GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

MARINE FITTER

(Duration: Two Years)
Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

SECTOR –CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

MARINE FITTER

(Engineering Trade)

(Revised in Jul 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the two-year duration of Marine Fitter trade, a candidate is trained on Professional Skill, Professional Knowledge and Employability Skill related to job role. In addition to this, a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered under Professional Skill subject are as below:

FIRST YEAR: In this year, the trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. Identify parts of single / multi-cylinder I.C. engines and marine engines. Impart study of different types of pumps and valves in the basic fitting skills sawing, filing, marking, chipping, drilling are imparted and as well as forging,carpentry, fundamental electricaland electronic circuitry skillsare also imparted. Awareness, plan and preparation of vessel sailing, use and maintenance of LSA- FFA, checkup for proper working condition of emergency fire pump, bilge pump and keep firefighting extinguishers in their satiable place. The candidate will be able to achieve the skill on dismantling, overhauling and assembling single and multi cylinder marine engine, its different parts. Achieve skill on fault Simulation analysis using Trainer Kit. Develop skills on drilling, tapping to fasten bolts, nuts and rivets and skills on welding, gas cutting, brazing and soldering operation for joining metals. Impart training to dismantle, overhaul and assemble different types of DC and AC machines. Basic concept on operation and maintenance of Fuel system, Cooling system, Lubrication System, starting, stopping and watch keeping procedure of the main engine on board Vessel.

SECOND YEAR: In this year, includes procedure and steps for the dismantling and overhauling the single and multi cylinder marine engine, overhaul and assembles pumps and motors andimparts training on different turning operations. Develop skill on bunkering procedure and safety precautions of the Fuel bunkering on board vessel. This part includes the wide range of skills viz. lubrication, valve mechanism, intake and exhaust system, clearance checking, power generation and distribution system, steering system in marine engine. The candidate will be able to operate, maintain, overhaul and diagnose defects and trouble shooting of marine engine and OBM engine. This part includes the skill to carryout operation and maintenance works of the power generation system and transmission system of marine engine of the vessel. The candidate will be able to test, identify defects, detect leakage and trouble shooting of refrigeration system, able to check dry dock and undertake maintenance.

Professional Knowledge subject is simultaneously taught in the same fashion to apply cognitive knowledge while executing task. In addition components like Physical properties of engineering materials, Interchangeability, Method of expressing tolerance as per BIS Fits, different types of iron, properties and uses, special files, Metallurgical and metal working processes such as Heat treatment, the various coatings used to protect metals, different

bearing, working material with finished surface as aluminium, duralumin and stainless steel, topics related to non-ferrous metals, Method of lubrication are also covered under theory part.

The related projects need to be completed by the candidates in a group. In addition to above components the core skills components viz., Workshop calculation & science, Engineering drawing, employability skills are also covered. These core skills are essential skills which are necessary to perform the job in any given situation.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variantsand Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

The Marine Fitter under CTS is one of the significant trades as no similar courses are available in the vocational system to cater this area. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) impart requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job, and repair & maintenance work.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters in tabulation sheet related to the task undertaken.

2.2 PROGRESSION PATHWAYS:

- Can join industry as Marine Fitter and will progress further as Senior Marine Fitter, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join onboard Deep Sea Vessel as ERA (Engine Room Assistant), Oil Man, Greaser to acquire 6 months sea service & 6 Months workshop apprenticeship in CIFNET/FSI/CIFT under Dept. of Fisheries of GOI Marine Engineering Workshop leading to National apprenticeship certificate (NAC).

- Can also join Apprenticeship programs in different types of relevant industries leading to a National Apprenticeship certificate (NAC)
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two-years: -

S No.	Course Element	Notional Training Hours	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	840	840
2	Professional Knowledge (Trade Theory)	240	300
3	Employability Skills	120	60
	Total	**1200**	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

4	On the Job Training (OJT)/ Group Project	150	150

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification or add on short term courses.

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment (Internal)** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning

outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by **Controller of examinations, DGT** as per the guidelines. The pattern and marking structure is being notified by DGTfrom time to time. **The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examining body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Marks in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Marks in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Marine Fitter; repairs, services and overhauls engines and accessories of ships, boats etc., under guidance of Marine Engineer/other designated expert.Examines drawings and other specifications. Checks and measures parts for flaws and other accuracy of fit using gauges, micrometers etc., and removes defect by chipping, filing, scraping, grinding and does other supplementary tooling as necessary. Assembles engines and auxiliary machinery in position using hoisting equipment and other tools. Tests completed assembly and makes necessary adjustments, Dismantles partly or completely such machinery in ship as propelling machinery, steam diesel or electric auxiliaries, pumps, cargo-handling machinery anchor-handling gear, ventilating and firefighting equipment, steering gear etc., removes and replaces worn or damaged parts and reassembles them as per drawings under guidance of Marine Engineer using hand and portable tools. Installs below deck auxiliaries such as evaporators, stills, heaters, pumps, condensers and boilers and connects them to steam pipe systems. Tests and inspects installed machinery and equipment during dock and sea trials and removes defects, if any. May attend to minor electrical defects.May assist in keeping watch on engine, boiler and other machinery and assist in their operation.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Reference NCO-2015:

7233.2200 - Marine Fitter

Reference NOS:

(I) ISC/N9401,
(II) ISC/N 9402,
(III) ISC/N 9420,
(IV) ISC/N 9421,
(V) ISC/N 9422,
(VI) ISC/N 9423,
(VII) ISC/N 9424,
(VIII) ISC/N 9425,
(IX) ISC/N 9426,
(X) ISC/N 9427,

(XI) ISC/N 9428,
(XII) ISC/N 9429,
(XIII) ISC/N 9430,
(XIV) ISC/N 9431,
(XV) ISC/N 9432,
(XVI) ISC/N 9433,
(XVII) ISC/N 9434,
(XVIII) ISC/N 9435,
(XIX) ISC/N 9436,
(XX) ISC/N 9437,
(XXI) ISC/N 9438,
(XXII) ISC/N 9439,
(XXIII) ISC/N 9440,
(XXIV) ISC/N 9441,
(XXV) ISC/N 9442,
(XXVI) ISC/N 9443,
(XXVII) ISC/N 9444

4. GENERAL INFORMATION

Name of the Trade	**MARINE FITTER**
Trade Code	DGT/1095
NCO - 2015	7233.2200
NOS Covered	ISC/N9401, ISC/N 9402, ISC/N 9420, ISC/N 9421, ISC/N 9422, ISC/N 9423, ISC/N 9424, ISC/N 9425, ISC/N 9426, ISC/N 9427, ISC/N 9428, ISC/N 9429,ISC/N 9430, ISC/N 9431, ISC/N 9432, ISC/N 9433, ISC/N 9434, ISC/N 9435, ISC/N 9436, ISC/N 9437, ISC/N 9438, ISC/N 9439, ISC/N 9440, ISC/N 9441, ISC/N 9442, ISC/N 9443, ISC/N 9444
NSQF Level	Level – 4
Duration of Craftsmen Training (Instructional Hours)	Two Years (2400 hours + 300 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	88 Sq. m
Power Norms	3.51 KW
Instructors Qualification for:	
(i) Marine Fitter Trade	B.Voc/Degree in Mechanical/Electrical/Electronic Engineering, from AICTE/UGC recognized Engineering College /university with one year experience in the relevant field. **OR** 03 years Diploma in Mechanical/Electrical/Electronic Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years experience in the relevant field. **OR** NTC/NAC passed in the Trade of "Marine Fitter" With three years' experience in the relevant field.

	<u>Essential Qualification</u>: Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT. ***Note: - Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.***
(ii) Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR NTC/ NAC in any one of the engineering trades with three years' experience. **<u>Essential Qualification:</u>** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT
(iii) Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. OR NTC/ NAC in any one of the Mechanical groups (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **<u>Essential Qualification:</u>** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
(iv) Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) OR Existing Social Studies Instructors in ITIs with short term ToT Course

	in Employability Skills.
(v) Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 LEARNING OUTCOMES

FIRST YEAR:

1. Recognize and comply Safe Working Practice, and illustrate Survival Technique following safety precautions.(NOS:ISC/N9420)
2. Explain general aspects of shipping and illustrate the nautical & engineering technology as per ship model/ video/ on board. (NOS:ISC/N9421)
3. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check dimensions. accuracy. (Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping, Turning and Grinding etc.) (NOS:ISC/N9422)
4. Identify various electrical & electronic components and carryout testing, measurement to ensure functionality. (Various electrical & electronic components:-Resistor, capacitor, inductor, transformer, fuse, relays, semiconductor devices, battery, etc) (NOS:ISC/N9423)
5. Demonstrate different joining operations observing standard procedure. (Different joints: - Bolt joints, Gas welding, Arc welding, Brazing) (NOS:ISC/N9424)
6. Perform surface preparation & painting of marine structure following safety procedure. (NOS:ISC/N9425)
7. Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality. (NOS:ISC/N9426)
8. Perform appropriate modification of valves & valve seats as per requirement and reassemble to ensure proper functioning. (NOS:ISC/N9427)
9. Test fuel injector fuel pump and governor system and ensure proper functioning. (NOS:ISC/N9428)
10. Check the cooling & lubrication system and conduct necessary maintenance as per requirement. (NOS:ISC/N9429)

11. Recognize engine room duties and demonstrate engine room cleanliness. (NOS:ISC/N9430)
12. Diagnose and troubleshoot various defects of OBM engine. (NOS:ISC/N9431)
13. Perform the maintenance/ assembling of various power transmission systems with proper alignment and check functionality. (Various power transmission: - steering gear, propeller, gear box) (NOS:ISC/N9432)
14. Read and apply engineering drawing for different application in the field of work. (NOS:ISC/N9401)
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS:ISC/N9402)

SECOND YEAR:

