SYLLABUS FOR THE TRADE
OF

MARINE FITTER

(SEMESTER PATTERN)

UNDER
CRAFTSMAN TRAINING SCHEME (CTS)

Designed in – 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN-Block, Sector-V, Salt Lake
Kolkata-700 091

List of members of Trade Committee meeting for the trade of
"**MARINE FITTER**"
held on June 2010 at ATI, Chennai.

SL. NO.	NAME & DESIGNATION	REPRESENTING ORGANISATION	REMARKS
1	Shri A. Mahendiran , Director	ATI, Chennai -32	Chairman
2	Shri R.C.Sinha , Director	CIFNET-Kochi	Member
3	Shri S.Harinath Babu, Joint Director of Training	ATI, Chennai -32	Member
4	Shri M.Rajavel, Senior Instructor (Training)	CIFNET-Kochi	Member
5	Shri K.C.Udyaprakash, Senior Instructor(Fishing Technology)	CIFNET-Kochi	Member
6	Shrri. Makwana, Chief Instructor (Marine Engg)	CIFNET-Kochi	Member
7	Dr.Jomon Joseph, Chief Instructor (Fishing Technology)	CIFNET-Kochi	Member
8	Shri Mariapparaj .P	NATRIP, Global Automotive Research centre, kancheepuram. Tamilnadu-602105	Member
9	Shri Dr.K.Annamali HOD	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
10	Shri S.Arul Selvan, Assistant professor	Dept Auto Engg, M.I.T, Anna University, Chennai.	Member
11	Shri K.Srinivasa Rao , Deputy Director of Training	ATI, Chennai-32	Member
12	C.Yuvaraj, Assistant Director of Training	ATI, Chennai-32	Member
13	Shri P. Marveldass, Assistant Director of Training (Electronics)	ATI, Chennai-32	Member
14	Shri N.P. Banni Bagi, Training Officer	ATI, Chennai-32	Member
15	Shri R. Rajesh Kanna Training Officer	ATI, Chennai-32	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Muhkerjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

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

2. N.C.O. Code No. :

3. Duration : 2 years (4 Semesters)

4. Power norms : 30.0 KW

5. Space norms : Workshop: 256 Sqr meter.

6. Entry Qualification : Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.

7. Unit size (No. of Student) : 16

8. Instructors Qualification :

(A) Degree in Marine/Mechanical Engineering from recognized engg. college/university with one year experience in the relevant field OR
Diploma in Marine/Mechanical Engg from recognized board of technical education with two years experience in the relevant field
OR

10^{th}/Madhyamic pass + NTC/NAC in the Trade of "Maine fitter" with 3 years post qualification experience in the relevant field.

(B) Desirable qualification
: Preference will be given to a candidate with Craft Instructor's Certificate.

* **Note**: At least one Instructor must have Degree/Diploma in Marine/Mechanical Engg.

Syllabus for the Trade of "**Marine Fitter**" under C.T.S.
Duration : Six Month

First Semester **Code: MRF – Sem-I**

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Workshop calculation and science
1 &2	Visit to different sections of the institute. Demonstration on elementary first aid artificial respiration etc.	**Admission & introduction to the trade:** Familiarisation with institute, Job opportunities in the Marine sector, Machinery used in Trade. Types of work done by the students in the shop floor.	Introduction for machine drawing Introduction meaning and usefulness of Machine drawing. Concept of standard and standardization.	**Introduction of the subjects Metals and heat treatment** Metals -Ferrous metals and alloys – non ferrous metals and alloys
3	Practical related to Safety and Health , Demonstration on PPE (Personal Protection Equipments) Demo on First aid and Fire safety, Use of fire extinguishers.	**Occupational Safety & Health** Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. emergency evacuation procedure, Safe handling of Fuel Spillage, Use of Fire extinguishers, safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles, Environment control of Running indoors engines, Study of Material safety data sheet (MSDS), Safety disposal of Used engine oil, Electrical safety practices. House Keeping – 5S Concept.	- do -	Heat treatment of iron and steel – Description and purpose of heat treatment – principle methods of heat treatment and its purposes **Mechanical working of metals** Mechanical working process and purposes - hot working
4	**Fitting section-I**	**Materials** Various metals and alloys – manufacturing process, properties – Testing – tensile, hardness, impact, non destructive test, Marine Application of various metals,	- do -	principle methods of hot working - - 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
5	Chipping Filing Making male and female joints	**Fuel & Lubricant** Refining process – properties and tests, density, viscosity, poor point, flash point, fire point, calorific valve, octane number, cetanen number, carbon residue, sediment content, corrosive effect, Base number, clearing property, demulsibility, corrosion inhibition, foam inhibition, water in oil, acidity, alkalinity	Code of practice for Engg. drawing (IS 696-1972) Scale, lines, lettering, titling, dimensioning, tolerance	Arc, gas, TIG, MIG, submerged weldings, defects in welding - crack, porosity, deformation etc. adjustment of the flame, selection of correct Nozzle, Soldering and brazing - uses, tools for operation, types of solders, difference between soldering and brazing
6	**Gas cutting / welding / brazing / soldering**	**Boilers** Classification, mountings, construction failures and repairs, Boiler water and treatment, steam system, application of steam. Understanding about the construction Free hand drawings of boilers	**Plane geometry** Terms & definition used – construction and division of lines, angles, triangles, quadrilaterals, polygons, circles and tangents Construction and division of lines, angles, triangles, quadrilaterals, polygons, circles and tangents	**Pattern making and foundry works** General description, casting processes, types of pattern, moulding sand, How to make mould, defects in casting **Fastenings** General description – classification of fasting - Rivets and riveting –

