SYLLABUS FOR THE TRADE OF MARINE FITTER

GENERAL INFORMATION

1. Name of the Trade : **Marine Fitter.**

2. Duration of Craftsmen Training : 2 Year.

3. Entry Qualification : Passed in 10th class examination under 10+2 system of education with 50% marks in Math. & Science or its equivalent.

4. Unit Size 16

DETAILS OF PAPERS FOR MARINE FITTER COURSE UNDER NCVT AND EVALUATION WEIGHTAGE FOR EACH SUBJECT

S. No.	Name of Paper as per NCVT pattern	Subject details as per NCVT Syllabus	Subject wise Allocation of marks in question paper	Total	Weightage for evaluation %	Remarks
1.	Trade Theory	Marine Engines	40	100	40	
		General Engineering Knowledge	20		20	
		Heat Engines and Refrigeration	20		20	
		Marine Electrical Technology and Basic Electronics & Instrumentation	20		20	
2.	Workshop calculation and science	Workshop Technology	15	50	30	
		Naval Architecture & Ship Construction	10		20	
		Hydraulics, Pneumatics & Deck Machineries	10		20	
		Fishing Techniques and Seamanship & Navigation	10		20	
		General English & Applied Mathematics	5		10	
3.	Drawing	Engineering Drawing and Machine Drawing	50	50	100	
4.	Social Studies	Social Studies	50	50	100	
	Trade Practical					
5.	Practical ï 1	Workshop Practical - I	100	300	33.33*	* Separate assessment on the basis of individual question paper for practical 1, 2 & 3.
6.	Practical ï 2	Workshop Practical And Viva Voce ï II	100		33.33*	
7.	Practical ï 3	Onboard Training ï Operation, Troubleshooting and Maintenance of Marine Engines, Auxiliaries and other Machineries& Equipments.	100		33.33*	

Week No.		Trade Practical (3 Trade Practical, 100 marks each)	Trade Theory	Engineering Drawing	Workshop calculation and Science	Social Studies
NCVT	CIFNET	Total Marks: 300	Total Marks: 100	Total Marks: 50	Total Marks: 50	Total Marks: 50
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
1.		Visit to different sections of the institute. Demonstration on elementary first aid artificial respiration etc.	Familiarisation with institute and trade. Safety precaution to be observed in the trade during theoretical as well as practical classes. elementary first aid	Concept of standard and standardisation	Revision of elementary methodical process	
		Practical - 1 WORKSHOP PRACTICAL-I (Evaluation weightage:33.33%)	**Part A MARINE ENGINES (Evaluation weightage:40%)**	**ENGINEERING DRAWING AND MACHINE DRAWING (Evaluation weightage:100%)**	**Part A WORKSHOP TECHNOLOGY (Evaluation weightage:30%)**	**SOCIAL STUDIES (Evaluation weightage:100%)**
2.		Fitting section - Chipping	**Fundamentals of Internal Combustion engine** Terminology - Classification of internal combustion engine - Working principles of four stoke and two stroke engines - Cycle of Operations - Four stroke diesel cycle - Two stroke diesel cycle - indicator diagram ï P.V. diagram - Engine indicator - Valve timing diagram - Port timing diagram - Relation between valve timing and port timing	**ENGINEERING DRAWING** **Introduction for machine drawing** Introduction meaning and usefulness of machine drawing ï	**Introduction of the subjects** **Metals and heat treatment** Metals -Ferrous metals and alloys ï non ferrous metals and alloys	**Part A Social Science** 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

			diagrams			Policy ï Salient points
3.		Fitting section - Filing	- do -	- do -	Heat treatment of iron and steel ï Description and purpose of heat treatment ï principle methods of heat treatment and its purposes **Mechanical working of metals** Mechanical working process and purposes - hot working	- do -
4.		Fitting section - Filing	Comparison of working principle of four stroke engine with indicator, valve and port timing diagrams - Scavenging - Cross flow, loop flow and uni flow scavenging - Difference between two stroke and four stroke engines	- do -	principle methods of hot working - cold working - principle of cold working **Smithy & forging** General description of smithy and its tools, Forge - types of forges, Smith's tools for hand forging **Welding** General description of welding, uses and methods of welding	- do -
5.		Making male and female joints ï 'T' joint, 'L' joint, 'V' joint	- do -	- do -	Arc, gas, TIG, MIG, submerged weldings, defects in welding - crack, porosity, deformation etc. adjustment of the	- do -

					flame, selection of correct Nozzle, Soldering and brazing - uses, tools for operation, types of solders, difference between soldering and brazing	
6.		Making male and female joints ï 'T' joint, 'L' joint, 'V' joint	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 ï calculation of efficiency	- do -	**Pattern making and foundry works** General description, casting processes, types of pattern, moulding sand, How to make mould, defects in casting **Fastenings** General description ï classification of fasting - Rivets and riveting ï keys: different types and purposes, Cotter joints: different types and purposes, Pin joints: different types and purposes, nut & bolts: different types and purposes ï construction of nuts bolts, rivets, screw threads, shaft keys, spur gear	Civics a) Salient features of the constitution of India b)Preamble and Directive Principles c)Fundamental Rights & Responsibilities of a citizen Population Growth and its Socio Economic Inspection i) Employment ii) Housing iii) Food iv) Educational v) Clothing vi) Transport vii) Environment viii) Ecological system

			Components of Diesel Engine Understanding on the construction of the engine- 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	- do -	**Carpentry** General description of carpentry tools ï types of carpentry tools and uses ï common varieties of Indian timber ï carpentry processes ï different types of carpentry joints - Carrying out job works on this trade **Power transmission** Types of belt drive ï types of pulleys ï jockey pulley or rider pulley	- do -
8.		Welding / brazing / soldering ï practice of arc welding on a surface Gas cutting - Adjustment of flame setting for different gas cutting	- do -	Instruments and materials used for drawing	Chain drive ï types of clutches ï types of gear drive ï cam drive ï rope drive **Bearings** General description ï different kinds of bearings and purposes ï material of each bearings **Measuring instruments and gauges** Scriber - material, uses and types of, Dividers - material, uses and types. Calipers - description,	- do -

					material, uses, types of callipers - Taking measurement with all gauges	
9.		Gas cutting	Thrust bearing - Cylinder block - Cylinder liner -Piston - Piston rings - Connecting rod - Gudgeon pin (or) Piston pin - Gudgeon pin Bush - Water jacket - Air Fins - Cam shaft - cylinder head - cylinder head studs and nuts - cylinder head packing or gasket	- do -	Vernier caliper - Description, material, uses and types Vernier bevel protractor - Description, material uses and types Micrometers - Description, material uses and types Combination set - description, material, uses Depth gauge - description, material uses Depth micrometer, description, uses Telescoping gauge - description, material, uses Feeler gauge - description, material uses, screw pitch gauge - Description, material, uses Radius gauge - description, material, uses, wire gauge -	- do -

					description, material uses - Calculation of least count etc	
10.		Welding / brazing / soldering ï practice of arc welding on a surface	- do -	- do -	- do -	Salience feature of programme and series i) Temporary and permanent methods of contraception with same knowledge of Anatomy and physiology of Human Reproductive system. ii) N C H Services including Immunisation & nutritional deficiency diseases, Dehydration Therapy.
11.		Welding / brazing / soldering ï practice of arc welding on a surface	Valves - valve guide bush - valve seat - valve collet - 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 valve - de-compression lever - fuel injector - injector nozzle - air filter ï silencer - materials used - Sketching of all parts with emphasis on liner, piston, connecting rod etc.	- do -	**Bench work, fitting & fabrication** 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, maintenance of a file Fitting - Types of fitting work scrapers, types of scrapers checking and finishing	- do -