16. Identify and maintain various auxiliary equipments as per standard procedure. (Various Auxiliary equipments:- Pumps, Valves) (NOS:ISC/N9433)
17. Carryout pipe joints using gaskets, gland packing and check for any leakage. (NOS:ISC/N9434)
18. Identify hydraulic & pneumatic components and construct various circuits to check functionality. (NOS:ISC/N9435)
19. Troubleshoot and maintain marine refrigeration and air conditioning check performance. (NOS:ISC/N9436)
20. Set various electrical sub-systems and measure its parameters. (Various sub-system:- motor, DC machine, starter motor, DC compound motor, alternator, induction motors, DOL system, dynamo) (NOS:ISC/N9437)
21. Summarize the properties of material for lagging & insulation and select the same for use. (NOS:ISC/N9438)
22. Shift machinery items using various lifting devices and maintain cargo handling & storage equipment. (NOS:ISC/N9439)
23. Identify types of storage tanks & check for any leakage. (NOS:ISC/N9440)
24. Operate, maintain and trouble shoot marine engine on board. (NOS:ISC/N9441)
25. Maintain marine & auxiliary machines as per schedule. (NOS:ISC/N9442)
26. Illustrate bunkering procedure and identify SOPEC equipment. (NOS:ISC/N9443)
27. Plan & prepare for docking and maintain vessel to ensure quality compliance. (NOS:ISC/N9444)
28. Read and apply engineering drawing for different application in the field of work. (NOS:ISC/N9401)

29. Demonstrate basic mathematical concept and principles to perform practical 28operations. Understand and explain basic science in the field of study. (NOS:ISC/N9402)

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Recognize and comply Safe Working Practice, and illustrate Survival Technique following safety precautions.(NOS:ISC/N9420)	Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	Recognize and report all unsafe situations according to site policy.
	Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	Identify, handle and store/ dispose of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	Identify and observe site policies and procedures in regard to illness or accident.
	Identify safety alarms accurately.
	Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	Identify and observe site evacuation procedures according to site policy.
	Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	Identify basic first aid and use them under different circumstances.
	Identify different fire extinguisher and use the same as per requirement.
	Avoid waste and dispose waste as per procedure.

	Illustrate survival techniques
2. Explain general aspects of shipping and illustrate the nautical & engineering technology as per ship model/ video/ on board.(NOS:ISC/N9421)	Explain role of shipping
	Identify location of all Continents & Ocean / sea route
	Illustrate the role of Nautical Department.
	Explain the working of various parts, space of the ships and its structure.
	Explain berthing, anchoring, mooring system.
3. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check dimensions. accuracy. (Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping, Turning and Grinding etc.)(NOS:ISC/N9422)	Plan & identify tools, instruments and equipments for marking and make this available for use in a timely manner.
	Select raw material and visual inspection for defects.
	Mark as per specification applying desired mathematical calculation and observing standard procedure.
	Measure all dimensions in accordance with standard specifications and tolerances.
	Identify hand tools for different fitting operations and make these available for use in a timely manner.
	Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding.
	Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job.
	Make jobs by performing basic lathe operations.
	Observe safety procedure during above operation as per standard norms and company guidelines.
	Check for dimensional accuracy as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
4. Identify various electrical & electronic components and carryout testing, measurement to ensure functionality. (*Various electrical & electronic*	Identify various electrical & electronic components for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation for measurement and testing.
	Plan work in compliance with standard safety norms and collecting desired information.

components:-Resistor, capacitor, inductor, transformer, fuse, relays, semiconductor devices, battery, etc)(NOS:ISC/N9423)	Demonstrate possible solutions and agree tasks within the team. Test components for functionality. Measure different parameters and record.
5. Demonstrate different joining operations observing standard procedure. (Different joints: - Bolt joints, Gas welding, Arc welding, Brazing)(NOS:ISC/N9424)	Plan and select appropriate tools and materials for the work and make it available timely. Set the equipments observing safety procedure. Perform joining as per requirement following standard procedure. Check the joint for conformity of standard requirement. Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
6. Perform surface preparation & painting of marine structure following safety procedure.(NOS:ISC/N9425)	Plan & select different tools & machines to carry out the work. Observe safety while performing the task. Perform surface preparation & painting as per standard guidelines. Solve problems during operation by selecting and applying basic methods, tools, materials and collect and organize information for quality output Check/gauge the surface to painting.
7. Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality. (NOS:ISC/N9426)	Plan & select appropriate tools equipment for the work and make it available timely. Dismantle the different components of multi cylinder marine engine. Check for any defects/correctness & measure dimensions of the components using appropriate instruments. Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work. Solve problems during operation by selecting and applying basic methods, tools, materials and collect and organize information for quality output

	Assemble components & check functionality of engine.
8. Perform appropriate modification of valves & valve seats as per requirement and reassemble to ensure proper functioning. (NOS:ISC/N9427)	Plan & select appropriate tools equipment for the work and make it available timely.
	Dismantle the rocker arm assembly, cylinder head, valves & other related parts as per standard procedure.
	Clean and check various parameters of valves & valve guide.
	Demonstrate possible solutions and agree tasks to be carried within team
	Recondition valve seat as per requirement
	Assemble and test the functioning of valves.
9. Test fuel injector fuel pump and governor system and ensure proper functioning. (NOS:ISC/N9428)	Plan & select appropriate tools equipment for the work and make it available timely.
	Dismantle fuel injector and remove fuel pump.
	Test to check for the proper functioning.
	Assemble and adjust idle speed of engine with mechanic & hydraulic governor.
	Check the performance as per set procedure.
10. Check the cooling & lubrication system and conduct necessary maintenance as per requirement. (NOS:ISC/N9429)	Identify various parts of cooling and lubrication system and their functions.
	Plan & select appropriate tools to carry out the work
	Remove the parts of cooling & lubrication system and perform required maintenance as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
	Observe safety/ precaution during the work.
	Test the cooling & lubrication system to check functionality
11. Recognize engine room duties and demonstrate engine room cleanliness. (NOS:ISC/N9430)	Recognize the different engine room duties.
	Identify different signs & symbols commonly found in engine room.
	Perform different operation and maintenance related work of engine room.
	Carryout engine room cleanliness for its proper up keeping.

12. Diagnose and troubleshoot various defects of OBM engine. (NOS:ISC/N9431)	Plan and collect relevant information to perform trouble shooting of OBM engine.
	Diagnose the various defects & faults of OBM
	Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work.
	Solve/ Trouble shoot problems during operation by selecting and applying basic methods, tools, materials and collect and organize information for quality output
	Check the functionality of OBM engines
13. Perform the maintenance/ assembling of various power transmission systems with proper alignment and check functionality. (Various power transmission: - steering gear, propeller, gear box)(NOS:ISC/N9432)	Plan and select appropriate method to perform the maintenance/ assembling.
	Carryout repair and maintenance of various power transmission system
	Check accuracy/ correctness of components with gauge or instruments for their usage.
	Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work.
	Assemble and fit the components with proper alignment
	Check functionality of the transmission system
14. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.(NOS:ISC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
15. Read and apply engineering drawing for different application in the field of work. NOS:ISC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information

	and make own calculations to fill in missing dimension/parameters to carry out the work.
SECOND YEAR	
16. Identify and maintain various auxiliary equipments as per standard procedure. (Various Auxiliary equipments:- Pumps, Valves) (NOS:ISC/N9433)	Plan & select appropriate tools & equipment to carryout maintenance work.
	Collect relevant information from appropriate source for proper techniques for dismantling and assembling of auxiliary equipment
	Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work.
	Solve problem during execution by selecting and applying basic methods, tools, materials and collecting information for quality output.
	Maintain the equipment observing standard and practice.
17. Carryout pipe joints using gaskets, gland packing and check for any leakage. (NOS:ISC/N9434)	Plan & identify different tools & jigs to perform pipe joints.
	Carryout pipe joints observing standard practice and as requirement
	Test for leakage
18. Identify hydraulic & pneumatic components and construct various circuits to check functionality. (NOS:ISC/N9435)	Identify various hydraulic & pneumatic components and their functions.
	Construct various circuit as per requirement
	Demonstrate possible solutions within team using desired knowledge of facts, principles, process and general concept in the field of work while preparing circuit.
	Solve problem during execution by selecting and applying basic methods, tools, materials and collecting information for quality output.
	Check the functionality of system.
19. Troubleshoot and maintain marine refrigeration and air conditioning check performance. (NOS:ISC/N9436)	Identify various refrigeration& air-conditioning system
	Select appropriate tools & raw materials to conduct maintenance work.
	Comply with safety rules when performing the work
	Troubleshoot and maintain marine refrigeration & air-conditioning system observing standard procedure.