				keys: different types and purposes, Cotter joints: different types and purposes, Pin joints: different types and purposes, nut & bolts: different types and purposes – construction of nuts bolts, rivets, screw threads, shaft keys, spur gear
7	Adjustment of flame setting for different gas cutting Gas cutting Welding / brazing / soldering – practice of arc welding on a surface.	**Marine corrosion** Prevention – surface preparation, painting, cathodic protection, impressed current system. Field visit to know about the schedules	**Solid geometry** Angles generally use on solid geometry, method of first angle & third angle projections – definitions Projection of simple solids (construction) conventional representations	**Smithy & forging** General description of smithy and its tools, Forge - types of forges, Smith's tools for hand forging Carrying out job works **Carpentry** General description of carpentry tools – types of carpentry tools and uses –common varieties of Indian timber – carpentry processes – different types of carpentry joints - Carrying out job works on this trade. **Power transmission** Types of belt drive – types of pulleys –

				jockey pulley or rider pulley
8 & 9	**WORKSHOP PRACTICAL – II & VIVA VOCE** **MACHINE SHOP-I** **Lathe work** – centering / fixing of job, facing, plain turning / step turning **Drilling** – drilling / tapping of MS plates	**Turbines** Impulsive & reaction turbines – gas turbine – steam turbine – water turbine – construction and working principle Free hand sketch on working of turbines	Instruments and materials used for drawing	Chain drive – types of clutches – types of gear drive – cam drive – rope drive **Bearings** General description – different kinds of bearings and purposes – material of each bearings **Measuring instruments and gauges** Scriber - material, uses and types of, Dividers - material, uses and types. Calipers - description, material, uses, types of callipers – Taking measurement with all gauges. Vernier caliper - Description, material, uses and types Vernier bevel protractor - Description, material uses and types
10 & 11	**Grinding** – sharpening of the tool in the grinding machine. **Measuring tools** – vernier calliper, outside micrometer, inside micrometer, depth	**INTRODUCTION TO ELECTRICITY** Electricity and its important forms. Classification of Electricity – static electricity, current electricity. Effects of electricity – Magnetic effect, Heating effect, chemical effect and physical effect. Electric circuit – open circuit, closed circuit and short circuit	-do-	**Bench work, fitting & fabrication** Filing - General description of a file, classification of files, cut grade, shapes of

	micrometer, telescopic gauge, thread pitch gauge, wire gauge			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 of flat surfaces by scraping and bearing setting, material of the tool
12	**ON BOARD VESSEL PRACTICAL – I & VIVA VOCE**	Introduction to electricity electricity and its important forms. Classification of electricity – static electricity, current electricity. Effects of electricity – magnetic effect, heating effect, chemical effect and physical effect. Electric circuit – open circuit, closed circuit and short circuit	-do-	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
13	Preparation for sailing Use and maintenance of LSA & FFA Starting, stopping and watch keeping procedures of engine and auxiliaries	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 alternating current. Joule's law and joule's effect. Electric power, electric energy and their units, numerical examples.	-do-	Striking devices – Hammer – types of hammers, materials of a hammer and the uses of the hammer Cutting – Hack saw – General description, uses & method of operation – 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
14	Preparation of Electrical circuits using Wheat stone bridge.	**Ohm's Law and Kirchhoff's Law** 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. Kirchhoff's law – Point law or current law, Mesh or voltage law. Wheatstone bridge and its application in Electrical circuits, numerical examples.	-do-	hacksaw, 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 the correct size of vice, method of

				holding a work Fabrication of pipes, flanges, etc.
15 & 16	Preparation of Electrical circuits using parallel & series connections.	**Simple Electric Circuits** 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. Parallel circuit – formula, characteristics and parallel circuit – voltage remains same in each branch, total current I divides in separate branch, numerical examples. Comparison between series and parallel circuits. Application of parallel circuit in wiring. Series and parallel combination circuit, numerical examples.	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 measure-ment 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.
17		Conductors, semi conductors and insulators conductor – definition, types of conductors and their uses. Conductor and its relationship with length, area of cross section, material and temperature. Semi conductors – definition and their uses. Insulators – definition, types of insulators and their uses.	**-do-**	**- Reamers** Description - Material, types of reamers, purpose of the tod, counter boring and spot facing, reaming, method of using the 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		**Cells and Batteries** **Primary cells** Electric cell – definition. battery– definition.. Chemical effect of electric current, principles of Electrolysis, Faraday's laws of Electrolysis, Electro chemical equivalent. Principle and description of	-do-	**BASIC MATHEMATICS** **Arithmetic** Simple problems on the first four rules. Fractions, Decimals