					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 chisels and the material of the tool. Marking off - Methods of marking off marking of tools straight edge - materials and uses, Trisquare - material, uses checking of trisquare. Surface plate - types of surface plate, material, uses. Vee block - types of vee blocks material uses and method of holding a work, Marking block, material, types of blocks, method of marking, parallel blocks, material, method of using the tool - Working with the tools	

		joints welding, practice of soldering / brazing	**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. **Fuel System** Main fuel oil tank - Fuel transfer pump - Daily service tank - Fuel filter ï water-oil separator ï purifier ï clarifier - Fuel pumps - Regulation of fuel supply - Fuel injector - Fuel Consumption - Governors - Direct acting governors - Relay governors - Sensitivity - Stability - Hunting - Power - Full load speed - Idling Speed - Instantaneous speed change - Permanent speed change - Fuel pump, fuel injector: sketching of the schematic diagram and sketching Schematic diagrams of system	- do -	- do -	- do -

		operation ï hexagonal bolt, hexagonal nut	- do -	- do -	Striking devices ï Hammer ï types of hammers, materials of a hammer and the uses of the hammer Cutting ï Hack saw ï General description, uses & method of operation ï types of hack saws, 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, chisels ï already explained under chipping. Punches and drifts ï material and uses. Types of punches and drifts and how to use Holding devices ï Vices ï types of vices, material uses, selection of the correct size of vice, method of holding a work Fabrication of pipes, flanges, etc.	- do -

			Cooling System Necessity of cooling - Indirect cooling using heat exchanger - Indirect cooling using keel cooler - Direct cooling by sea water - accessories - water pump - heat exchanger - overboard valves - trainers - sea chest - thermostatic valves ï sketching Schematic diagrams of system		- do -	iii) Family Welfare Services available at Primary Health Centres and Sub centres, Urban Family Welfare Centres & Dispensaries, ESI, Railway Hospitals and Dispensaries Awareness, cause and prevention of AIDS/HIV + STD
15.		Smithy section ï Forging operation ï hexagonal bolt, hexagonal nut	- do -	Code of practice for Engg. drawing (IS 696-1972)	**Screw threads** General description of a thread, types of threads and its uses. Important parts of a thread- Major diameter, minor diameter, pitch lead, root, crest, left hand thread, right hand thread, Internal thread, External thread **Taps** Description of a tap - material and how to use the tool - Taking measurement with all gauges **Dies** Description - material, types of dies and stocks and how to use the tool- Taking	- do -

					measurement with all gauges **Drills** 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 a drill, angle of a drill care and maintenance of a drill, checking the angle of a drill Taking measurement with all gauges Calculation of pitch etc.	
16.		Carpentry section - Sawing, Planning, Making male and female joints ï 'T' joint, 'L' joint, 'V' joint, Dovetail joint	**Lubrication System** Lubrication - Lubricating oils - Methods of lubrication - Lubrication of marine diesel engines - Equipment used in lubrication system - sketching Schematic diagrams of system	- do -	- do -	- do -
17.		Carpentry section - Sawing, Planning, Making male and female joints ï 'T' joint, 'L' joint, 'V' joint, Dovetail joint	**Starting System** Hand starting ï electrical starting ï air starting ï construction and working ï maintenance of starting system ï safety devices on air starting system ï air	- do -	**Reamers** Description - Material, types of reamers, purpose of the tod, counter boring and spot facing, reaming, method of using the	- do -

			starting valves ï sketching Schematic diagrams of system		tool **Hand tools** Screw drivers - types of screw drivers material and uses **Sheet metal** General description, method of operation types of tools and materials- Carrying out job works **Drilling machine** General description and uses. - Carrying out jobs on the machine	
18.		- do -	- do -	- do -	Types of Machines, types of drilling machine, feed mechanism, method of holding the drill, chucks **Lathe** General description and uses. Parts of lathe feed mechanism, tumbler gear mechanism, method of holding the work and attachments, steady rest, follower rest, catch plate and carriers - Carrying out jobs on the machine -	Awareness and prevention from Drug addition Role of Craftsmen/Craft women in Motivating to adopt small family Norm. 1. i) By adopting centreceptive Technique himself/herself. ii) Acting as motivator in the community and educating fellow craftsman/Crafts women for adopting

					Calculation of thread cutting, taper turning etc.	contraceptive Technique to adhere to small family norms **Part B** **Population education** National Family Welfare Programme i) Population problem in India ii) 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 and recycling of waste materials Linkage of lack of energy conservation and environmental pollution.
19.		Carrying out job works of Smithy & forging Carrying out job works of welding and field visit on special welding	**Valve Mechanism System** Functioning - Valve tappet clearance - Checking of valve tappet clearance- sketching Schematic diagrams of system **Intake and exhaust system** Natural aspiration - forced	- do -	- do -	- do -

			aspiration - intake system - inlet elbow - air filter - exhaust system - exhaust elbow - exhaust pipe- silencer- tail pipe- supercharging system- principles of turbo charging- inter cooler ï purpose, construction details, components, routine maintenance, alignment - sketching Schematic diagrams of system			
20.		- do -	- do -	- do -	Different lathe tools, different methods of taper turning **Grinding machine** General description uses & method of operation ï precautions- Carrying out jobs on the machine **Arbour Press & hydraulic press** General description, uses & method of operation ï Carrying out jobs on the machine	- do -

			Engine Handling & Maintenance Operation - Preparations before starting - Watch keeping the performance while running - watch keeping system - Operating the watch - Handing over and taking over the watch - Precautions for stopping	Scale, lines, lettering, titling, dimensioning, tolerance	Care & maintenance of a workshop, Engine room and workshop lay out	- do -
					Part B NAVAL ARCHITECTURE AND SHIP CONSTRUCTION (Evaluation weightage:20%)	
22.		- do -	Maintenance - guidance for scheduled maintenance - Condition based planned maintenance - Preventive maintenance - Top overhauling - Major overhauling. **Trouble Shooting of Diesel Engines** Starting - Power variations - Speed variation - Abnormal smokes -	- do -	**NAVAL ARCHITECTURE Hydrostatics** Density - Relative density - pressure exerted by a liquid - load on an immersed plane - centre of pressure - load diagram - sheering force on bulkhead stiffeners - Calculation on hydro pressure, load etc. **Displacement, TPC, coefficients of form** Archimedes principle ï	- do -