	Check the performance of refrigeration & air-conditioning system.
20. Set various electrical sub-systems and measure its parameters. (Various sub-system:- motor, DC machine, starter motor, DC compound motor, alternator, induction motors, DOL system, dynamo)(NOS:ISC/N9437)	Plan and identify tools, instruments and equipment for the work and make it available timely.
	Set up workplace/ assembly location with due consideration to operational stipulation.
	Plan work in compliance with standard safety norms and collecting desired information.
	Demonstrate possible solutions and agree tasks within the team.
	Set electrical sub-system and measure the parameters.
	Record the parameters as per format/site instructions.
21. Summarize the properties of material for lagging & insulation and select the same for use. (NOS:ISC/N9438)	Identify and explain properties of common materials used for lagging and insulation.
	Read and analyse the specification to ascertain material requirement.
	Select the material as per requirement.
22. Shift machinery items using various lifting devices and maintain cargo handling & storage equipment. (NOS:ISC/N9439)	Plan and identify lifting devices and acquaint with functional application of each device.
	Shift the machinery to desired location.
	Observe safety procedure during shifting work
	Solve problem during execution.
	Maintain cargo handling and storage equipment as per standard procedure.
23. Identify types of storage tanks & check for any leakage. (NOS:ISC/N9440)	Identify types of storage tank
	Comply safety guidelines related with different tanks.
	Clean the tanks and check for leakage in fuel lines.
24. Operate, maintain and trouble shoot marine engine on board. (NOS:ISC/N9441)	Identify and collect relevant information for executing the operation and maintenance.
	Plan as per guidelines before starting marine engine.
	Identify defects and carryout needful maintenance work as per standard procedure.
	Solve problem during execution by selecting and applying basic methods, tools, materials and collecting information during on

	board.
	Observe safety & comply maintenance procedure during the operation and maintenance work
25. Maintain marine & auxiliary machines as per schedule. (NOS:ISC/N9442)	Collect and interpret maintenance schedule for marine & auxiliary machines.
	Prepare inspection report as per schedule/site rule.
	Maintain log book while undertaking maintenance of marine & auxiliary machines
	Observe safety which executing the task.
26. Illustrate bunkering procedure and identify SOPEC equipment. (NOS:ISC/N9443)	Collect relevant information related to bunkering and SOPEP equipment from appropriate source.
	Illustrate bunkering procedure
	Identify SOPEP equipment and explain their utilization.
27. Plan & prepare for docking and maintain vessel to ensure quality compliance. (NOS:ISC/N9444)	Plan & prepare for docking as per standard guidelines
	Prepare for stopping engine and auxiliaries machines/system.
	Carryout docking as per laid procedure.
	Identify appropriate tools and machinery for maintenance of vessel
	Check different parameters to undertake maintenance
	Prepare report as the laid procedure.
	Ensure quality as per standard defined.
	Prepare report of different work executed.
28. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.(NOS:ISC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
29. Read and apply engineering drawing for different application in the field of	Read & interpret the information on drawings and apply in executing practical work.
	Read &analyze the specification to ascertain the material

work.(NOS:ISC/N9401)	requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.

7. TRADE SYLLABUS

SYLLABUS FOR MARINE FITTER TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 63Hrs; Professional Knowledge 10Hrs	Recognize and comply Safe Working Practice, and illustrate Survival Technique following safety precautions. (NOS:ISC/N9420)	1. Importance of trade training, List of tools & Machinery used in the trade. (04 hrs) 2. Visit and studying Marine Dock yard, Ship Repairing Yards, Various Ships. (05 hrs) 3. Health & Safety: Introduction to safety equipment and their uses. Introduction of first aid, operation of Electrical mains. (05hrs) 4. Occupational Safety & Health. (04hrs) 5. Importance of housekeeping & good shop floor practices.(03hrs) 6. Health, Safety and Environment guidelines, legislations & regulations as applicable.(03hrs) 7. Disposal procedure of waste materials like cotton waste, metal chips / burrs etc. (03hrs) 8. Identification and use of Personal Protection Equipment.(03hrs) 9. Safe Working Procedures-lifting weights and lifting equipment, Tools, Instrument and Power Tool Preventive measures for electrical and fire accidents & steps to be taken in such accidents. (03hrs) 10. Practice – Safe Method – Rescue a person from live	- Importance of safety and general precautions observed in the in the industry/shop floor. - All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. - Soft Skills: its importance and Job area after completion of training. - Basic safety introduction, Personal protective Equipment(PPE): Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message - Proficiency in Survival Techniques (TC 31 of 2004) - Elementary of First Aid (TC 30 of 2004) - Fire Prevention and Fire Fighting - Personal Safety and Social Responsibility (STCW 2010 TC13 of 2012) - Security Training Seafarer with Designated Security Duties (STCW 2010 TC of 2012) - Safe Working Practice - Personal Protection

		wires.(03hrs) 11. First Aid for Electric Shock and Burn.(02hrs) 12. Use of Fire extinguishers (3hrs) 13. Demonstrate working knowledge of electrical safety.(03hrs) 14. Reading and understanding of Safety information symbols, signs and signals etc. (07hrs) 15. Practice on First Aid and Fire Prevention and Fire Fighting as per STCW 2010 TC13 of 2012. (06hrs) 16. Practice on Personal Safety and Social responsibility and Security training seafarer with designated duties as per STCW 2010 TC13 of 2012.(06hrs)	Equipment - Risk Assessment (Basic) - Permit to Work System - Work-Permits - Emergencies - Safe Access to the Ship - Safety Precautions, when working aloft, over side, enclosed spaces, manual lifting of weights, handling chemicals and strong detergents - Types and pattern of Symbol, sings and signals - Safety information symbols, signs and signals etc. (10 hrs.)
Professional Skill 42Hrs; Professional Knowledge 08Hrs	Explain general aspects of shipping and illustrate the nautical & engineering technology as per ship model/ video/ on board. (NOS:ISC/N9421)	17. Role of shipping in the national and international trade (4hrs) 18. Identify the location of continents and oceans by using World Map (without labels) or Globe.(04hrs) 19. Identify International sea routes for ships.(04hrs) 20. Identification, Use and Differentiate the type of Ships / vessels.(04hrs) 21. Understanding role of nautical Department, Engineering Department and Catering Department on board.(04hrs)	- Importance of Shipping in the National and International Trade - International Routes - Shipping / Merchant rules and Act - Introduction of Indian Shipping Agencies - Types of Ships and Cargoes - Shipboard Organization (04 hrs.)
		22. Identification, understanding the nomenclature of ships/vessels and its structure and machineries. (04hrs) 23. Understanding the working of various parts, space of the Ships and its structure.(04hrs) 24. Understanding of ship operation by identification of various machineries.(06hrs)	- Nomenclature of Ships/vessels and its Structure and Machineries - Classification of Ship structure - Hull - Ships Decks - Fore Castle - Poop Deck - Accommodation - Bridge

		25. Understanding of berthing, anchoring mooring systems and mooring operations. (04hrs) 26. Identification of various component and sub parts of Engine room machineries like main engine, shafting, Auxiliary Engines, Auxiliaries etc.(04hrs)	- Monkey Island - Machinery Space (Engine Room/Pump room) - Berthing, anchoring mooring systems and mooring operations (04 hrs.)
Professional Skill 105Hrs; Professional Knowledge 21Hrs	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy. (Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm) (NOS:ISC/N9422)	27. Identification and practice of various types of engineering hand tools.(03hrs) 28. Practice Hacksawing.(03hrs) 29. Flat filling.(05hrs) 30. Drilling and chipping.(04hrs) 31. Pipe Hack sawing, drilling and internal threading.(05hrs) 32. Identify the major components of pedestal grinding machine, hand grinder, portable grinder and changing of grinding wheel.(03hrs) 33. Identify major part of Grinding machine, Drill Machines, Power Saw, lathe.(03hrs) 34. Carryout grinding operation on a given job taking specific safety precautions related to grinding.(03hrs) 35. Counter boring and Countersinking.(06hrs) 36. Practice marking Square Holes.(03hrs) 37. Make internal threads by taps and external threads by dies .(06hrs) 38. Marking, Cutting, Shearing, Folding, Notching and Bending / Folding of Sheet Metals.(06hrs) 39. Making holes and securing sheet metal by screws.(05hrs) 40. Identification and use of screws, screw drivers and	- Basic engineering hand tools and their classification: - Measuring tools: Simple measuring tool, Precisions measuring tool, rule, Callipers, Micrometre, height and depth gauge, Vernier bevel protector, Gauges and indicator, combination set etc. - Marking tools: Marking table, surface place, angle plate, calliper, divider surface gauge, universal surface gauge, trammel, V block, punch - Cutting Tools: Chisel, File, Scraper, Hacksaw, Drill, Tap Die, Reamer, Stud extractor - Dismantling and assembling tools (Specialized Tools): Screw Driver, Plier, Spanner, Wrench, Hammer, vice, Clamp Tong Holder, Wire brush etc. - Marking Media - General Workshop Machineries: Grinding Machine, Drill Machines, Power Saw, lathe etc. - Threads and Thread cutting - Dip sticks, sounding rods, gauge glass, sight glass, sounding tapes - Smith & Forging: General description of smithy and its tools. Forge – types of forges, Smith's tools for hand forging

		pliers.(03hrs) 41. Identify and name instruments, gauges and measuring scale in the engine room like pressure gauge, thermometer, pyrometer, level gauges and units of measurements.(04hrs) 42. Demonstrate use of dip sticks, sounding rods, gauge glass, sight glass, sounding tapes in a sounding a level of liquid in a tank.(03hrs) 43. Identify and practice to use of common cutting tools and measuring instruments used in machining.(05hrs) 44. Lath work – Centring / Fixing a Job, Facing, Plan turning, Step turning, under cut, taper turning, external thread. (14hrs) 45. Sharpening of the tool in the grinding machine.(03hrs) 46. Use appropriate cutting tools and face a job and take a straight cut. (03hrs) 47. Make a square bar, cube and a rivet head in smith forging.(10hrs) 48. Make carpentry joint of a male-female joint, T Joint, L joint by sawing, planning. (05hrs)	- Basic Carpentry and its tools (21 hrs.)
Professional Skill 126Hrs; Professional Knowledge 30Hrs	Identify various electrical & electronic components measurement testing of same to ensure functionality. (NOS:ISC/N9423)	49. Identification of Prepare termination – Skinning cable ends (03hrs) 50. Make simple twist, married and tee joint with cables / wires joints (04hrs) 51. Solder copper conductor joints and lugs.(03hrs) 52. Identify and demonstrate the type of electrical instruments and its use.(04hrs) 53. Testing of electronic	Basic Electrical - Basic Electricity and its importance - Introduction of National Electrical Code 2011 - Types of Current - Electrical Units - Ohms law and Kirchhoff's Law - Types Electrical Tools and Instrument - Testing and Measuring - Types of Electrical Circuits