		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. **Secondary Cells** 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. Precautions to be taken while maintaining the lead acid batteries. Testing instruments used. General defects and remedies of a lead acid cell. General maintenance and upkeep of lead acid cells.		The Unitary method Time and distance Square root **Algebra** Quadratic equations Simultaneous equations Problems on equations **Trigonometry** Trigonometrical ratios Compound angles Multiple and sub-multiple angels. Product formula and identities. Calculation of thread cutting, taper turning etc.
19		**Magnetism and Electro Magnetism** Magnetism – Magnetic properties, principle of magnetism, Magnetic field and magnetic lines of force, Magnetisation. Types of magnets. Electro magnetism – Electricity and magnetism, Magnetic field due to current carrying conductors and loops. Right hand grip rule. Cork screw rule. Solenoid and its polarities. 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 hand rule for generators.	-do-	Different lathe tools, different methods of taper turning **Grinding machine** General description uses & method of operation –precautions- Carrying out jobs on the machine **Arbour Press & hydraulic press** General description, uses & method of operation – Carrying out jobs on the machine Care & maintenance of a workshop, Engine room and workshop lay out

		BASIC ELECTRONICS		
20		**Vacuum Tubes & Semiconductor Basics (8 hrs)** The nature and structure of atom, charged particles, Ionisation, Electron emission, vacuum tubes, conduction in gases. Insulators, Semi conductors and conductors 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.	- do -	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.
21 & 22		**Semi conductor Devices and Circuits** Semi conductor diode, forward – reverse biasing, diode as half wave, full wave rectifier and Bridge rectifier circuits, Different types of Diode. Transistor, Biasing of transistor, Transistor as an Amplifier, Classes of Amplifier, Simple amplifier circuit, Oscillator, simple oscillator circuit, Thyristors, FETs & MOSFETs, Integrated Circuits.	Scale, lines, lettering, titling, dimensioning, tolerance	**Displacement, TPC, coefficients of form** Archimedes principle – displacement – tonne per cm immersion coefficient of form – wetted surface area – similar figures – shearing force and bending moment - Calculation of displacement, TPC, coefficient, W.S.A etc. **Centre of gravity** Centre of gravity – effect of addition of mass – effect of movement of mass – effect of suspended mass

				Stability of ships Statical stability at small angles of heel – calculation of BM – metacentric diagram – inclining experiment – free surface effect – stability of large angles of heel – stability of a wall-sided vessel Centre of gravity, centre of buoyancy Class room practicals Sketch a cross section of ship and mark various stability parameters
23 & 24		**Electronic components** Resistors, Capacitors, inductors, different types, Series and Parallel connections, their units, Behaviour in AC and DC circuits, Reactance and Impedance, Resonance and Behaviour of tuned circuits and uses, fuses, transformers, crystals, switches and relays, microphones and headphones.	-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** **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
25	**Project work / Industrial Visit (optional)**			
26	**Examinatoin**			

Syllabus for the Trade of "Marine Fitter" under C.T.S.

Duration : Six Month

Second Semester **Code : MRF – Sem-II**

Week No.	Practical	Trade Theory	Engineering Drawing	Workshop calculation and science
1	**Introduction to Marine Engines** Terminology - Classification of internal combustion engine - Working principles of four stoke and two stroke engines			
2-4	**Fitting section-II**	**Fundamentals of Internal Combustion Engine** 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 - 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 - 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. Understanding on the construction of the engine Calculation of efficiencies	- **Plane geometry** Terms & definition used – 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 Stern tube arrangements. Bulkhead - Construction of model boat - Free hand Drawing. Caulking and Stopping Wheel house and other superstructures, rigging Sheathing Underwater fittings, Painting and varnishes Engine installation, alignment Tanks and plumbing work Deck fittings
5-6	Chipping Filing Making male and female joints	**Components of Diesel 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 - Thrust bearing -	**-do-**	**SHIP CONSTRUCTION** **Stresses in ship structure** Longitudinal bending in still water and waves – transverse bending –

	Identification of parts of Diesel engine	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 - 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 – silencer - materials used.		stresses when docking – pounding – panting **Bottom and side framing** Double bottom – internal structure – side framing – tank side bracket – beam knees –web frames **Shell and decks** Shell plating – bulwarks – deck plating – beams – deck gurders and pillars discontinuities – hatches – hatch corners – Free hand sketches **Bulk heads** Water tight bulk head – water tight doors – non-water tight –bulkhead
	Gas cutting / welding / brazing	**MARINE ELECTRICAL TECHNOLOGY (ELECTRICAL MACHINARIES)**	**-do-**	**Fore end arrangements** Stem plating – anchor – cable arrangement **Aft end arrangements** Transom stern – stern frame and rudder – ship tunnel – Kort nozzle – fixed pitch propeller– variable pitch propeller **Fish hold** Insulated fish hold. **Reading drawing on various constructional stages of a ship-** Free hand sketches