					displacement ï tonne per cm immersion	
		Practical - 2 WORKSHOP PRACTICAL – II AND VIVA VOCE (Evaluation weightage:33.33%)				
23.		**I.C. Engines** Engine parts ï 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) ï dismantling / assembling,	- do -	- do -	coefficient of form ï wetted surface area ï similar figures ï shearing force and bending moment - Calculation of displacement, TPC, coefficient, W.S.A etc. **Centre of gravity** Centre of gravity ï effect of addition of mass ï effect of movement of mass ï effect of suspended mass **Stability of ships** Statical stability at small angles of heel ï calculation of BM ï metacentric diagram ï inclining experiment ï free surface effect ï stability of large angles of heel ï stability of a wall-sided vessel	Concept of environment & Ecological Balance, The effect of over exploitation of natural resources & industrialization Inter ï relationship between Men & his environment and need for replacement of earthôs resources like soil, ground water, Forest, River, Sea & wildlife. Elements of Environments planning & Management - Conservation of National Resources - Conservation of wild life - Creation of parks & sanctuaries

		function of the governor. Piston ring ï procedure of removing / assembling, checking of butt clearance. Engine operation, Engine maintenance ï valve grinding, engine clearance			Centre of gravity, centre of buoyancy Class room practicals Sketch a cross section of ship and mark various stability parameters	
24.		- do ï Understanding about the construction	Abnormal pressure - Abnormal temperatures - Abnormal Sound. **Power Development** Indicated Horse Power - Brake Horse Power - Frictional Horse Power - Shaft Horse Power - Effective Horse Power ï Calculation of Power - Rating of engines - Testing of engines - Testing of propulsive machinery.	- do -	Equilibrium of ships, Angle of loll, Metacentre, Metacentric ht. Righting lever, Righting moment, Block coefficient, Reserve buoyancy, Effect of density on draft, Basic problems related to draft and density, TPC, FWA. **Manoeuvring** Types of propellers, Effect of propellers, Shallow water effect, turning a vessel in a short round, squat.- Sketch the effect of the propellers and stow how the fishing I vessels turned in a short round **Introduction of fishing crafts**	- do -
25.		- do -	- do -	- do -	- do -	- do -

		opening of the OBM for understanding the principle. Field visit to know about the schedules				
26.		- do -	**Selection of Engines** Fuel and lubricant - Reliability and durability - Strokes/cooling method - Running characteristics - Maintenance - Vibration - Size - Weight - Power requirement **Outboard Motors** Prime mover - Transmission system - Trouble shooting	- do -	**Boat Building materials** Steel, Fibre glass, other composite materials, wood, Characteristics of Boat Building timbers **Terms in boat building** General descriptions **Importance of lofting in boat building** **Construction** Backbone assembly Building stock, making the moulds	- do -
27.		- do -	- do -	**Plane geometry** Terms & definition used ï construction and division of lines, angles, triangles, quadrilaterals, polygons, circles and tangents	Rabbet building of wood Hull planking - different types Framing and longitudinal Deck beams and carlings Knees, Riders and pointer Deck planking Floor timbers and Engine bearers	1 Type of Pollution & its sources 2 Effects of Pollution on environment and on humanity, plant, Animal, Machine, health & thus on energy conservation. 3 Remedial steps to control pollution 4 Environmental

					Stern tube arrangements Bulkhead - Construction of model boat - Free hand drawing **Caulking and stopping**	Laws. **Part C Energy Conservation & Environment Management** Concept of Energy Non-conventional sources of energy like solar wind, bio-gas etc. Energy crisis and Energy scarcity. **Principal of Energy conservation**, with special reference to - Domestic Appliances & Cooking gas - Transport - Industries including industrial lighting Heating, Ventilation and Air conditioning
			Part B GENERAL ENGINEERING KNOWLEDGE (Evaluation weightage:20%)			
28.		- do -	**Materials** Various metals and alloys ï manufacturing process,	- do -	Wheel house and other superstructures, rigging Sheathing	- do -

			properties ï Testing ï tensile, hardness, impact, non destructive test, Marine Application of various metals **Fuel & Lubricant** Refining process ï properties and tests, density, viscosity, poor point, flash point, fire point, calorific valve, octane number, cetanen number, carbon residue, sediment content, corrosive effect		Underwater fittings Painting and varnishes Engine installation, alignment Tanks and plumbing work Deck fittings	
29.		**Machine shop** Lathe work ï centering / fixing of job, facing, plain turning / step turning / taper turning, thread cutting, knurling Drilling ï drilling / tapping of MS plates, enlarging of hole with drilling method, reaming operation of enlarged holes Grinding ï sharpening of the tool in the grinding machine. Shaper ï surfacing, keyway slot cutting Milling ï surfacing, parting, bolt head cutting, gear cutting. Power hacksaw ï cutting Measuring tools ï vernier calliper, outside micrometer,	- do -	- do -	**SHIP CONSTRUCTION** **Stresses in ship structure** Longitudinal bending in still water and waves ï transverse bending ï stresses when docking ï pounding ï panting **Bottom and side framing** Double bottom ï internal structure ï side framing ï tank side bracket ï beam knees ï web frames **Shell and decks** Shell plating ï bulwarks ï deck plating ï beams ï deck	- do -

		micrometer, telescopic gauge, thread pitch gauge, wire gauge			gurders and pillars discontinuities ï hatches ï hatch corners ï Free hand sketches **Bulk heads** Water tight bulk head ï water tight doors ï non-water tight ï bulkhead	
30.		- do -	Base number, clearing property, demulsibility, corrosion inhibition, foam inhibition, water in oil, acidity, alkalinity **Boilers** Classification, mountings, construction failures and repairs ï Free hand drawings of boilers	- do -	- do -	- do -

		Identification of all gauges	- do -	- do -	**Fore end arrangements** Stem plating ï anchor ï cable arrangement **Aft end arrangements** Transom stern ï stern frame and rudder ï ship tunnel ï Kort nozzle ï fixed pitch propellerï variable pitch propeller **Fish hold** Insulated fish hold. **Reading drawing on various constructional stages of a ship-** Free hand sketches	- do -
					Part C HYDRAULICS, PNEUMATICS AND DECK MACHINERIES (Evaluation weightage:20%)	
32.		- do -	**Marine corrosion** Prevention ï surface preparation, painting, cathodic protection, impressed current system. **Steering gear** Mechanical steering gear, Electric steering gear, electro hydraulic steering gear	- do -	**General description** Fundamentals S.I. Units, Base, Supplementary and derived, Pressure of fluids- Pascal's law, Atmospheric pressure, Pressure head, Pressure gauge, Pressure	**Working conditions & workers education** a) Preliminary knowledge about the Social Security legislations as covered by the following Acts.

					measuring instruments.-Properties of liquids- Static head , vapour pressure, mass density, weight density, specific volume, specific gravity, compressibility, cohesion adhesion, surface tension, capillary action, viscosity, temperature with density, viscosity.- Flow of fluid ï method of flows ï radial flow, axial flow ï velocity , speed, venturimeter, hydraulic press, hydraulic torque - Free hand sketch of the experiments- Flow of fluid, velocity, volume, discharge time etc. - calculation	i) Factory Act, 1948 ii) Workmen Compensation Act, 1923. iii) ESI Act, 1948
33.		- do -	- do -	- do -	- do -	- do -
34.		- do -	automative hydraulic steering system, Hydraulic rams, types of rudders ï semi balanced, fully balanced unbalanced ï pintle clearance, jumping clearance- Free hand drawing and schematic diagrams of different	**Solid geometry** Angles generally use on solid geometry, method of first angle & third angle projections ï definitions	**Hydraulic devices** Pumps, Motor ï Control system, types of valves, tank, strainer, filter, breathers, piping	- do -

			steering systems **Practice** Opening the different steering systems			
35.		- do -	- do -	- do -	Types of hydraulic pump, mechanical working arrangement, fluid operation ï dynamic pressure ï positive displacement ï fixed and variable displacement ï Reciprocation pump ï gear pump ï vane pump ï piston type pump ï Centrifugal pump - Free hand sketch of all pumps and accessories - Discharge capacity, power of pumps calculations ï operational level	- do -
36.		- do -	**Power transmission** Outboard motors - Inboard motors - Reduction / Reverse Gears - Epicyclic gear - Differential gear	- do -	- do ï **Practice** Dismantling and assembling of pumps Field visit to acquaint systems Dismantling and assembling of all motors Dismantling and assembling of filters	iv) Employment standing order 1946 v) Payment of wages Act, 1936 vi) Minimum wages Act, 1948 vii) Industrial Disputes Act, 1947 viii) Contact Labour (Regulation & Abolition Act