		component – resisters, capacitors, inductors, transformer, fuse, speakers, relays Semiconductors devices.(03hrs) 54. Determine the relationship between V.I and R in a DC circuit (04hrs) 55. Apply ohm's law and verify circuit parameters.(04hrs) 56. Analyse the effects of the short and open in parallel circuit.(04hrs) 57. Measure Power directly and indirectly.(02 hrs) 58. Measure energy in circuits.(04hrs) 59. Measure the current of a given load in an AC circuit without interrupting connection (Tong-Tester)(03hrs) 60. Measure the insulation resistance using an insulator tester (Megger)(04hrs) 61. Measure Voltage and Current using Multimeter.(03hrs) 62. Identifying, checking, finding value and testing of resistors and capacitors.(05hrs) 63. Identification of parts of a Transformer and measure its transformation ratio.(04hrs) 64. Identification of rectifier diodes.(03hrs) 65. Identifying specifications, applications and equivalents of a diode using diode data book.(04hrs) 66. Construct and test a half-wave and bridge rectifier.(05hrs) 67. Identifying terminals and testing of LEDs.(02hrs) 68. Identification and testing zenordiodes.(02hrs)	- Different types of electrical Symbols - Conductors and its classification - Insulators and its classification - Cables and Wires - Joints in Electrical Conductors - Different types switches, Circuit breakers, fuses, plugs - Electrical Wiring System and types - Transformer and its classification and working - Work, Power and Energy - Industrial Energy Meter - Various Electrical Appliances - Earthing, its importance and Types - Electric Panels Cell and Batteries - Classification and its construction, uses - Magnetism and Electromagnetism Basic Electronics - Capacitors, Inductors, - Semiconductors, types and its function / working - Diodes, types, function, uses - Transistor, types, function, uses - Amplifier – modulator and demodulator - Oscillator, Thyristors, FETs & MOSFETS, ICs - PA systems - Basic Digital Electronics and instrumentation - Basic knowledge of various navigation equipment (30 hrs.)

		69. Identification and checking transistors.(03hrs) 70. Forward biasing of transistors.(04hrs) 71. Identify electrical component – plugs sockets, bulbs, tubes cluster lights, portable lamps, switches, boards, starters, panels.(06hrs) 72. Industrial Wiring Practice.(12hrs) 73. Soldering practice and making simple circuits by using PCBs.(06hrs) 74. Identify the various parts of Lead Acid Battery.(05hrs) 75. Practice on Battery Charging by different methods. (06hrs) 76. Capacity and performance testing of batteries.(05hrs) 77. Studying and understanding of Electric Panels on Ships.(09hrs)	
Professional Skill 63Hrs; Professional Knowledge 10Hrs	Demonstrate different joining operations observing standard procedure. *[Different joints: - Bolt joints, Gas welding, Arc welding, Brazing]* (NOS:ISC/N9424)	78. Identify various types of fasteners.(03hrs) 79. Demonstrate proper methods of using fasteners and features.(03hrs) 80. Practice to repair damaged internal and external thread.(04hrs) 81. Demonstrate ways and means of releasing rusted nuts, opening rounded nuts, removing broken studs, releasing nuts seized on a stud, securing studs back on a body of valves and similar location.(05hrs) 82. Setting up oxy-acetylene plant and flame.(03hrs) 83. Straight cutting by hand (Gas)(04hrs) 84. Counter joint (gas), Corner joint on steel sheet in flat position	- Types of Joint - Types of fasteners – bolts, studs, nuts common screw, common lock nuts and washers - Types of Welding and Welding Machines - Working of MIG, TIG Manual Metal Arc Welding and Oxy-acetylene welding - Metal Cutting with gas cutter - Safety precaution and safety apparels for welder - Brazing & Soldering (10 hrs.)

		by gas.(08hrs) 85. Setting the Arc welding Plant and Striking & maintaining Arc.(10hrs) 86. Square butt joint by arc-flat position.(10hrs) 87. Brazing on ferrous and non-ferrous metal plates using gas welding.(06hrs) 88. Practice with cutting torch for cutting a plate or rusted part.(06hrs)	
Professional Skill 21 Hrs; Professional Knowledge 05Hrs	Perform surface preparation & painting of marine structure following safety procedure. (NOS:ISC/N9425)	89. Identification and use of various surface cleaning, preparation tools and machines. (02hrs) 90. Use of high pressure, hydro, sand and grit blasting machines. (06hrs) 91. Practice on Painting of various marine structure as per the prescribed methods. (06hrs) 92. Safety precaution while surface cleaning and preparation. (01hr) 93. Care and maintenance practice of surface preparation and painting equipment.(04hrs) 94. Performing gauging of ship hauling with various equipment like ultrasound etc.(02hrs)	- Various types of paints coatings and application on marine structure - Various types of Painting tools, equipment and safety apparels - Methods and procedure of painting on marine structure - Surface preparation for painting - Tools used for chipping are, chipping hammers, scarpers, wire brushes, sanding discs, chipping machines, needle, guns etc. - Use of high pressure hydro, sand, and grit blasting machines - Gauging of plate: types, methods of gauging and instruments **Marine corrosion** Prevention – surface preparation, painting, cathodic protection, impressed current system. Field visit to know about the schedules (05 hrs.)
Professional Skill 147Hrs; Professional	Perform dismantling & assembling of multi-cylinder marine engine as per makers manual and	95. Identification of parts of general Diesel Engine and Marine Diesel Engine.(04 hrs) 96. Practical Exercises on Engines running/ its	- Basic Thermodynamics - Thermodynamics Units System - Potential and Kinetic Energies, System States and

Knowledge 30Hrs	check functionality. (NOS:ISC/N9426)	demonstration.(04hrs) 97. Dismantling and Reassemble cylinder head, crank gear, timing gear and cam gear of four stroke Single cylinder and Multi cylinder Diesel Engines.(04 hrs) 98. Prepare valve timing diagram of four stroke of Single cylinder and Multi cylinder Diesel Engines.(04hrs) 99. Experiment for making TDC and BDC in single cylinder engine.(04 hrs) 100. Practicing sketch of all cycles.(04 hrs) 101. Practical demonstration of various systems of Marine engine.(04 hrs) 102. Practical checking of Inlet valve and Exhaust vale opening and closing of single cylinder and multi cylinder diesel engine.(04 hrs) 103. Visit on board Vessel – Practical demonstration of various systems of Marine engines and other equipment's inside engine room.(04 hrs) 104. Practical on dismantling and assembling of four stroke single cylinder engine.(08 hrs) 105. Practical demonstration of Starting system of single cylinder and multi cylinder Engine.(03hrs) 106. Practical on dismantling of Multi cylinder marine engine and identifying parts of the engine.(08 hrs) 107. Removing piston & connecting rod from engine and examine piston ring	Thermodynamic Properties, Thermodynamic Processes, The Conservation Concept, Phase Diagrams, The First Law of Thermodynamics, Second Law of Thermodynamics, Heat Modes of Energy Transport, Heat Transfer Modes, Vapour and Gas Power Cycles. - Introduction to Marine Engines - Terminology - Classification of Internal combustion engine - Working principles of four stoke and two stroke engines - Fundamentals of Internal Combustion Engine - Working Cycle of Operations - Four stroke diesel cycle / engine - Two stroke diesel cycle / engine - Indicator diagram - Engine indicator - Valve timing diagram - Port timing diagram - Relation between valve timing and port timing diagrams - Scavenging - Supercharging of IC engines and its methods - Advantages and disadvantages of two stroke and four stroke engines - Difference between spark ignition and compression ignition engines - Heat balance - Efficiency: Thermal, Mechanical, Mean effective pressure and Volumetric efficiency. - Understanding on the

		grooves for wear, cracks & distortions, clean oil holes.(04 hrs) 108. Measuring piston ring clearances.(02hrs) 109. Check connecting rod for bend and twist and cylinder bore for taper and ovality and gudgeon pin bushes for wear.(04hrs) 110. Check elongation of bottom end bearing bolts of connecting rods.(02hrs) 111. Checking cylinder linerbore using bore gauge to check ovality and precautions while fitting new liners.(04 hrs) 112. Gauging of crank pin, checking of crank journal for any damage, – checking crank shaft for bend & twist – checking oil retainer and thrust surfaces for wear.(05 hrs) 113. Measure crank shaft journal for wear.(04hrs) 114. Checking flywheel and mounting flange, spigot, bearing.(06 hrs) 115. Check vibration damper for defects.(03hrs) 116. Check cam shaft for bend and crack. Check crank shaft deflection.(04hrs) 117. Checking cylinder blocks surface – major cylinder bore for tapered and ovality.(06 hrs) 118. Check main bearing for taper and ovality, clean oil gallery passage and oil pipe lines.(06hrs) 119. Check main bearing cap bolt holes.(04hrs)	construction of the engine Calculation of efficiencies - Components / Parts of Marine Diesel Engine - Role and function of various component of Marine Engines - Frame System - Energy generating system - Power transmission system - Intake and Exhaust System - Valve Mechanism System - Firing order - Diagnose process and troubleshooting of marine engine and other equipment on-board vessel. **Boilers** - Classification, mountings, construction failures and repairs, Boiler water and treatment, steam system, application of steam. **Turbines** - Impulsive & reaction turbines - gas turbine - steam turbine - water turbine - working principle. (30 hrs.)