7	Gas cutting Welding / brazing practice of arc welding on a surface, Joining of two surfaces, 'V' joints welding, practice of brazing	**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 – separately excited and self excited generators. Types of D.C. generators – series generator, shunt generator and compound generator	**Solid geometry** Projection of simple solids (construction) conventional representations & sectioning	**General description** 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 density, weight density, specific volume, specific gravity, compressibility, cohesion adhesion, surface tension, capillary action, viscosity, temperature with density, viscosity.- Flow of fluid – method of flows – radial flow, axial flow – velocity , speed, venturimeter, hydraulic press, hydraulic torque - Free hand sketch of the experiments- Flow of fluid, velocity, volume, discharge time **etc. – calculation**

8	**Smithy section**	**D C Motor** Function, construction and working principles of DC motor. Fleming's left hand rule for D.C. motors. motor action. Terms used in DC motors such as Torque, speed and Back emf. Types of DC motors – shunt motor, series motor, and compound motor. Starting methods – 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.	-do-	**Hydraulic devices** Pumps, Motor – Control system, types of valves, tank, strainer, filter, **breathers, piping**
9	Forging operation – hexagonal bolt, hexagonal nut	**Alternating current** Basic concept, Alternating current and its behaviour, 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	-do-	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 - Free hand sketch of all pumps and accessories - Discharge capacity, power of pumps calculations – operational level
10	**WORKSHOP PRACTICAL – II & VIVA VOCE** **MACHINE SHOP-II**	**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	-do-	- do – Practice Dismantling and assembling of pumps Field visit to acquaint systems

		two phase and three phase systems. Comparison between star and Delta connections. Power measurement by Two watt meter method. Difference between shore electrical installations and marine electrical installations.		Dismantling and assembling of all motors Dismantling and assembling of filters
11	**Lathe work** –taper turning, thread cutting, knurling **Drilling** –enlarging of hole with drilling method, reaming operation of enlarged holes **Shaper** – surfacing, keyway slot cutting **Milling** – surfacing, parting, bolt head cutting, gear cutting. Power hacksaw– cutting **Measuring tools** – vernier calliper, outside micrometer, inside micrometer, depth micrometer, telescopic gauge, thread pitch gauge, wire gauge	**Alternators** Principle of Alternator. Parts of Alternator, Emf equation of Alternator, Rating of Alternators. Types of Alternators – 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.	**Fastening** Construction of nuts, bolts, rivets, screw threads, shaft, keys, cotters, spur gear Calculation for thread, spur gear etc.	Motors 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- Free hand sketch of all motor and accessories- Power and capacity calculations – operational level
12	**ON BOARD VESSEL PRACTICAL – II & VIVA VOCE**	**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 – synchronous motor, method of starting of synchronous motors, induction motors, method of starting induction motors, direct on line (dol) starters, star – delta starters.	-do-	**Control system** direction control – pressure control – volume control – pressure relief valve – brake valve– rotary valve– spool control

				valve– pressure regulator– check valve– solenoid valve **Other devices** Tank and accessories– piping– strainers– oil seals– filters- oil cooler- Free hand sketch
13	Starting, stopping and watch keeping procedures of Refrigeration compressor and system Maintenance and troubleshooting of main engine and auxiliaries	**Transformers** Inductance and its properties, Self inductance and mutual inductance. Principle and Construction 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.	-do-	**General** Hydraulic circuit – closed system – open system – power units - – desirable properties of hydraulic oil and its grades – loss of head – cavitation – air purging **Deck Machineries** Trawl winch – Wind lass – Net drum- purse seine winch – triplex winch- power block – line hauler- Free hand sketch
14	-do-	**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.	**Introduction to computer drafting** Basics of CAD	cargo winch – gun whale roller – side thrusters - Construction, working principle, circuit diagram **Trouble shooting** cause and remedies

15	-do-	**A C Power Generation And Distribution System** Alternator and prime mover. Main circuit breaker, protective devices, Main switch board - Ship's main supply section, Auxiliary supply section, Inter 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.	-do-	**NAVAL ACRHITECTURE AND SHIP CONSTRUCTION-I** **Maintenance of all systems**
		DIGITAL ELECTRONICS AND INSTRUMENTATION	-do-	**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.
16		**Digital electronics** Binary number system, Boolean Algebra & Logic gates, Half adder, full adder, Multiplexer and Demultiplexer, Parity checker/ generator, Flip Flop, Registers and Counters, Introduction to Microprocessor	Projection of simple solids (construction) conventional representations & sectioning	**Displacement, TPC, coefficients of form** Archimedes principle – displacement–tonne per cm immersion – coefficient of form – wetted surface area – similar figures – shearing force and bending moment Calculation of displacement, TPC, coefficient, W.S.A etc.