						1970) ix) Employees Provident Fund and Payment of Gratuity Act, 1952.
37.			- do -	- do -	**Motors** Hydraulic Motors ï types ï working arrangement ï high speed low torque ï Low speed high torque motors.- vane motors ï gear motors ï radial piston motor ï axial piston motor ï internal gear motor ï power and efficiency- Free hand sketch of all motor and accessories- Power and capacity calculations ï operational level	- do -
38.			Hydraulic gear for fixed pitch propeller - Hydraulic gear for variable pitch propeller - Intermediate shaft - Shaft bearing - Stern tube - Water lubricated stern tube - Oil lubricated stern tube - Propeller - Fixed pitch propeller - Variable pitch propeller.	- do -	**Control system** direction control ï pressure control ï volume control ï pressure relief valve ï brake valveï rotary valveï spool control valveï pressure regulatorï check valveï solenoid valve **Other devices** Tank and accessoriesï	- do -

					pipingï strainersï oil sealsï filters- oil cooler- Free hand sketch	
		Practical – 3 **ONBOARD TRAINING- OPERATION, TROUBLESHOOTING AND MAINTENANCE OF MARINE ENGINES, AUXILIARIES AND OTHER MACHINERIES & EQUIPMENTS** **(Evaluation weightage:33.33%)**				
39.		Onboard practical on all engineering system operation and maintenance	- do -		**General** Hydraulic circuit ï closed system - open system ï power units - ï desirable properties of hydraulic oil and its grades ï loss of head ï cavitation ï air purging **Deck Machineries** Trawl winch ï Wind lass ï Net drum- purse seine winch ï triplex winch- power block ï line hauler- Free hand	- do -

					sketch	
40.		Preparation for sailing	**Pumps and Pumping systems** Types of pumps ï reciprocating, centrifugal, axial, screw, sewage and sludge system, bilge, ballast, piping arrangements - Free hand drawing **Remote controls** Need for remote control ï mechanical remote controls ï pneumatic control systems - Free hand drawing of the circuit	- do -	cargo winch ï gun whale roller ï side thrusters - Construction, working principle, circuit diagram **Trouble shooting** cause and remedies	b) Occupational Hazards& Safety measures i) Causes of Accidents and safety management ii) Theories of accident prevention iii) Medical First Aid iv) Selection & use of personal protection equipment of different types v) Use of Fire-safety equipment vi) Safety legislation
41.		*Preparation for sailing*	- do -	Projection of simple solids (construction) conventional representations & sectioning	**Maintenance of all systems**	- do -
42.		*Preparation for sailing*	**Instrumentation, meters & gauges & control** Instruments ï sensors & measuring elements for temperature, pressure, flow, level, speed etc., Control systems ï diaphragm valve,	- do -	**Introduction to Pneumatics** Pneumatic system and physical units, Basic requirements for pneumatic system, Air compressor, pneumatic	- do -

			electric telegraph fluid temperature control, unattended machinery space		cylinder and air motor valves, circuits, Hydro pneumatics- Free hand sketch	
					Part D **FISHING TECHNOLOGY & FISH FINDING EQUIPMENTS** **(Evaluation weightage:20%)**	
43.		*Use and maintenance of LSA & FFA*	- do -	- do -	**FISHING TECHNOLOGY & FISH FINDING EQUIPMENTS** **Operation of fishing gear** A brief introduction about various types of gear now being used- Local Visit **Fishing without gear** Method of using, knife, shovels and picks for catching Molluscs and crabs	- do -
44.		*Use and maintenance of LSA & FFA*	**Turbines** Impulsive & reaction turbines ï gas turbine ï steam turbine ï water turbine ï construction and working principle- Free hand sketch on working of turbines	- do -	**Wounding gear** Harpoon, spear, blow pipe and bow and arrow **Stupefying** Dynamiting, poisoning and electric fishing	- do -

			Dry docking procedures Dry docking procedure ï preparation before docking and undocking ï preparation of defect list ï safety procedure for entering and working in confined spaces / welding / cleaning etc - Field visit and on board training in dry dock		**Code of conduct for responsible fishing** Selective fishing gear and practices ï Environmentally, eco-friendly gear and enhancement of resources	
45.		*Use and maintenance of LSA & FFA*	- do -	- do -	**Fish Traps** To catch fishes by attracting them to the desired cages, Fyke net, Plunge basket, crab pot. **Traps for jumping fishes** Changadam, Raft, etc **Bag nets with fixed mouth** Dol net (Bombay) Stake net (Kerala backwaters)	Human Relations & Trade Unions a) Organisational structure & employer ï employee relations b) Purpose and function of Trade Unions with respect to Trade Union Act & Amendments. c) Responsibilities & Duties of workmen towards i) Society ii) Organisation iii) work iv) Vis-à-vis work culture

			Part C **HEAT ENGINES AND REFRIGERATION** **(Evaluation weightage:20%)**			
46.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	**Introduction** Matter ï Weight ï Force ï Speed ï pressure ï acceleration ï momentum ï work ï torque ï power- energy **Heat and work** Theory of heat ï temperature ï thermometer ï expansion of solids by heat ï expansion of liquid by heat ï unit of heat ï specific heat- latent heat ï sensible heat ï transmission of heat Work ï turning moment of work ï Rate of work ï energy ï mechanical equivalent of heatï vapour cycle - Practicing sketch of all cycles	- do -	**Dragged gear** Beam trawl, otter trawl Bull trawl **Surrounding gear** To catch shoaling fishes, purse seine and ring net	- do -
47.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	- do -	Fastening Construction of nuts, bolts, rivets, screw threads, shaft, keys, cotters, Spur gear	**Encircling gear** To catch shoaling fishes purse-seine and ring net **Dip or lift nets** Hand dip net, Chinese dip net	- do -