		120. Check cam shaft bearing and tappet bolts.(04hrs) 121. Descaling water passage and examine bursting disc, check cylinder head for wrapping.(06hrs) 122. Fixing of crank shaft and bearing and engine entablature and checking and adjusting of clearances end play etc. (06hrs) 123. Reassembling of multi cylinder Marine engine in correct sequence and torque as per maker's recommendations for engines.(12hrs) 124. Maintenance and troubleshooting of main engine and auxiliaries.(12hrs)	
Professional Skill 63Hrs; Professional Knowledge 10Hrs	Perform appropriate modification of valves &valve seats as per requirement and reassemble to ensure proper functioning. (NOS:ISC/N9427)	125. Demonstration on valve mechanism system of Marine Engine.(04hrs) 126. Practical on measurement of valve tappet clearance of an engine.(04hrs) 127. Practical demonstration of intake and exhaust system of Multi cylinder marine engines.(04 hrs) 128. Experiment of practices on types of starting of an engine.(04hrs) 129. Practical on dismantling of single /multi-cylinder marine engines and checking of its various clearances, defects.(04 hrs) 130. Dismantling, assembling and maintenance of Inlet and Exhaust manifold system in Marine Engine.(04 hrs) 131. Remove rocker arm assembly, cylinder head, valves and its	Valve Mechanism System - Functioning - Valve tappet clearance - Checking of valve tappet clearance 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 Power Development - Indicated Horse Power - Brake Horse Power - Frictional Horse Power

		parts.(04 hrs) 132. Cleaning and decarburizing and Checking valve seat and valve guide.(05 hrs) 133. Reconditioning valve seats and refacing valves and lapping valves on its seat.(06 hrs) 134. Testing leakage of valve seat for leakage inspection of cylinder head and manifold surfaces for lapping and cracks.(06 hrs) 135. Clean and check shaft, bushes, pork and rocker arm for wear and cracks and reassemble.(06 hrs) 136. Check valve springs, tappets push rods, tappet screws, and valve stem cap.(06 hrs) 137. Reassembling of valve parts in sequence refit cylinder head and manifold, rocker arm assy., adjusting of valve clearances, starting of engine after decarburizing.(06hrs)	- Shaft Horse Power - Effective Horse Power - Rating of engines Testing of engines - Testing of propulsive machinery - Calculation of power Selection of Engines: - Fuel and lubricant - Reliability and durability - Strokes/cooling method - Running characteristics - Maintenance - Vibration - Size - Weight - Power requirement (10 hrs.)
Professional Skill 63Hrs; Professional Knowledge 10Hrs	Test fuel injector fuel pump and governor system and ensure its proper functioning. (NOS:ISC/N9428)	138. Identification/ familiarization of fuel system of Marine engine.(04hrs) 139. Identifying/ familiarization parts of the Fuel pump &assembling.(04hrs) 140. Practical's on dismantling of fuel injectors and identifying its parts &assembling.(08hrs) 141. Testing and re-conditioning of Fuel Injector and Fuel Pump.(06hrs) 142. Familiarizations of all systems Fuel system, cooling system and its demonstration.(04hrs) 143. Removing a fuel injection pump from an engine- refits the pump to the engine reset	- Classification of Fuels and its merit and demerits - Calorific Value of Fuels - Fuel System - Main fuel oil tank - Fuel transfer / feed pump - Daily service tank - Fuel filter - water-oil separator - purifier – clarifier - - Fuel pumps - Regulation of fuel supply - Fuel injector – Fuel Consumption - IC engines fuels and rating. - IC engine air fuel mixture requirements. - Diesel injection systems.

		timing –fill adjust slow speed of the engine.(08hrs) 144. Start engine adjust idling speed and damping device in pneumatic governor and venture control unit checking performance of engine with off load adjusting timings.(06hrs) 145. Start engine-adjusting idle speed of the engine fitted with mechanical and hydraulic governors, checking-high speed operation of the engine.(06hrs) 146. Checking performance for missing cylinder by isolating defective injectors – dismantle and replace defective parts and reassemble and refit back to the engine, importance of correct setting of pressure – while assembling the unit and also fitting on to the engine.(06hrs) 147. Start & run a Single Cylinder I.C. Engine.(05hrs) 148. Start and run Multi cylinders I.C. Engines and Marine Engines.(06hrs)	Types. Jerk type pump. - Injectionpump governors. Types of nozzles. - Introduction to petrol injection. - 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 Starting System - Hand starting - electrical starting - air starting - construction and working - maintenance of starting system - safety devices on air starting system - air starting valves **Fuel & Lubricant** - Properties and tests, density, viscosity, poor point, flash point, fire point, calorific valve, octane number, cetanenumber, carbon residue, sediment content, corrosive effect, Base number, clearing property, de-mulsibility, corrosion inhibition, foam inhibition, water in oil, acidity, alkalinity. (10 hrs.)
Professional Skill 63Hrs;	Check the cooling & lubrication system and conduct	149. Identification/ familiarization of cooling system of Marine engine.(02hrs)	Cooling System - Necessity of cooling - Cooling system for IC engines

Professional Knowledge 10Hrs	necessary maintenance as per requirement. (NOS:ISC/N9429)	150. Identify, name the parts and function strainers, filters, heat exchangers – cooler and heater.(03hrs) 151. Repair and maintenance of Lub oil coolers and Heat exchangers.(04hrs) 152. Removing radiator and water pump from engine, cleaning & reverse flushing.(04hrs) 153. Radiator testing thermostat and refitting on engine – overhauling – water pump refitting – adjusting fan belt tension and connecting water pump with radiator with hoses & flushing cooling system of the engine.(04hrs) 154. Overhauling of Various types of Condenser like Shell and tube etc.(04hrs)	– Air and Water Cooling system - 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 - Layout of cooling system and function of parts like radiator – thermostat & need to maintain engine working temperature. - Effect of sea water in marine engine cooling system. Prevention of corrosion of engine parts from sea water
		155. Identify grease nipple, greasing and oiling equipment.(04hrs) 156. Practice of using various greasing and lubricating tools and equipment like windlass, winches, block, chocks, drums wheels cleats, dogs, nuts, wire ropes etc. (04hrs) 157. Testing and Changing lub oil on Compressors and Engines (04hrs) 158. Care and maintenance Lubricating equipment.(04hrs) 159. Practical on familiarization of lubrication system and its parts of marine engine.(04hrs)	Lubrication System - Importance of lubrication - Types of fluids, lubricants and grease etc. - Cylinder oil, crankcase oil crankcase oil, gear oil, hydraulic oil, general purpose grease, open grease, wire rope grease. - Methods of lubrications on various marine structure and machineries - Ship lubrication plan - Pre and Post Safety precaution - Equipment used in lubrication system. - Lubrication of marine diesel engine (07 hrs.)
		160. Identifying different types oil filters and air filters and its parts used onboard and	- Various Type of filter and its construction and use - Function of oil and other

		engines.(04hrs) 161. List precautions to be taken before opening a filter for cleaning on a stand by machine.(05hrs) 162. Checking filters during cleaning and re-assembly and precautions to be taken while working.(07hrs) 163. Bleeding of air from the fuel lines servicing primary & secondary filters removing filters elements in pressure filters, overhauling of fuel valves.(06hrs)	filters used in board - types of diesel fuel HSD & HFO - Description of oil fuel valves & their functions - Hazards involved in cleaning filters on a running machinery. - Importance of blowing cleaning air thru the filter opposite to the direction of medium flow (03 hrs.)
Professional Skill 42Hrs; Professional Knowledge 08Hrs	Recognize engine room duties and demonstrate engine room cleanliness. (NOS:ISC/N9430)	164. Practice to keep the engine room floor plates, cleaning and free of oil.(04hrs) 165. Operation and maintenance of sewage treatment plant oily water separator. (05hrs) 166. Study the working of bilge pumping system.(04hrs) 167. Knowing bilge and sludge system are segregated from each other.(04hrs)	- Bilges, disposal of engine room waste and bilge pumping system - Importance of keeping the engine room floor plates clean and free of oil - Importance of segregation of garbage and the colour coding used for garbage segregation - The importance of segregation of oil and water in the machinery space - Precaution in operation of an oil water separator (04 hrs.)
		168. Duties of rating in the Engine Room for assisting in maintenance and watch keeping. (06hrs) 169. Identification of various space of engine room space like generator platform, bottom platform, funnel trunking, tank top, pipe tunnel, emergency escapes, steering flat, workshop, ventilation and engine control room. (07hrs) 170. Identify different signs and	- Duties of a Trainee - Describe Engine Room Space - Engine Room Machinery and their purpose - Auxiliary Machinery and their function - Symbols used in the engine room - Engine room watch keeping procedures - State the person to report to while working in the engine room

		symbols commonly found in the engine room like danger, no smoking, emergency escape, electrical safety and no entry. (06hrs) 171. Practicing orders for taking over a watch, duties undertaken during watch and maintenance procedures for handover of a watch. (06hrs)	**Boat Building materials** - Steel, Fibre glass, other composite materials, wood**,** Characteristics of Boat Building timbers. - Terms in boat building - General descriptions. (04 hrs.)
Professional Skill 21Hrs; Professional Knowledge 05Hrs	Diagnose and troubleshoot various defects of OBM engine. (NOS:ISC/N9431)	172. Identifying and understanding the function of various parts of OBM Engine.(04hrs) 173. Practical on dismantling and re-assembling of OBM engine and identifying parts and its defects.(06 hrs) 174. Repairing and maintenance of OBM machines.(06 hrs) 175. Diagnosing and troubleshooting of various defects and faults of OBM.(05 hrs)	OBM / Engine - Introduction of Petrol Engine - Working Cycle of 2 stroke and 4 stroke petrol engine - Ignition system of petrol engine - Various parts of Petrol Engine and its working - Basic concept of the OBM Engine types and its application. - Outboard motors - Inboard motors - Outboard Motors Prime mover - Transmission system - Trouble shooting, - Various systems of OBM engine. (05 hrs.)
Professional Skill 21Hrs; Professional Knowledge 05Hrs	Perform the assembling of various power transmission systems with proper alignment and check functionality. (Various power transmission: - steeling gear, propeller, gear box) (NOS:ISC/N9432)	176. Repairing and maintenance of function of a steering gear & its importance for trouble free operation & checks to be made while taking a round in the steering flat.(03hrs) 177. Demonstrate the functions of bow thruster, its location and importance (Video demonstration/as available).(03hrs) 178. Opening of different steering systems, Free hand drawing and schematic diagrams of	Power transmission – Marine Gear Box - Gears and Types of Gears - Reduction/ Reverse Gears, Epicyclic gear, Differential gear, - Hydraulic gear for fixed pitch propeller - Hydraulic gear for variable pitch propeller Propeller & Shafting types - Intermediate shaft – - Shaft bearing - Stern tube

		different steering systems.(04hrs) 179. Identification of Various types of Marine Gear Box.(02hrs) 180. Removing and dismantling of Marines gearbox.(03hrs) 181. Understanding the working of Marine gearbox and its cooling & Lubrication systems.(03hrs) 182. Reassembling and fitting with proper alignment with engine of Marine Gear Box.(03hrs)	- Water lubricated stern tube - Oil lubricated stern tube - Propeller - Fixed pitch propeller - Variable pitch propeller. Steering and Steering System - Function of a steering gear & its importance - Function of bow thrusters Steering gear - Mechanical steering gear, Electric steering gear, electro hydraulic steering gear, automotive hydraulic steering system, Hydraulic rams, types of rudders – semi balanced, fully balanced unbalanced – printle clearance, jumping clearance. (05 hrs.)
ENGINEERING DRAWING: (40 Hrs.)			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work. (NOS:ISC/N9401)	**Topic** Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Rhombus, Parallelogram. • Lettering & Numbering – Single Stroke. Dimensioning • Types of arrowhead • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation – • Different symbols used in the Marine Fitter trade.	