17		**Instrumentation** Ammeter, Voltmeter, Ohmmeter, Multimeter, Megger, Power meter, Energy Meter, Frequency meter, Synchroscope. Measurement of temperature, pressure, flow, RPM (Techometer) Principle and operation of smoke detectors, Angle and pitch position indicators	-do-	**Centre of gravity** Centre of gravity – effect of addition of mass – effect of movement of mass – effect of suspended mass **Introduction to Pneumatics** Pneumatic system and physical units, Basic requirements for pneumatic system, Air compressor, pneumatic cylinder and air motor valves, circuits, Hydro pneumatics- Free hand sketch
18		**Control systems** Control remote control and monitoring of protective systems in main engine installations. Servo control and applications of feed back systems	-do-	**Stability of ships** Statical stability at small angles of heel – calculation of BM – metacentric diagram – inclining experiment – free surface effect – stability of large angles of heel – stability of a wall-sided vessel, Centre of gravity, Centre of buoyancy, 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. Class room practicals Sketch a cross section of ship and mark various stability parameters
19		**Marine Electronic Equipments** Marine communication Equipments, Marine RADAR, Global Positioning System, Automatic Identification System, NAVTEX – working Principle & Operation	-do-	**Manoeuvring :** Types of propellers, Effect of propellers, Shallow water effect, Turning a vessel in a short round, squat On board sketch the effect of the propellers and show how the fishing vessel turned in a short round
		HEAT ENGINES AND REFRIGERATION-I		**Introduction of fishing crafts**
20		**Introduction)** Matter – Weight – Force –Speed – pressure – acceleration – momentum –work – torque – power- energy	-do-	**Boat Building materials** Steel, Fibre glass, other composite materials, wood**,** Characteristics of Boat Building timbers Carpentry joints
21	Practicing sketch of all cycles	**Heat and Work** Theory of heat – temperature – thermometer – expansion of 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 cycle	-do-	**Terms in boat building** General descriptions

22		**Expansion and compression of gases and ideal cycle** 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	-do-	**Importance of lofting in boat building** Plotting Free hand drawing
23		Refrigeration method of lowering the temperature of a liquid- introduction- ice refrigeration- evaporative refrigeration– refrigeration by expansion of air– refrigeration by throttling of gas– vapour refrigeration system– steam jet refrigeration system– refrigeration by using liquid gases– dry ice refrigeration- unit of refrigeration- heat pump	-do-	**Caulking and stopping**
24	Free hand sketch of schematic diagram Free hand sketch of schematic diagram	**Vapour absorption system** Working cycle and principles **Air Refrigeration System** Working cycle and principles	-do-	Wheel house and other superstructures, rigging Sheathing) Underwater fittings Painting and varnishes APPLIED MATHEMATICS Trigonometry Heights and distances Basics of spherical Trigonometry Mensuration Area of two dimensional plane figures Three dimensional solids – Volume, Lateral surface area and Total surface area – cube, cuboid, cylinder,

				cone and sphere Describing motion Speed, velocity and acceleration – definition, formulae and problems
25	**Project work / Industrial Visit (optional)**			
26	**Examination.**			

Syllabus for the Trade of "Marine Fitter" under C.T.S.
Duration : Six Month

Third Semester **Code : MRF –Sem-III**

Week No.	Practical	Trade Theory	Engineering Drawing	Workshop calculation and science
1	**Electrical** Schematic diagrams of all systems	**Introduction to Marine 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.	**Introduction to computer drafting** Basics of CAD	**Taps** Description of a tap - material and how to use the tool Taking measurement with all gauges
2	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	**Fuel System** 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 Consumption - Governors - Direct acting governors - Relay governors - Sensitivity - Stability - Hunting - Power - Full load speed - Idling Speed - Instantaneous speed change - Permanent speed change. Servicing of fuel pump, fuel injector, governor Fuel pump, fuel injector Sketching of the schematic diagram	-do-	**Dies** Description - material, types of dies and stocks and how to use the tool Taking measurement with all gauges
3	Identification of Electrical tools and their uses. Verification of ohms law.	**Cooling System** Necessity of cooling - Indirect cooling using heat exchanger - Indirect cooling using keel cooler - Direct cooling by sea water - accessories - water	**MACHINE DRAWING** **Machine parts** Wall brackets (5 types) shaped blocks (5 types),CI	**Drills** Description - material, types of drills, feed speed, cutting speed, cutting speed of

	Identifying the Difference between series and parallel circuits. Acquainting with the parts Sketching the schematic diagram	pump - heat exchanger - overboard valves - trainers - sea chest - thermostatic valves	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, stepped pulley, pipe wise body, screw jack, stuffing box	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
4	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 Acquainting with the parts. Sketching the schematic diagram	**Lubrication System** Lubrication - Lubricating oils - Methods of lubrication - Lubrication of marine diesel engines - Equipment used in lubrication system.	-do-	**Reamers** Description - Material, types of reamers, purpose of the tod, counter boring and spot facing, reaming, method of using the tool Taking measurement with all gauges
5	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,	**Starting System** Hand starting - electrical starting - air starting - construction and working - maintenance of starting system - safety devices on air starting system – air starting valves	-do-	**Hand tools** Screw drivers - types of screw drivers material and uses Taking measurement with all gauges

