoses.	-do-		- Nil-	-do- Prepare a must list for a fishing vassals, practical on operation and refilling of extinguishers
92		- Nil -	<b>Life saving appliances</b> – Life jacket, life buoy, life raft, class ‘C’ boat, rescue boat, EPIRB, SART, life boat its care and maintenance.	-do-	- Nil -	- Nil-	-do- Practical on using lifebuoy and life jacket, inflate the life raft and identify the parts and equipments. Using the SART.
93		- Nil -	<b>Accidents</b> – Grounding, beaching, refloat. Collision and leaks, man		- Nil -	- Nil-	-do- prepare a

			overboard.				collision mate model.
94		- Nil -	<p><b>Distress signals &amp; its penalty, procedure for sending distress call.</b>  Procedure for sending urgency and safety messages.</p> <p><b>Buoyage system-</b>  Buoyage and wreck marking system.</p>		- Nil -	- Nil-	<p>-do-</p> <p>Identify the various distress signals such as a hand flare, parachute, smoke float and sketch the equipment and mark the parts.</p>
95		- Nil -	<p><b><u>HEAT ENGINES &amp; MARINE REFRIGERATION</u></b></p> <p><b>Introduction –</b>  Matter, weight, force, speed, pressure, acceleration, momentum, work, torque, power energy.</p> <p><b>Heat and work –</b>  Theory of heat, temperature, thermometer, expansion of</p> <p>solids by heat, expansion of liquid by heat, unit of heat, specific heat, latent heat, sensible heat, transmission of heat work, turning moment of work, rate of work, energy, mechanical equivalent of heat, vapour</p>	Practicing sketch of all cycles	- Nil -	- Nil-	-do-

			cycle.				
96		- Nil -	<p><b>Expansion and compression of gases and ideal cycle –</b> Laws of thermodynamics, Boyles law, heating of gas at constant volume, heating gas at constant pressure, temperature raising by compression, ideal heat engine cycle, carnot cycle, Otto cycle, diesel cycle, dual cycle.</p>		- Nil -	- Nil-	-do-
97		- Nil -	<p><b>Refrigeration –</b> Method of lowering the temperature of liquid, introduction, ice refrigeration by expansion of air, refrigerating by throttling of gas, vapour refrigeration system, steam jet refrigeration system,</p> <p>refrigeration by using liquid gases, dry ice refrigeration, unit of refrigeration, heat pump.</p>		- Nil -	- Nil-	-do-
98			<p><b>Vapour absorption system-</b> Working cycle and principles. <b>Air refrigeration system –</b></p>	Free hand sketch of schematic diagram	- Nil -	- Nil-	-do-

			Working cycle and principles.				
99		- Nil -	<b>Vapour compression system</b> Working cycle and principles, refrigeration equipments, description of parts, compressor, condenser, receiver, drier, evaporator, and expansion valve oil separator.	Free hand sketch of schematic diagram	Calculation of heat generated by a system and capacity of plant required.	- Nil-	-do-  Field visit to refrigeration plant, dismantling and assembling all components.
100		- Nil -	-Do-	Free hand sketch of schematic diagram		- Nil -	-do-
101		- Nil -	<b>Control devices –</b> Control devices as applied to refrigeration system, automatic liquid valve, automatic water valve, low pressure controls, high pressure controls, lubricating oil controls and cut outs various gauges fitted to compressors, types of expansion valves, sketch of thermostatic expansion valves, functions, remote thermometer and thermostatic cut outs.	Free hand sketch	- Nil -	- Nil-	Report onboard training - operation, troubleshooting and maintenance of marine engines, auxiliaries and other machineries and equipments.  Dismantling and assembling of controls.

102		- Nil -	<p><b>Refrigerants</b> Properties of refrigerant, deal refrigerant, secondary refrigerant, anti freeze solutions.</p> <p><b>Defrosting –</b> Necessity of defrosting, manual defrosting, automatic periodic defrosting, solid and liquid adsorbents, water defrosting, defrosting by reversing cycle, automatic hot gas defrosting, thermo bank defrosting, electric control defrosting, electric air switch defrosting system, two outdoor units, multiple evaporator defrosting.</p>		Requirement of refrigerant system	- Nil-	-do-  Practicing and defrosting methods.
103		- Nil -	<p><b>Lubricating oil –</b> Desirable properties..</p> <p><b>Trouble shooting –</b> Moisture in the system, air in the system, under charge, lub.oil in the system,</p> <p>detection of leakage in the</p>		Testing of duplicating oil	- Nil -	-do-

			system, high condensing pressure, low suction pressure, high delivery pressure, excess lub. Oil in the system.				
104		<b>REVISION AND FINAL TRADE TEST.</b>					

242/1544.