		keeping procedures of engine and auxiliaries	**Expansion and compression of gases and ideal cycle** Laws of thermodynamics- Boyles law- heating of gas at constant volume ï heating gas at constant pressure ï temperature raising by compression ï ideal heat engine cycle ï carnot cycle ï otto cycle ï diesel cycle ï dual cycle	- do -	**Falling nets** Cast nets, with strings and string-less **Gill and tangle nets** To catch fishes by gilling and entangling Set and drift gill nets Trammel nets	- do -
49.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	- do -	- do -	**Energy conservation** Fishing gear and methods, vessel technology	- do -
50.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	**Refrigeration** Method of lowering the temperature of a liquid- introduction- ice refrigeration- evaporative refrigerationï refrigeration by expansion of airï refrigeration by throttling of gasï vapour refrigeration systemï steam jet refrigeration systemï refrigeration by using liquid gasesï dry ice refrigeration- unit of refrigeration- heat pump	- do -	**Elementary Acoustics** Sound waves and propagation of sound, Velocity, wavelength, reflection, echo, ultrasound, range, measuring distance by sound.	**Part D Entrepreneurship** Need and scope for self-employment with special reference to self-employment schemes and sources of assistance in central and State Govts, Organisations I DIC, SIDA, SISI, NSIC, SIDO, financial institutions and National Banks
51.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	- do -	- do -	**Fish finding equipments** Principle of Echo	- do -

					sounding, Block diagram of echo sounder, operation, main parts of echo sounder, controls, video echo sounders and features, SONAR and NET SONDE Errors of Echo sounders.	
52.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	**Vapour absorption system** Working cycle and principles- Free hand sketch of schematic diagram **Air refrigeration system** Working cycle and principles - Free hand sketch of schematic diagram	- do -	**SEAMANSHIP AND NAVIGATION** **Parts of ship** Principal dimensions, Port, star board, beam, bow Quarter free board, draft Bulwork etc. **Rope works, Types of ropes, care and maintenance of synthetic and wire ropes** Knots and splices, breaking strength, working load, and problems connected therewith	- do -
53.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	- do -	**Introduction to computer drafting** Basics of CAD	**Blocks & purchases** Types of blocks, frictional resistance and problems connected therewith Different types of	- do -

					tackles, safety practices to be followed, care and maintenance of blocks and tackles.	
54.		*Starting, stopping and watch keeping procedures of engine and auxiliaries*	**Vapour compression system** Working cycle and principlesï refrigeration equipmentsï description of partsï compressorï condenserï receiverï drierï evaporatorï expansion valve oil separator- Free hand sketch of schematic diagram - Calculation of heat generated by a system and capacity of plant required	- do -	**Chart, Latitudes, longitudes, Fixing position on the chart, setting course and finding the distance** Abbreviations and symbols **Lead lines** Deep sea lead line and hand lead line	(a) Characteristics of a successful entrepreneur and a successful enterprises. (b) Special objectives of business and entrepreneurship (c) The causes of failure, identification of entrepreneurship abilities through self assessment & other techniques (d) The type of business in different trades and the importance of skill
55.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	- do - **Practice** Field visit to refrigeration plant Dismantling and assembling of all components Dismantling and assembling of all controls	**MACHINE DRAWING** **Machine parts** Wall brackets (5 types) shaped blocks (5 types) CI blocks (5 nos.) Monkey for scribing block, split muff coupling Flanged coupling, fork for hooks	**Sea Anchor**, **Fire fighting** 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 -

				coupling, bushed bearing, bracket with split bearing, foot step bearing Open bearing, plummer block, stepped pulley, pipe wise body, screw jack, stuffing box		
56.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	- do -	- do -	**Life saving appliances** Life jacket, life buoy, Life raft, class 'C' boat, Rescue boat, EPIRB, SART, life boat its care and maintenance	- do -
57.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	**Control devices** 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	- do -	**Accidents** Grounding, Beaching, Refloat. Collision and leaks, man overboard	- do -

		keeping procedures of Refrigeration compressor and system	- do -	- do -	**Distress signals & its penalty, procedure for sending distress call** Procedure for sending urgency and safety messages. **Buoyage system** Buoyage and wreck marking system	- do -
59.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	**Refrigerants** Properties of refrigerantï ideal refrigerant- secondary refrigerant ï anti freeze solutions -	- do -	Identification of parts on board the fishing vessel and make sketches Practicals on making different types of knots and splices such as eye slice , short splice , back splice and long splice	Understanding the consumer and market through consumer behaviour Market Survey, Scope and influence, publicity and advertisement, consumer action forum
60.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	- do -	- do -	Identification of blocks and tackles. Practicals on marking different tackle and to calculate safe working load	- do -
61.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	**Defrosting** Necessity of defrostingï manual defrosting- automatic periodic defrosting- solid and liquid adsorbents- water defrosting- defrosting by reversing cycle- automatic hot gas defrosting- thermo bank	- do -	Using chart, Fix the vessels position on a navigational charts and measure the course and distance between two given position. Identification of various symbols and abbreviations on chart.	- do -

			defrosting- electric control defrosting- electric air switch defrosting system- two outdoor units- multiple evaporator defrosting - Requirement of refrigerant for the system		Fabricate a handle lead line on a given rope and make proper makings	
62.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	- do ï **Practice** Practising defrosting methods	- do -	Prepare a must list for a fishing vessels. Practicals on operation and refilling of extinguishers.	- do -
63.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	**Lub. Oil** Desirable properties - Testing of lub. Oil **Trouble shooting** Moisture in the system ï air in the system ï under chargeï lub. oil in the system ï detection of leakage in the system ï high condensing pressure ï low suction pressure ï high delivery pressure ï excess lub. oil in the system	- do -	Practicals on using life buoy and life jacket. Inflate the life raft and identify the parts and equipments. Using the SART.	Product and site selection, Finance, Account keeping, inventory control, personnel Management, Business Operation & criteria for exports
64.		*Starting, stopping and watch keeping procedures of Refrigeration compressor and system*	- do -	- do -	Prepare a collision mate model.	

			Part D **MARINE ELECTRICAL TECHNOLOGY AND BASIC ELECTRONICS & INSTRUMENTATION** **(Evaluation weightage:20%)**			
65.		*Maintenance and troubleshooting of main engine and auxiliaries*	**MARINE ELECTRICAL TECHNOLOGY** **Introduction to Electricity** Electricity and its important forms. Classification of Electricity ï static electricity, current electricity. Effects of electricity ï Magnetic effect, Heating effect, chemical effect and physical effect. Electric circuit ï open circuit, closed circuit and short circuit **Electro kinetics** 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	- do -	Identify the various distress signals such as a hand flare , parachute ,smoke float and sketch the equipment and mark the parts.	Case studies and projects preparation