	Fan or light through a regulator, two lamps, one socket, three Switches by switch box wiring. Testing of wiring insulation Acquainting with the parts Sketching the schematic diagram			
6	Fault finding in lighting circuit and defect rectification in a given model circuit. Checking of valve tapper clearance Sketching the schematic diagram	**Valve Mechanism System** Functioning - Valve tappet clearance - Checking of valve tappet clearance.	-do-	**Sheet metal** General description, method of operation types of tools and materials Carrying out job works
7	**Carpentry** Acquainting with the parts Opening of turbo charger and intercooler Sketching the schematic diagram	**Intake and exhaust system** 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	-do-	**Drilling machine** General description and uses. Types of Machines, types of drilling machine, feed mechanism, method of holding the drill, chucks Carrying out jobs on the machine
8	Sawing, Planning, Making male and female joints – 'T' joint, 'L' joint, 'V' joint, Dovetail joint	**HEAT ENGINES AND REFRIGERATION - II**	-do-	**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, lathe tools, different methods of taper turning Carrying out jobs on the machine Calculation of thread cutting, taper turning etc.
9-10	**WORKSHOP PRACTICAL – II & VIVA VOCE** **I.C ENGINES -I** Field visit to refrigeration plant. Dismantling and assembling all components Free hand sketch of schematic diagram Calculation of heat generated by a system and capacity of plant required	**Vapour compression system** Working cycle and principles – refrigeration equipments – description of parts – compressor – condenser – receiver – drier – evaporator – expansion valve oil separator	-do-	**Grinding machine** General description uses & method of operation – precautions Carrying out jobs on the machine
11	**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,	**Refrigerants** Properties of refrigerant – ideal refrigerant- secondary refrigerant – anti freeze solutions Requirement of refrigerant for the system	-do-	**Arbour Press & hydraulic press** General description, uses & method of operation Carrying out jobs on the machine

	butt clearance, skirt clearance, bearing clearance, bumping clearance **Overhauling** - single cylinder Diesel engine and Petrol engine			
12-14	Power transmission system Operation and maintenance of power generation and distribution system Bunkering procedures Opening of different steering systems Free hand drawing and schematic diagrams of different steering systems	**Steering gear** Mechanical steering gear, Electric steering gear, electro hydraulic steering gear, automative hydraulic steering system, Hydraulic rams, types of rudders – semi balanced, fully balanced unbalanced – pintle clearance, jumping clearance.	-do-	**Engine room and workshop lay out**
15-16	Dismantling and assembling of pumps Free hand drawing	**Pumps and Pumping systems** Types of pumps – reciprocating, centrifugal, axial, screw, sewage and sludge system, bilge, ballast, piping arrangements	-do-	**Workshop layout**
17	Field visit to acquaint with the system	**Remote controls** Need for remote control – mechanical remote controls – pneumatic control systems	-do-	**HYDRAULICS & PNEUMATICS – II**
18	Free hand sketch of all motor and accessories Dismantling and assembling of motor Power and capacity calculations – operational level	**Power transmission system**	-do-	**Motors** 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
19	Dismantling and assembling Free hand sketch	**Power transmission system**	-do-	**Control system**– direction control – pressure control – volume control – pressure relief valve – brake valve – rotary valve – spool control valve – pressure regulator – check valve – solenoid valve
20		**Power transmission system**	-do-	**Introduction to Pneumatics** Pneumatic system and physical units, Basic requirements for pneumatic system, Air compressor, pneumatic cylinder and air motor valves, circuits, Hydro pneumatics
21		**Operation and maintenance of power generation and distribution system**	**Object drawing and assembly drawing** Piston – cylinder head Valves - Valve guide springs – rocker arm – injector – connecting rod – fuel pump– crank shaft – cross head – air starting valve Free hand sketching	**Construction** Backbone assembly , Building stock, making the moulds, Rabbet building of wood Hull planking - different types Framing and longitudinal Deck beams and carlings Knees, Riders and pointer, Deck planking

			of Valves- cockscylinder relief valve – pumps – governor – cylinder liner – reverse reduction gears – clutch – lub. oil circuit – cooling system – engine room layout – workshop layout	Floor timbers and Engine bearers Stern tube arrangements, Bulkhead Construction of model boat
22		Operation and maintenance of power generation and distribution system	-do-	Engine installation, alignment Tanks and plumbing work Deck fittings
23-24	Reading drawing on various constructional stages of a ship	Operation and maintenance of power generation and distribution system	-do-	**Stresses in ship structure** Longitudinal bending in still water and waves – transverse bending – stresses when docking – pounding – panting Free hand sketches **Bottom and side framing** Double bottom – internal structure – side framing – tank side bracket – beam knees – web frames Free hand sketches **Shell and decks** Shell plating – bulwarks – deck plating – beams