		Concept and reading of Drawing in • Concept of axes plane and quadrant • Concept of Orthographic and Isometric projections • Method of first angle and third angle projections (definition and difference Reading of Job drawing related to Marine Fitter trade.
WORKSHOP CALCULATION & SCIENCE: (38 Hrs)		
Professional Knowledge WCS- 38 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study (NOS:ISC/N9402)	**Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non ferrous metals Physical and mechanical properties of metals Introduction of iron and cast iron **Mass, Weight, Volume and Density** Mass, volume, density, weight and specific gravity Related problems for mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** Work, power, energy, HP, IHP, BHP and efficiency **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature Problem of heat loss and heat gain with assignments Thermal conductivity and insulators Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring

		pressure **Basic Electricity** Introduction and uses of electricity, ~~molecule, atom, how electricity is produced~~, electric current AC,DC their comparison, voltage, resistance and their units **Levers and Simple machines** Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables
Project work / Industrial visit **Broad Areas:** • Assembling of simple electronic circuits • Cut Model of Single cylinder 2 Stroke & 4 Stroke engine demonstrating working principle of I.C. Engine. • Application of Pneumatic /Hydraulic models by using the material such as wood, thermocol, plastic etc.		

SYLLABUS FOR MARINE FITTER TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 63Hrs; Professional Knowledge 10Hrs	Identify and maintain various auxiliary equipment as per standard procedure. (Various Auxiliary equipment:- pumps, valves) (NOS:ISC/N9433)	183. Identification and understanding the function of various types of pumps (centrifugal, reciprocating, gear, screw pump) and pumping system (Bilges, Ballast, deck wash and fire supply, domestic fresh water, domestic sea water, expansion tanks, hot wells, compressed air system), valves, freshwater generator, oil, separators, purifiers, hydrophores, air compressors and their importance.(10hrs) 184. Repairing, Maintenance and Overhauling of various types of pumps.(10hrs) 185. Practice on operation of starting and shutting pumps.(02hrs) 186. Identify, demonstrate working of Centrifugal Separator and opening up purifiers and cleaning disk stack.(05 hrs) 187. Overhauling of Sea water pump and fresh water pump.(08hrs) 188. Studying of RO plants. (03hrs)	- General description on Auxiliary Equipment – Pumps & Pumping system, Valves, Joints and glad packing, filters, centrifugal separators, propeller & shafting - Pumps, types of pumps and pumping system on ships including ballasting / de-ballasting - Pumping system (Bilges, Ballast, deck wash and fire supply, domestic fresh water, domestic sea water, expansion tanks, hot wells, compressed air system) - Pumps under Positive displacement and their peculiarity **Pumps and systems** (i) sewage and sludge system, bilge, ballast, piping arrangements (07 hrs.)
		189. Identify common types of valves and cocks used on board: Globe, sluice or	- Types of Valves and its applications - Operating and closing of valves for operation: Globe, sluice or gate,

		gate, butterfly, spring loaded, non-return globe, float valve, taper cock and ball cocks.(06 hrs) 190. Identify major components of each type of valve and cock.(04hrs) 191. Demonstrate proper technique for dismantling and assembling a different valves and maintenance.(05hrs) 192. Demonstrate procedure for lapping a valve and seat valves.(05hrs) 193. Demonstrate to carry out maintenance of valves.(05hrs)	butterfly, spring loaded, non-return globe, float valve, taper cock and ball cocks - Function of drain valves and drain cocks for air bottles, oil fuel tanks, expansion tanks and level gauges. (03 hrs.)
Professional Skill 63Hrs; Professional Knowledge 10Hrs	Carryout pipe joints using gaskets, gland packing and check for any leakage. (NOS:ISC/N9434)	194. Identify types of joints used for pipe line and equipment having water, oil, air, steam, exhaust gases and hot water.(02hrs) 195. Identify type of packing material used for packing glands of valves or pumps for sea water, steam, and oil.(02 hrs) 196. Identify different tools and jigs for plumbing work.(03 hrs) 197. Identify different types of plumbing fittings and joints.(03 hrs) 198. Identify different types of pipes.(02hrs) 199. Bending of pipes- cold and hot.(06hrs) 200. Practice of use of different plumbing tools such as wrenches, hand saw and thread cutting.(04hrs)	- Pipes and pipe fitting- commonly used pipes. - Pipe schedule and standard sizes. - Pipe bending methods. - Use of bending fixture, pipe Threads-Std. - Pipe threads Die and Tap, pipe vices. - Methods of pipe fault identification, repairing / retrofitting and maintenance (10 hrs.)

		201. Practices for joining various plumbing components such as unions, bends and nipples using sealing tapes and compounds.(04hrs) 202. Dismantle and assemble a cock.(04hrs) 203. Demonstrate use of jubilee clip or band it clamping tool for repairing a pipe.(03hrs) 204. Use of sani-snake to clear blocked scuppers.(04hrs) 205. Demonstrate the use of M seal, araldite anabond and other devices.(03hrs) 206. Identify soft metal joins and 'O' rings and stat care to be taken on these during maintenance. (04hrs) 207. Cutting of joint / gaskets for various types flanges and demonstrate packing a gland.(08hrs) 208. Maintenance and repairing of various types to pipe lines or component in situ.(05hrs) 209. Carryout temporary repair to a leaky pipe using clamps or jubilee clips.(06hrs)	
Professional Skill 105Hrs; Professional Knowledge 30Hrs	Identify hydraulic & pneumatic compound and construct various circuit to check functionality. (NOS:ISC/N9435)	210. Identify the different types of hydraulic valves and their component parts.(04hrs) 211. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves	**General terminology Pneumatics** - Applications of pneumatics, - Hazards & safety precautions in pneumatic systems. - Pneumatic actuators: - Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. - Pneumatic valves: - Classification, Symbols of pneumatic components,

		and actuators.(06hrs) 212. Dismantle, replace, and assemble FRL unit.(06hrs) 213. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE).(01hrs) 214. Identify the parts of a pneumatic cylinder.(02hrs) 215. Dismantle and assemble a pneumatic cylinder.(04hrs) 216. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder.(06hrs) 217. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input signals.(04hrs) 218. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve.(04hrs) 219. Dismantling &Assembling of solenoid valves.(04hrs) 220. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video).(02hrs) 221. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses.(04hrs) 222. Inspect fluid levels,	3/2-way valves (NO & NC types) (manually- actuated & pneumatically-actuated) & 5/2-way valves, - Check valves, Flow control valves, One-way flow control valve - Pneumatic valves: Roller valve, Shuttle valve, Two-pressure valve - Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls **Hydraulics** - Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems - Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses Hydraulic cylinders –Types - Hydraulic motors –Types - Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-way valves - Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves - Hydraulic valves: Check valves and Pilot-operated check valves, Load holding function - Flow control valves: Types, Speed

		service reservoirs, clean/replace filters.(02hrs) 223. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings.(03hrs) 224. Identify internal parts of hydraulic cylinders, pumps/motors.(03hrs) 225. Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2-way valve (Weight loaded d/a cylinder be used as a s/a cylinder), 4/2 & 4/3 way valves.(12hrs) 226. Maintenance, trouble-shooting, and safety aspects of pneumatic and hydraulic systems (The practical for this component may demonstrated by video).(12hrs)	control methods – meter-in and meter-out - Preventive maintenance & troubleshooting of pneumatic & - hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils Deck Machineries - Trawl Winch - Wind lass - Net drum - Purse seine winch - Triplex winch - Power Block - Line hauler - Cargo winch - Gun wale roller - Side thrusters (25 hrs.)
		227. Demonstrate different uses of compressed air for auxiliary purposes. (cleaning components and portable machines).(02hrs) 228. Demonstrate risks involved in working with compressed air for auxiliary purposes. (03hrs) 229. Demonstrates use of compressed in cleaning filters and other components.(02hrs) 230. State the arrangement provided for draining the water from the air bottle.(06hrs) 231. Repair and Maintenance	- Air compressors types, its function and uses - Properties of Compressed air - Description & operation of Air compressor, turbo chargers and common troubles & maintenance. (05 hrs.)