			Alternating current. Joule's law and joule's effect. Electric power, Electric energy and their units, numerical examples			
					Part E GENERAL ENGLISH AND APPLIED MATHEMATICS (Evaluation weightage:10%)	
66.		*Maintenance and troubleshooting of main engine and auxiliaries*	**OHM's Law and Kirchhoff's Law** Ohmôs law ï Definition ï Relationship between the ôBig threesô in Electrical circuit ï voltage, current and resistance. Ohmôs law triangle. Twelve ohmôs law formulae, numerical examples. Kirchhoffôs law ï Point law or current law, Mesh or voltage law. Wheat stone bridge and its application in Electrical circuits, numerical examples. **Simple electric circuits** Series circuit ï formula, characteristics of series circuit ï current remains same in each resistance and	- do -	**GENERAL ENGLISH** **Basic Grammar** Parts of speech ï noun, subjective	- do -

			in the line, numerical examples. Application of series circuit in wiring. Parallel circuit ï formula, characteristics and parallel circuit ï voltage remains same in each branch, total current I divides in separate branch, numerical examples. Comparison between series and parallel circuits. **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 controlled by Two switches, stair case wiring, Fan or light through a regulator, two lamps, one socket, three Switches by switch box wiring. Testing of wiring insulation			
67.		*Maintenance and troubleshooting of main engine and auxiliaries*	- do -	- do -	pronoun, verb, adverb, preposition, conjunction and interjection	- do -
68.		*Maintenance and troubleshooting of main engine and auxiliaries*	Application of parallel circuit in wiring. Series and parallel combination circuit, numerical examples. **Conductors, Semi**	- do -	definition and examples of Tense ï uses of tenses	- do -

			conductors and Insulators Conductor ï Definition, Types of conductors and their uses. Conductor and its relationship with length, area of cross section, material and temperature. **Practice** Safety measures to be taken while working on live Electrical line/system. First Aid for Electric shock and burn. An introduction to Indian Electricity rules. Identification of Electrical tools and their uses. Verification of ohms law. Identifying the Difference between series and parallel circuits.			
69.		*Maintenance and troubleshooting of main engine and auxiliaries*	Semi conductors ï Definition and their uses. Insulators ï Definition, types of insulators and their uses. **Cells and Batteries** **Primary cells** Electric cell ï definition. batteryï definition.. Chemical effect of electric current, principles of Electrolysis, Faradayôs laws of Electrolysis, Electro chemical equivalent.	- do -	**Kinds of sentences** Simple, complex, compound	**Part E** **Information Technology** Introduction a)Date and information ï Definitions ï Difference between information and Date ï Information Technology (IT) and the

			Principle and description of voltaic cell, its defects and remedies. Leclanche cell, dry cell and their descriptions, working, advantages. Uses, and maintenance. Grouping of cells for forming batteries of different voltages and currents.			importance of IT in to dayôs life. - Need of information in Business Management - Need of information in Decision Making b) Over view of IT c) Use of phone, Mobile, satellite telephone, TV, VCR, Computer, E-Mail, Fax etc.
70.		*Maintenance and troubleshooting of main engine and auxiliaries*	**Secondary cells** Lead acid cell ï description, parts, working -discharging and charging. Capacity ï Ampere hour (AH), capacity, watt hour (WH) capacity. Efficiency ï Ampere hour efficiency, watt hour efficiency, with numerical examples. Battery charging ï constant current method, constant voltage method. Precautions to be taken while maintaining the lead acid batteries. Testing instruments used. General defects and remedies of a lead acid cell.	- do -	assertive, interrogative, imperative, negative & exclamatory sentences	- do -

			General maintenance and upkeep of lead acid cells. **Practice** 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 **Magnetism and Electro Magnetism** Magnetism ï Magnetic properties, principle of magnetism, Magnetic field and magnetic lines of force, Magnetisation. Types of magnets. Electro magnetism ï Electricity and magnetism, Magnetic field due to current carrying conductors and loops. Right hand grip rule. Cork screw rule. Solenoid and its polarities.			
71.		*Power transmission system*	- do -	- do -	**Transformation of sentences** Active voice ï passive voice	- do -
72.		*Power transmission system*	Magnetic and electric circuits. Residual magnetism	- do -	Degrees of comparison	Various fields of activity and their

			and its use. Principle of electro magnetic induction. Faradayôs laws ï First and law and second law. Lenzôs law. Types of induced emf ï self induced emf, Dynamically induced emf. Fleming's. Right hand rule for generators.			utilization a) Application of computer in Day to Day life i) Business ii) Office iii) Scientific iv) Education v) Engineering vi) Ticketing vii) Hotel viii) Medicine ix) Military etc.
73.		*Power transmission system*	**D C Generators** Generator 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 ï separately excited and self excited generators. Types of D.C. generators ï series generator, shunt generator and compound generator **D C Motor** Function, construction and working principles of DC motor. Fleming's left hand rule for D.C. motors. motor	- do -	Transformation of sentences in part II	- do -

			action. Terms used in DC motors such as Torque, speed and Back emf. Types of DC motors ï shunt motor, series motor, and compound motor.			
74.		*Operation and maintenance of power generation and distribution system*	- do -	- do -	**Direct speech**	- do -
75.		*Operation and maintenance of power generation and distribution system*	Starting methods ï 3 point starter and 4 point starter and their applications. Special D C motor used for starting Diesel engines. Function of Solenoid switch in starter motor. **Practice** Identify the parts of D C 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. Dismantling and defect rectification of starter Motor and engine starting system. **Alternating current** Basic concept, Alternating current and its behaviour,	- do -	**Indirect speech**	Development of Computers a) History ï First generation computers, second, third, fourth Type of Computers i) Super Computers ii) Main Frame Computers iii) Mini computer iv) Micro (Home Computer, Personal Computer, Laptop Portable Computers) v) Personal computer (P.C) vi) Stand alone vii) Intelligent Terminal viii) Dumb Terminal xi) Their usage

			AC cycle, Time period , frequency. Comparison of AC and DC currents. Root mean square (RMS) value, peak and effective values, AC average value. Concept of vector representation, A C through ohmic resistance, A C through pure inductance, A C through resistance and inductance, A.C. through capacitance, inductance. Power factor, importance of power factor in industrial applications			and limitations
76.		*Operation and maintenance of power generation and distribution system*	- do -	- do -	**Comprehension**	- do -
77.		*Operation and maintenance of power generation and distribution system*	**Poly Phase system** Importance of poly phase system, Generation of two-phase system, Generation of three phase system. Inter connection of three phases - star or wye connection, line voltage and line current in star connection. Delta or Mesh connection, Line voltage and line current in Delta connection. Comparison between two phase and three phase systems. Comparison	**Object drawing and assembly drawing** Piston ï cylinder head Valves - Valve guide springs ï rocker arm ï injector ï connecting rod ï fuel pumpï crank shaft ï cross head ï air starting valve Free hand sketching of Valves- cocks- cylinder relief valve ï pumps ï governor	**Letter writing**	- do -

			between star and Delta connections. Power measurement by Two watt meter method. Difference between shore electrical installations and marine electrical installations.	ï cylinder liner ï reverse reduction gears ï clutch ï lub. oil circuit ï cooling system ï engine room layout ï workshop lay out		
78.		*Operation and maintenance of power generation and distribution system*	- do -	- do -	**Precise writing**	Components of a Computer CPU Memory (Primary and secondary) Auxiliary storage Devices i) Magnetic Tape ii) Magnetic Disks iii) Compact Disk

			Alternators Principle of Alternator. Parts of Alternator, Emf equation of Alternator, Rating of Alternators. Types of Alternators ï static Excitation or Rotating armature type, Revolving excitation or Static Armature type. Advantage of static armature type Alternator. Concept of Brushless A.C. generator, its advantages over other systems, its suitability for marine application. **A C Motors** Working principle of AC motors. Rotating magnetic field, Rotor speed, synchronous speed, slip, torque, slip and torque relation. Types of AC motors ï synchronous motor, method of starting of synchronous motors	- do -	**Essay writing**	- do -
80.		*Bunkering procedures*	- do -	- do -	**General essays practice**	- do -
81.		*Bunkering procedures*	Induction motors, Method of starting induction motors, Direct on line (DOL) starters, Star ï Delta starters. **Practice** Measuring Instruments.	- do -	**Communicative English**	Input Devices i) Key Board ii) Mouse iii) Joystick iv) Light pen. Out put Devices