				– deck gurders and pillars discontinuities – hatches – hatch corners Free hand sketches **Bulk heads** Water tight bulk head – water tight doors – non-water tight – bulkhead Free hand sketches **Fore end arrangements** Stem plating – anchor – cable arrangement Free hand sketches **Aft end arrangements** Transom stern – stern frame and rudder – ship tunnel - Kort nozzle – fixed pitch propeller – variable pitch propeller Free hand sketches **Fish hold** Insulated fish hold. Free hand sketches
25	**Project work / Industrial Visit (optional)**			
26	**Examination**			

Syllabus for the Trade of "**Marine Fitter**" under C.T.S.
Duration : Six Month

Fourth Semester **Code: MRF – Sem-IV**

Week No.	Practical	Trade Theory	Engineering Drawing	Workshop calculation and science
1	**Introduction to Heat Engines & Refrigeration**			
2&3	**Fitting section** Dismantling and assembling of filters Free hand sketch Dismantling and assembling of controls Free hand sketch	**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	**Object drawing and assembly drawing** Piston – cylinder head Valves–Valve guide springs– rocker arm– injector– connecting rod–fuel pump– crank shaft–cross head–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	**Other devices**– Tank and accessories – piping – strainers – oil seals – filters – oil cooler
3&4	Chipping Filing Making male and female joints – 'T' joint, 'L' joint, 'V' joint, Dovetail joint Practising defrosting methods	**Defrosting** 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	-do-	**General**– Hydraulic circuit – closed system – open system – power units - – desirable properties of hydraulic oil and its grades – loss of head – cavitation – air purging

5	**Electrical**	**Lub. Oil** Desirable properties Testing of lub. Oil	-do-	**Deck Machineries** Trawl winch – Wind lass – Net drum- purse seine winch – triplex winch- power block – line hauler – cargo winch – gun whale roller – side thrusters - Construction, working principle, circuit diagram Free hand sketch Power and capacity calculations – operational level
6&7	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. 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	**Trouble shooting** Moisture in the system – air in the system – under charge– lub. Oil in the system – detection of leakage in the system – high condensing pressure – low suction pressure – high delivery pressure – excess lub. Oil in the system	-do-	**Trouble shooting** – cause and remedies

	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.			
8	**Identification of Components** Resistors, Capacitors, Inductors, Transformers and Semiconductor devices **Testing of components** Resistors, Capacitors, Inductors, Transformers, Fuses, Speakers, Relays, Semiconductor devices etc. Starting procedures, watch-keeping, overhauling **Handling of various test equipments** Use of test equipments, Measuring current, voltage and resistance using Multimeter, Evaluation of waveforms using Oscilloscope. **Soldering practice and making simple circuits** Series & Parallel Resistance circuits by using PCBs	**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 - Maintenance - guidance for scheduled maintenance - Condition based planned maintenance - Preventive maintenance - Top overhauling - Major overhauling.	-do-	**FISHING TECHNIQUES**

	Electronic projects Assembling of simple electronic circuits			
9	**WORKSHOP PRACTICAL – II & VIVA VOCE** **I.C ENGINES -II** Make up arrangements for understanding troubles developed	**Trouble Shooting of Diesel Engines** Starting - Power variations - Speed variation - Abnormal smokes - Abnormal pressure - Abnormal temperatures - Abnormal Sound.	-do-	**Operation of fishing gear** A brief introduction about various types of gear now being used Local visit (Fishing villages and fishing harbour)
10	**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, explanation of parts including function of the governor. Piston ring – procedure of removing/ assembling, checking of butt clearance. Engine operation **Engine maintenance** – valve grinding, engine clearance **Overhauling** – Multi cylinder Diesel engine	**Power Development** Indicated Horse Power - Brake Horse Power - Frictional Horse Power - Shaft Horse Power - Effective Horse Power - Rating of engines - Testing of engines - Testing of propulsive machinery. Calculation of power	-do-	**Fishing without gear** Method of using, knife, shovels and picks for catching Molluscs and crabs
11	**ON BOARD VESSEL PRACTICAL – IV & VIVA VOCE**	**Selection of Engines** Fuel and lubricant - Reliability and durability - Strokes/cooling method - Running characteristics - Maintenance -	-do-	**Wounding gear** Harpoon, spear, blow pipe and bow and arrow

		Vibration - Size - Weight - Power requirement		
12	Identification of parts. Opening of the OBM for understanding the principles Various fishing technique followed during fishing operation and operation of Electronic equipments. Dry dock checking and maintenance.	**Outboard Motors** Prime mover - Transmission system - Trouble shooting	-do-	**Stupefying** Dynamiting, poisoning and electric fishing
13		**Power transmission** Outboard motors - Inboard motors - Reduction / Reverse Gears - Epicyclic gear - Differential gear - 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-	**Code of conduct for responsible fishing** Selective fishing gear and practices – Environmentally, eco-friendly gear and enhancement of resources **Fish Traps** To catch fishes by attracting them to the desired cages, Fyke net, Plunge basket, crab pot.
14	Identification of all gauges Free hand drawing of the circuit	**Instrumentation, meters & gauges & control** Instruments – sensors & measuring elements for temperature, pressure, flow, level, speed etc., Control systems – diaphragm valve, electric telegraph fluid temperature control, unattended machinery space.	-do-	**Traps for jumping fishes** Changadam, Raft, etc.
15 & 16	Field visit and on board training in dry dock	**Dry docking procedures** Dry docking procedure – preparation before docking and undocking –	-do-	**Bag nets with fixed mouth** Dol net (Bombay)