		of Air compressor and Air bottles.(06hrs) 232. Practical on turbocharger of multi cylinder marine engine.(06 hrs)	
Professional Skill 84 Hrs; Professional Knowledge 25 Hrs	Troubleshoot and maintain marine refrigeration and air conditioning check performance. (NOS:ISC/N9436)	233. Practical on temperature measurement familiarization.(04hrs) 234. Identification of Various Refrigeration & Air-conditioning System.(04hrs) 235. Identify all components, controls and functions with specifications various RAC plants.(04hrs) 236. Identify the parts with function of a small capacity open type Reciprocating compressor.(04hrs) 237. Compressor pumping test.(02hrs) 238. Familiarization of safety procedures and Identify common basic refrigeration tools with specification and function and their care and maintenance.(04hrs) 239. Identify different types of condenser, evaporator and expansion device.(04hrs) 240. To swage and make a brazed joint on copper tubing of same size.(04hrs) 241. Check suction, discharge pressure, grill temperature and current of ACs. (04hrs) 242. Charging gas to air-conditioners / RAC plants	Heat engines and refrigeration: - History of Refrigeration - cryogenics - practical application - principle of refrigeration - ton of refrigeration (tor) - fundamentals of refrigeration & air-conditioning - thermal laws of refrigeration - refrigeration method of lowering the temperature of a liquid Refrigeration System - Methods of Refrigeration Vapour Refrigeration - Vapour Absorption system - Vapour compression system - Function of various Components of a Vapour compression system - Types of vapour compression system - Working cycle and principles - Refrigeration and Air-conditioning Tools & Equipment - Refrigeration Cycle - refrigeration equipment - description of parts - compressor - condenser - receiver - drier - expansion valve / Throttling Device - evaporator - oil separator - Refrigerant: Classification and its efficiency, Environmental Impact. - Refrigerant and Electric Controls - Lubricant and Driers - Thermal Insulation - Basic Acoustic and noise Controls - Concept of cooling load estimation in

		and check the performance.(08hrs) 243. Practical on leak testing and maintenance of RAC plants.(04hrs) 244. Practical on different trouble shootings in VCS and AHUs.(12hrs) 245. Fault Simulation of refrigeration systems using engine room simulator/trainer kit. (06hrs) 246. Starting, stopping and watch keeping procedures of Refrigeration compressor and system. (04hrs) 247. To find the COP of a simple vapour compression system.(06hrs) 248. Practical on familiarization of refrigerants.(04hrs) 249. Practice of Pump down the refrigerant.(06hrs)	refrigeration - Defrosting - coefficient of performance (COP) - Various types of tubes and pipes used in refrigeration and air-conditioning system (25 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 25 Hrs	Set various electrical sub-systems and measure its parameters. (Various sub-system:- motor, DC machine, starter motor, DC compound motor, alternator, induction motors, DOL system, dynamo) (NOS:ISC/N9437)	250. Identification of various types of Electric Motors. (04hrs) 251. Identification various parts of DC machine. (04hrs) 252. Practice on dismantling and assembling in DC machine(04hrs) 253. Identification of parts of starter Motor. (02hrs) 254. Identify parts and terminal of DC compound motors. (04hrs) 255. Measurement of Current, Voltage, Power and Power factor in single and poly	- Working principle of motors - Classification of motors – AC and DC motors - Use of motors in ships, boats etc. DC Motors - General construction of dc motors - Type of DC motors - DC motor starters - Trouble shooting in dc motors AC motors - Construction of three phase induction motors - Types of three-phase motors - Working principle of Ac motors - Single phasing in three-phase motors - Trouble shooting in three-phase motors

		phase circuits. (04hrs) 256. Measurement energy in single and poly-phase circuits. (04hrs) 257. Identification of phase sequence using phase sequence meter. (04hrs) 258. Power measurement in Star and Delta Systems. (06hrs) 259. Identification various parts of alternators. (06hrs) 260. Start run and reverse direction of rotation of three phase induction motors using starters. (06hrs) 261. Measure of slip, PF and efficiency a various loads. (06hrs) 262. Practice on connection of DOL starters. (06hrs) 263. Speed control using VFD. (06hrs) 264. Removing belt driven alternator, checking for defects and testing.(06hrs) 265. Removing starter motor from the engine and overhauling the starter motor-testing of starter motor.(06hrs) 266. General practice on rewinding and re-insulation of motor.(06hrs)	- Protections to the three-phase motors - Star delta connections - AC motor starters - Single phase AC motors - Types of single phase motors - Universal motors (ac/dc motor) - Basic difference between single and polyphase motors - Motor characteristics and applications - Trouble shooting of single-phase motors - Description of starter motor circuit-constructional detail of starter motor, solenoid switches, common troubles and remedy in starter circuit. Alternators - principal of working - types of prime mover - Description of charging circuit-operation of dynamo and regulator Unit- Ignition warning lamp-troubles & remedy in charging system. (25 hrs.)
Professional Skill 21 Hrs; Professional Knowledge	Summarize the properties of material for lagging &insulation and the same for use.	267. Identification and studying the properties of common material used for lagging and insulation.(07hrs) 268. Practice on different uses	- Lagging and Insulation - State purpose of lagging and insulation material on pipes and components in the engine room. - State importance of maintaining lagging and insulating material, and

06 Hrs	(NOS:ISC/N9438)	of lagging and insulators.(14hrs)	prevention of contact with oil. - State precaution to be taken while handling a torn lagging. Importance of lofting in boat building Construction Backbone assembly Building stock, making the mouldsRabbet 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. (06 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 25 Hrs	Shift machinery items using various lifting devices and maintain cargo handling & storage equipment. (NOS:ISC/N9439)	269. Identifying lifting devises and associated components – Slings, pulleys, eye bolts, shackles, Pulleys, Chain Blocks and Engine Room crane etc.(04hrs) 270. Identification and understanding the working of various cargo handling equipment like derricks, crane grabs, gantry, spreaders, pumps etc.(site visit)(08hrs) 271. Making different types of knots and splices such as eye splice, short splice, back splice and long splice. (08 hrs) 272. Demonstrate lifting of bales, drums, cartons, pipes, gase bottles using the correct sling and slinging procedure – snotter endless sling, net sling, drum clamps, log clamps and pallet. (04hrs) 273. Maintenance and Overhaul of Hatches. (site visit)(04hrs)	- Classification of Cargo - Cargo Handling types and terminology - Cargo Spaces (Cargo Holds, Tanks) - Cargo Handling Equipment Gear, and Containers - Derricks, Cranes, Grabs, Pumps etc. - Ropes and Rope works - Block and Tackle - 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. - Identification of blocks and tackles. - Practical on marking different tackle and to calculate safe working load. (25 hrs.)

		274. Maintenance of ventilators for holds accommodation space and engine room. (07hrs) 275. Maintenance & overhaul of tank cleaning machines and valves. (site visit)(04hrs) 276. Identification, care and maintenance of different kinds of ropes used on board.(05hrs) 277. Make a bend, hitches and knots for temporarily joining two ropes. (06hrs) 278. Make a temporary eye using a bulldog grip on a wire. (08hrs) 279. Inspection of a rope for defects and criteria for rejection and replacement. (04hrs) 280. Identification of Blocks and Tackles.(04hrs) 281. Move and Shift machinery item using lifting devices such as slings, pulley, eye bolts, shackles, pulley, chain block.(10hrs) 282. Procedure for safe hooking, hoisting and slewing lifting gears.(08hrs)	
Professional Skill 42 Hrs; Professional Knowledge 14 Hrs	Identify types of storage tanks & check for any leakage. (NOS:ISC/N9440)	283. Identify the types of storage tanks – wing tanks, double bottom tanks, tanks within the engine room such as lube oil storage, expansion tank, lube oil sump). (10hrs) 284. Demonstrate the liquids stored in tanks: Fuel, lubricating oil, and fresh	- Types of Storage tank - Safety and maintenance of Tank and its functioning - Fuel feed system in diesels **Bottom and side framing** - Double bottom - internal structure - side framing - tank side bracket - beam knees - web frames

		water.(10hrs) 285. Demonstrate the purpose & operation of a 'quick closing valve.(12hrs) 286. Cleaning fuel tanks, checking leaks in the fuel lines.(10hrs)	(14 hrs.)
Professional Skill 126 Hrs; Professional Knowledge 40 Hrs	Operate, maintain and trouble shoot marine engine on board. (NOS:ISC/N9441)	287. Practice in erecting overhauled engines on stands & foundations. (Site visit/Video demo)(08hrs) 288. Preparation of templates of foundation holes of the engine base, preparation of holding down bolts and nuts and boxes for foundation. (Site visit/Video demo)(10hrs) 289. Starting engine on foundation and observing vibrations. (12hrs) 290. Soldering & repairing pipe lines and unions brazing nipples to high pressure line studying the fuel feed system in diesel engines draining of water separators (centrifuges).(08hrs)	- Foundations for diesel engine in marine - Details of foundation bolts & nuts its dimensions. - Boxes to suit engine base – purpose of template need for aligning the engine on HD Bolts. - Checking methods for alignment. **Shell and decks** - Shell plating - bulwarks - deck plating - beams - deck girders and pillars discontinuities - hatches - hatch corners (15 hrs.)
		291. Practical demonstration of engine handling concept – operation and maintenance of Marine Engine and its other attached equipment and machineries. (04hrs) 292. Practical on preparation before starting of marine engine. (04hrs) 293. Experiment on watch keeping parameters, performance of running of an engine and marine	Engine Handling & Maintenance Operation - Preparations before starting - Watch keeping the performance while running - Operating the watch - Handing over and taking over the watch Maintenance - Precautions for stopping Maintenance - guidance for scheduled maintenance - Condition based planned maintenance - Preventive maintenance - Top overhauling

		engine. (04hrs) 294. Practical and study for taking precautions/steps for stopping of an engine /Marine engine. (04hrs) 295. Practical demonstration on types of maintenance and its concept for marine engine and its machineries, equipment inside workshop and on-board vessel. (08hrs) 296. Practical experiment of Maintenance-Top overhauling and major overhauling of single cylinder and multi-cylinder engine. (08hrs) 297. Practical on identifying defects, trouble shooting of single cylinder and multi-cylinder engine. (08hrs) 298. Practical on dismantling of Fuel Pumps for multi cylinders, servicing & assembling. Dismantling of Fuel Injectors, pressure testing and assembling. (10hrs) 299. Practical demonstration of power transmission system of a Marine diesel engine. (08hrs) 300. Practical experiment for starting of multi cylinder engine and learning /understanding of power transmission system. (06hrs) 301. Practical on fixed propeller system. (06hrs) 302. Practical on variable propeller system.(06hrs)	- Major overhauling. Trouble Shooting of Diesel Engines - Starting, Power variations, Speed variation, Abnormal smokes, - Abnormal pressure, Abnormal temperatures, Abnormal Sound. Report on onboard training - Operation, Troubleshooting, and maintenance of marine, engines, auxiliaries and other machineries & equipment **Bulk heads** - Water tight bulk head - water tight doors - non-water tight - bulkhead (25 hrs.)