			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 Use of starter. Use of DOL and start Delta starter. Motor winding connection in stair And Delta. Measurement of current in star and Delta connection 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. **Transformers** Inductance and its properties, Self inductance and mutual inductance. Principle and Construction			rinters (impact and non-impact printers Visual Display unit (VDU)

			of transformers. Types of transformers. Transformation ratio, numerical examples, Advantage of using transformer in AC supply. Principle of transformer in distribution of electrical energy. Transformer in D C supply.			
82.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	- do -	- do -	- do -	- do -
83.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	**D C power generation and distribution system** Generator, Main circuit breaker and its function. Main switch board 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.	- do -	**APPLIED MATHEMATICS** **Arithmetic** Simple problems on the first four rules	- do -
84.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	**A C Power generation and distribution system** Alternator and prime mover. Main circuit breaker, protective devices, Main switch board ï Shipôs main supply section, Auxiliary supply section, Inter	- do -	Fractions	Data communications and computer net work ata types, sharing of Data, sharing of resources, communication paths, satellites, cables,

			connection between Main supply and Auxiliary supply. Automatic voltage regulation. Synchronising of Alternators. Advantages of synchronizing Alternators. Conditions of parallel operation of Alternators. Parallel operation of three phase Alternators. Parallel operation of three phase Alternators. Synchronising with dark and bright lamp method, synchronizing with synchroscope method. Switch board equipments for controlling alternators. Earth testing circuit and its use. A.C. Distribution system.			Microwave system and High frequency waves, LAN, WAN etc. and internet.
85.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	- do -	- do -	Decimals	- do -
86.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	**BASIC ELECTRONICS & INSTRUMENTATION** **Energy bonds in solids** The nature and structure of atom, charged particles, Ionisation, Insulators, Semi conductors and conductors **Semi conductor Devices and Circuits**	- do -	The Unitary method	- do -

			Intrinsic and Extrinsic semi conductors, Covalent bond, Electron and hole concept, Semi conductor materials. Donor and acceptor, impurity, 'P' type and 'N' type semi conductors. Semi conductor diode, forward ï reverse biasing, diode for half wave and full wave rectifier.			
87.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	- do -	- do -	Time and distance	Operation systems Difference between operating system Common commands of MS ï DOS, WINDOWS How do we interact with the computer? Hardware System ï Application ï user
88.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	Biploar junction transistor, Biasing of transistor, testing transistor. Simple circuits for transistor in Amplifier and oscillator. **Electronic conduction in vacuum and gas tubes** Electron emission, vacuum tubes, conduction in gases, photoelectric devices.	- do -	Square root	- do -
89.		*Various fishing technique*	- do -	- do -	Logarithm	- do -

		operation and operation of Electronic equipments				
90.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	**Electronic components** Resistors, Capacitors, inductors, tuned circuits and resonance, fuse, transformer, crystals, switches and relays, microphone and headphone, thermistor, frequency spectrum and applications.	- do -	**Mensuration** Area of 2 dimensional plane figures Three dimensional solids ï Volume, Lateral surface area and Total surface area ï cube, cuboid, cylinder, cone and sphere	Programming language and Multimedia applications
91.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	- do -	- do -	- do -	- do -
92.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	**Digital electronics** Binary number system, Basic gates ï OR, AND, NOT, NOR, NAND. Half adder, full adder, parity checker / generator, Decoder / Demultiplexer, Data selector / multiplexer, registers and counters	- do -	**Algebra** Quadratic equations Simultaneous equations Problems on equations	Utility - Security, virus, future of computer ï trends in 21st Century what is artificial Intelligence.
93.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	- do -	- do -	- do -	- do -
94.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	**Instrumentation** Ammeter, Voltmeter, Ohmmeter, multimeter, power meter, power	- do -	**Trigonometry** Trigonometrical ratios Compound angles Multiple and sub-	**Part F** **Maritime Law and Conventions** Merchant shipping act

			frequency meter, synchroscope, Megger Measurement of temperature, pressure, flow, RPM (Techometer)		multiple angels Product formula and identities Heights and distances	Marine pollution
95.		*Various fishing technique followed during fishing operation and operation of Electronic equipments*	Principle and operation of smoke detectors Angle and pitch position indicators **Control systems** Control remote control and monitoring of protective systems in main engine installations. Servo control and applications of feed back systems	- do -	- do -	- do -
96.		*Report on onboard training – Operation, Troubleshooting and maintenance of marine engines, auxiliaries and other machineries & equipments*	- do -	- do -	**Describing motion** Definition of Speed, velocity and acceleration Different formula on speed, velocity and acceleration Different problems on speed, velocity and acceleration	Marine Ecology & environment International conventions - SOLAS, MARPOL, STCW, ILO Conventions
97.		*Report on onboard training – Operation, Troubleshooting and maintenance of marine engines, auxiliaries and other machineries & equipments*	- do -	- do -	- do -	- do -
98.		Revision				
99.		**MODEL EXAMINATIONS**				
100.						

		Revision
102.		Revision
103.		**TRADE TESTS**
104.		

MENTS FOR THE TRADE OF MARINE FITTER
FOR A BATCH OF 16 TRAINEES

1. LIST OF EQUIPMENTS

S.No.	Description of Article	Quantity
I.	**Motor Vessel of length not less than 25 m and BHP not less than 500**	**I No.**
II. 1	Air compressor	1
2	Air starter motor	1
3	Anvil	1
4	Arc welding set with accessories	3 sets
5	Bench grinder	2
6	Bench vice 6"	17
7	Centre lathe machine	2
8	Cylinder head marine diesel engine	2
9	Diesel driven pump	1
10	Diesel engine working model with gearbox and fixed pitch propeller	1 set
11	Electric blower 440 Volts 3 phase	1
12	Electric motor I HP 220 volt	1
13	Fuel injector pump	1
14	Fuel injector test bed	1
15	Fuel pump individual	2
16	Fuel pump multiple	2
17	Gear type pump	1
18	Generator for coupling to marine diesel engine	1
19	Hand operated hydraulic pipe bending m/c	1 set
20	Heat exchanger	1
21	Hydraulic control valve	1
22	Hydraulic line relief value	1 set
23	Hydraulic low pressure pump	1
24	Hydraulic motor with pinion	1
25	Hydraulic pump - High pressure	1
26	In line - diesel engine - multi-cylinder	1
27	Cut model single cylinder engine	1
28	Line hauler electrically operated	1
29	Out board engine	1

		1
		1
		1
33	Plummer block bearing	1
34	Portable drilling machine	1 set
35	Power Hacksaw machine	1
36	PTO clutch assembly	1
37	Shearing machine (Hand operated)	1
38	Single cylinder water cooled diesel engine, hand starting type	2
39	Smith's forge	1
40	Swage block	1
41	Vacuum pump - double stage, rotary	1
42	3 way valve	1
43	Acetylene Regulators for Gas welding	1
44	* Electric hand drilling machine 230V - ½" capacity	1
45	Expansion valve	1