		preparation of defect list – safety procedure for entering and working in confined spaces/welding /cleaning etc.		Stake net (Kerala backwaters)
17	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	Various fishing technique followed during fishing operation and operation of Electronic equipments	-do-	**Dragged gear** Beam trawl, otter trawl Bull trawl On board practical training.
18	- do -	Report on onboard training – Operation, Troubleshooting and maintenance of marine engines, auxiliaries and other machineries & equipments	- do -	**Surrounding gear** To catch shoaling fishes, purse seine and ring net **Encircling gear** To catch shoaling fishes purse-seine and ring net **Dip or lift nets** Hand dip net, Chinese dip net
19	- do -	Report on onboard training – Operation, Troubleshooting and maintenance of marine engines, auxiliaries and other machineries & equipments	- 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 **Energy conservation** Fishing gear and methods, vessel technology

20	- do -	Report on onboard training – Operation, Troubleshooting and maintenance of marine engines, auxiliaries and other machineries & equipments	- do -	**Elementary Acoustics** Sound waves and propagation of sound, Velocity, wavelength, reflection, echo, ultrasound, range, measuring distance by sound. **Fish finding equipments** Principle of Echo 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.
21	- do -	- do -	- do -	**Parts of ship** Principal dimensions, Port, star board, beam, bow Quarter free board, draft Bulwork etc. On board practicals Identification of parts on board the fishing vessel and make sketches **Rope works, Types of ropes, care and maintenance of**

				synthetic and wire ropes (6 hrs) Knots and splices, breaking strength, working load, and problems connected therewith On board, class room Practicals on making different types of knots and splices such as eye slice , short splice , back splice and long splice
22	- do -	- do -	- do -	**Blocks & purchases** 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. On board, class room Identification of blocks and tackles. Practicals on marking different tackle and to calculate safe working load **Chart, Latitudes, longitudes, Fixing position on the chart,**

				setting course and finding the distance. (8 hrs) Abbreviations and symbols 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 **Lead lines (2 hrs)** Deep sea lead line and hand lead line On board Fabricate a handle lead line on a given rope and make proper makings
23	- do -	- do -	- do -	**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 extingui-shers and fire hoses

				On board and class room Prepare a must list for a fishing vessels. Practicals on operation and refilling of extinguishers. **Life saving appliances (10 hrs)** Life jacket, life buoy, Life raft, class 'C' boat, Rescue boat, EPIRB, SART, life boat its care and maintenance On board and class room Practicals on using life buoy and life jacket. Inflate the life raft and identify the parts and equipments. Using the SART **.**
24	- do -	- do -	- do -	**Accidents** Grounding, Beaching, Refloat. Collision and leaks, man overboard Class room and on board Prepare a collision mate model. **Distress signals & its penalty, procedure for sending distress call**

				Procedure for sending urgency and safety messages. Identify the various distress signals such as a hand flare , parachute ,smoke float and sketch the equipment and mark the parts. **Buoyage system** Buoyage and wreck marking system On board and class room
25	**Revision**			
26	**Examination**			

MARINE FITTER

List of Tools & Equipments for 16 Trainees + one

A. Trainees Kit – (As per the below table)

SI. No.	Name of the items	Qty.
I.	**Motor Vessel of length not less than 25 m and BHP not less than 500**	**1 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"	21
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
30	Petrol engine	1
31	Pillar drilling machine	1
32	Pipe vice	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
III.	**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
IV.	**Other Electrical test equipments**	
1	Megger	2
2	Tong Tester	2
3	Armature Growler	1
4	Test Lamp	1
5	Motor winding machine	1
V.	**Electronic Equipments & Tools**	
1	Global Positioning System	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

B. General Machinery Shop Outfit(As per the below table)

SI. No.	Name and Description of Tools	Quantity
1	3 Leg bearing puller	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
32	Chain wrench	1
33	Check valve	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	Cuftogen, 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
65	Fibre glass helmet	2
66	Flaring tool	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 cuffogen	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	21 set
81	Round file rough & smooth different sizes	21 set
82	Triangular file rough & smooth different sizes	21 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
98	Metal cutting snips	1
99	Micrometer 0-25mm (outside)	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
131	Scribing block	1
132	Single end spanner	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
164	Vice grip plier	1
165	Welding accessories, cable, cable log, earth clamps, chipping hammer, wire brush welding 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

C. Workshop Furniture

Sl. No	Names & Description of Furniture	Quantity
1.	Work bench 250x120x75 with four vices of 12.5 cm	4
2.	Locker with 8 drawers (standard size)	2
3.	Metal Rack 180x150x45cm	2
4.	Steel almirah / cupboard	1
5.	Black board and easel	1
6.	Instructor's Desk or table	1
7.	Chair	1