Battery testing equipments

1	Hydrometer	3
2	Cell Tester 2 V	3
3	Battery Tester 12V	3
4	Multimeter	3
5	Disti lied water plant	1
6	Battery charger	1

Other Electrical test equipments

1	Megger	2
2	Tong Tester	2
3	Armature Growler	1
4	Test Lamp	1
5	Motor winding machine	1

s

	stem	1
2	Colour Video Echo Sounder	2
3	HF Radio Transceiver	1
4	VHF Radio Transceiver	1
5	Megger	1
6	Digital Multimeter	1
7	Analogue Multimeter	2
8	Temperature Controlled Soldering Station	1
9	De-soldering station	1
10	Frequency counter	1
11	4OV/20A variable voltage Battery charger	1

1		[illegible]	1
2		BSW Tap set	1 set
3		Adjustable pipe wrench	1
4		Adjustable plier	1
5		Adjustable reamer	1
6		Hand reamer	1
7		Allen key set	1 set
8		Allen screw wrench	1 set
9		Ball pein hammer 1 lb	1
10		Ball pein hammer 2 lb with handle	18
11		Bearing scraper Flat	1
12		Bearing scraper half round	1
13		Bearing scraper triangular	1
14		Bench vice 6" size	18
15		Bevel protractor	1
16		Blow lamp	1
17		Blow pipe	1
18		Blue goggles for gas cutting work	6
19		Box spanner set	3 sets
20		BSF Taps with tap wrench	3
21		BSP die set (pipe)	1 set
22		BSW die (pipe)	3
23		BSP pipe die with stock	3
24		C clamp	1
25		Cable joining clamp	1
26	*	Calipers asserted sizes (inside/outside)	1 set
27		Carpenter's clamp	1
28		Carpenters vice	1
29		Carpentry chisel different sizes	6 sets
30		Centre punch	6
31		Chain pulley block	1

			1
			1
34		Chisel set (Flat, Half round, Cross cut, Diamond)	2 sets
35		Nose plier	1
36		Circlip plier inside	2
37		Circlip plier outside	2
38		Claw hammer 1/2kg	1
39		Cold chisel	2
40		Combination drill bit	1
41		Combination set	1
42		Combination spanner	1 set
43		Compass	1
44		Counter boring cutter	1
45		Counter sunk Cutter	1
46		Cross pein hammer	1
47		Straight pein hammer	1
48		Cutter gun for gas cutting	1
49		Cutting plier	2
50		Cuttogen, blow pipe with nozzles for gas welding and cutting	6
51		Depth gauge	1
52		Depth micrometer	1 set
53	*	Dial gauge with magnetic stand	1
54		Dial gauge stand - Inside	1
55		Dial test Indicator	1 set
56		Double end spanners	1 set
57		Draw bolt	1
58		Parallel shank drill bit different sizes	1 set
59		Taper shank drill bit different sizes	1 set
60		Electrode holder	6
61		Electronic leak tester	1
62		Emery grinding wheel dresser	1
63		Engineer's Tri-square	2
64		Feeler gauge mm size	2

			2
			1 set
67		Flat chisel	18
68		Flat file rough & smooth different sizes	18 sets
69		Folding scale	1
70		Foot rule	3
71		Fuel injector nozzle cleaning bit	1 box
72		Gas cutting torch cuttogen	6
73		Gas welding blow pipe low pressure different sizes	1 set
74		Gas welding blow pipe with high pressure different sizes	1 set
75		Gas welding nozzles different sizes	4 set
76		Grease gun	1
77		Green goggles	3
78		Green goggles for gas welding	3
79	*	Hacksaw frame 12"	18
80		Half round file rough & smooth different sizes	18 set
81		Round file rough & smooth different sizes	18 set
82		Triangular file rough & smooth different sizes	18 set
83		Hand file rough & smooth different sizes	2 each
84		Hand vice	2
85		Heavy duty screw driver (carpenters)	2
86		Hole punch different size	1 set
87		Hydraulic jack	1
88		Needle file set rough & smooth	1 set
89	*	Injector cup wrench, injector test equipment	1 each
90		Inside caliper spring bow	1
91		Inside micrometer	1
92		Knife edge file 8" rough & smooth	6
93		Leather hand gloves	6 pairs
94		Letter punches	2 sets
95		Magnetic stand	1 box
96		Magnifying glass with handle	1
97		Measuring tape 3 mtrs. mm size	2

			1
		utside)	1
100		Micrometer 25-50mm	1
101		Morse taper sleeve 0-1, 1 -2,2-3,3-4	1 each
102		Drill chuck with key	1
103		Nose plier	1
104		Number punches	1
105		Odd leg caliper (Spring bow)	2
106		Offset screw driver	1
107		Oil can	1
108		Oil gun	1
109		Oil measuring can 100/200 ml	1
110		Oil stone	2
111	*	Orifice plates (assorted sizes)	2
112		Outside caliper(Spring bow)	2
113		Oxygen regulators-gas welding	6
114		Parallel shank end mill cutter	1
115		Philips screw driver bit different sizes	1 set
116		Pin vice	1
117	*	Pipe die, pipe cutter & pulley black	2 each
118		Pipe spanner	1 set
119		Pipe vice	2
120		Pipe wrench	1
121		Pitch gauge	1
122		Plain goggles for welding	6
123		Radius gauge	1
124		Ratchet screw driver with bit	1
125	*	Ratchet square handle	1
126	*	Reamer ½"	1
127		Ring spanner different sizes	3 sets
128		Screw driver with plastic handle	3 sets
129		Screw spanner	2
130		Scriber	1

			1
			I set
133		Sledge hammer	3
134		Slip joint pliers	1
135		Soft hammer small size	3
136		Soldering iron (for smithy)	6
137		Spirit level with wooden case	1
138		Steel tape	1
139		Straight edge - 1 mtr.	1
140	*	Stud Remover (assorted sizes)	1
141		Surface gauge	1
142		Surface plate l' x l'	1
143		Swage punch 1/8" x -3/4"	1 set
144		Swage top and bottom	2
145		Swaging tool ¼ x 5/8	1
146		Telescopic gauge different size	1 set
147		Tongs flat	3
148		Tongs round	3
149	*	Tool bit holder	2
150		Tool box-set Refrigeration plant	1
151		Torque wrench	1
152		Torque wrench (ratchet type)	1
153		Trammel	1
154		Try square	18
155	*	Tube cutter (Cu)	1
156		Tube spanners	1 set
157		Universal scribing block (surface gauge)	1
158		V block with clamp	1 set
159		Valve seat cutter (In a box)	1 set
160		Valve seat grinding machine	1
161		V- block	2
162		Vernier caliper different sizes	3
163		Vernier height gauge	1

			1
		cable, cable log, earth clamps, chipping elding hatch, and leather gloves	1 set
166		Welding screen	6
167		Wire gauge (SWG)	1
168		Wooden mallet	6
169	*	Led wire (0.5 - 1.5 mm	As required
170	*	Ear muffs / Ear plugs	6 sets
171	*	Masonry drill bits	2 sets
172	*	Bearing pulley extractor (assorted sizes)	1 set
173	*	Safety Lamp	24
174	*	Mallet Hammer	10
175	*	Copper Hammer	10

N.B.:- In the above Tools & Equipment list for the trade of "Marine Fitter" under CTS, Indicating * asterisk marked have been incorporated by the Trade Committee Members.