		303. Practical experiment on brake load of multi-cylinder engine and its calculation of various parameters in heat engine lab. (08hrs)	
Professional Skill 42 Hrs; Professional Knowledge 14 Hrs	Maintain marine & auxiliary machines as per schedule. (NOS:ISC/N9442)	304. Maintenance schedule to check – daily, weekly, monthly for different types of Engines, Auxiliary Machines and Ships. (10hrs) 305. Writing Marine Engines, Auxiliary Machines and Ships procedure of inspection schedules. (06hrs) 306. Maintenance log book of Engines, Auxiliary Machines and Ships. (06hrs) 307. Details of maintenance work of Engines, Auxiliary Machines and Ships. (20hrs)	- Need of maintenance, - Check up in Marine engines – preparation of maintenance schedule from charts of popular makes of engine - Preventive Maintenance of Marine Engines, Auxiliary Machines and Ships **Remote controls** - Need for remote control - mechanical remote controls - pneumatic control systems. **Free hand sketches** - Caulking and stopping - Wheel house and other superstructures, rigging Sheathing) Underwater fittings Painting and varnishes (14 hrs.)
Professional Skill 42 Hrs; Professional Knowledge 14 Hrs	Illustrate bunkering procedure and identify SOPEC equipment. (NOS:ISC/N9443)	308. Practice on systems – Lubrication, valve mechanism, intake & exhaust etc.(8hrs) 309. Practice on of LSA, FFA, fire-fighting equipment.(06hrs) 310. Power transmission system Operation and maintenance of power generation and distribution system, Bunkering procedures.(10hrs)	- Describe Ballasting and deballasting system and Bunkering procedure - Lubrication, valve mechanism, intake & exhaust etc. - Practice on of LSA, FFA, fire fighting equipment - Power transmission system Operation and maintenance of power generation and distribution system, Bunkering procedures. Opening of different steering systems. **Parts of ship** - Principal dimensions, Port, star board, beam, bow Quarter free board, draft Bulwark etc. - On board practical. - Identification of parts on board the different vessels. - Rope works, Types of ropes, care and

			maintenance of synthetic and wire ropes. (07 hrs.)
		311. Connect bunker hose to manifold using a reducer. Close drain plug of drip try.(08hrs) 312. Identifies SOPEP equipment (Site visit/Video demo).(06hrs) 313. Demonstrate theuse of scupper plugs/doors.(04hrs)	- Marine pollution – Its types and control. - Effect of marine pollution on marine life. - Deep sea lead line and hand lead line. On board Fabricate a handle lead line on a given rope and make proper makings. **Chart, Latitudes, longitudes, Fixing position on** the chart, setting course and finding the distance. (07 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 25 Hrs	Plan & prepare for docking and maintain vessel to ensure quality compliance. (NOS:ISC/N9444)	314. Preparation for sailing use and maintenance of LSA & FFA. (10hrs) 315. Stopping and Watch keeping of Engine and Auxiliaries.(06hrs) 316. Presentation on Marine Engines, Dry Docking, Repair, Maintenance of vessel in Shipyard.(06hrs) 317. Demonstrate Docking (Dry / Float / Slipway). (16hrs)	- Basic knowledge of planning and preparation of vessels for for sailing - Use and maintenance of LSA a,d FFA - Basic concept of the docking / slipways and floating dock - Need for docking - Docking methods and Procedure - Preparation before docking and undocking - Procreation of defect / retrofit list of the vessels - Safety procedure for entering and working in confined spaces / welding / cleaning etc. (13 hrs.)
		318. Checking of thickness of Ship plates (Gauging) with various methods like ultrasound etc.(14hrs) 319. Smoke Testing of Marine Engine.(12hrs) 320. Preparation of MMD and IRS survey reports.(20hrs)	- Ship hauling / plate gauging types and techniques - Destructive and Non-Destructive test - Receiving or screening Inspections. - In-Process Inspections - Final Inspections. - Role of MMD and IRS surveyor - MMD and IRS survey reports (12 hrs.)
ENGINEERING DRAWING: (40 Hrs.)			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the	**Friction** Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction Friction - Lubrication	

	field of work. (NOS:ISC/N9401)	Friction - Co- efficient of friction, application and effects of friction in workshop practice **Centre of Gravity** Centre of gravity - Centre of gravity and its practical application **Elasticity** Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress **Heat Treatment** Heat treatment and advantages Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalizing and case hardening **Estimation and Costing** Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing
WORKSHOP CALCULATION & SCIENCE: (22 Hrs)		
Professional Knowledge WCS- 22 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study (NOS:ISC/N9402)	**Topic** Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Double nut, Castle nut, Pin, etc. Reading of Rivets and rivetted joints, welded joints Reading of drawing of pipes and pipe joints Reading of Job Drawing & Assembly view

- Field visit in local industry/shipyard/onboard vessel for practical learning/ (For understanding report, operation, trouble shooting maintenance of marine engines, auxiliaries and other machineries & equipment)
- Field visit and on board training in dry dock

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs. + 60 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in / dgt.gov.in

ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
MARINE FITTER (For batch of 20 candidates)			
Sl. No	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Motor Vessel of a length not less than 25 m and BHP not less than 500		1 No. for VNC and MFC
2.	Air compressor		1 No.
3.	Air starter motor		1 No.
4.	Anvil		1 No.
5.	Arc welding set with accessories		3 sets
6.	Bench grinder		2 Nos.
7.	Bench vice	150 mm.	21 Nos.
8.	Centre lathe machine		2 Nos.
9.	Cylinder head marine diesel engine		2 Nos.
10.	Diesel driven pump		1 No.
11.	Diesel engine working model with gearbox and fixed pitch propeller		1 set
12.	Electric blower	440 Volts 3 phase	1 No.
13.	Electric motor	1 HP 220 volt	1 No.
14.	Fuel injector pump		1 No.
15.	Fuel injector test bed		1 No.
16.	Fuel pump individual		2 Nos.
17.	Fuel pump multiple		2 Nos.
18.	Gear type pump		1 No.
19.	Generator for coupling to marine diesel engine		1 No.
20.	Hand operated hydraulic pipe bending m/c		1 No.
21.	Heat exchanger		1 No.

22.	Hydraulic control valve		1 No.
23.	Hydraulic line relief value		1 No.
24.	Hydraulic low pressure pump		1 No.
25.	Hydraulic motor with pinion		1 No.
26.	Hydraulic pump - High pressure		1 No.
27.	In line - diesel engine - multi-cylinder		1 No.
28.	Cut model single cylinder engine		1 No.
29.	Line hauler electrically operated		1 No.
30.	Out board engine		1 No.
31.	Petrol engine		1 No.
32.	Pillar drilling machine		1 No.
33.	Pipe vice		1 No.
34.	Plummer block bearing		1 No.
35.	Portable drilling machine		1 No.
36.	Power Hacksaw machine		1 No.
37.	PTO clutch assembly		1 No.
38.	Shearing machine (Hand operated)		1 No.
39.	Single cylinder water cooled diesel engine, hand starting type	5 hp	2 Nos.
40.	Smith's forge		1 No.
41.	Swage block		1 No.
42.	Vacuum pump - double stage, rotary		1 No.
43.	3 way valve		1 No.
44.	Acetylene Regulators for Gas welding		1 No.

45.	Electric hand drilling machine	230V - ½"capacity	1 No.
46.	Expansion valve		1 No.
Battery testing equipments			
47.	Hydrometer		3Nos.
48.	Cell Tester	2V	2Nos.
49.	Battery Tester	12V	1 No.
50.	Battery charger		1 No.
Other Electrical test equipments			
51.	Megger		2Nos.
52.	Tong Tester		1 No.
53.	Armature Growler		1 No.
54.	Test Lamp		1 No.
55.	Starter motor test bench		1 No.
56.	Alternator synchronization		1 No.
57.	Working work bench		4Nos.
58.	Motor test/Assembly bench		4Nos.
Electronic Equipments& Tools			
59.	Global Positioning System		2Nos.
60.	Colour Video Echo Sounder		2Nos.
61.	HF Radio Transceiver		1 No.
62.	VHF Radio Transceiver		1 No.
63.	Megger		1 No.
64.	Digital Multimeter		2Nos.
65.	Analogue Multimeter		2Nos.
66.	Temperature Controlled Soldering Station		1 No.
67.	De-soldering station		1 No.
68.	Frequency counter		1 No.
69.	40V/20A variable voltage Battery charger		1 No.
70.	Soldering iron		6Nos.
71.	Bread board		6Nos.
72.	Panel meter		6Nos.
73.	Automatic identification system		1 No.
LIST OF TOOLS			

74.	3 Leg bearing puller		1 No.
75.	BSW Tap set		8 set
76.	Adjustable pipe wrench		3 Nos.
77.	Adjustable plier		1 No.
78.	Adjustable reamer		3 Nos.
79.	Hand reamer		3 Nos.
80.	Allen key set		1 set
81.	Allen screw wrench		1 set
82.	Ball peen hammer	1 lb	6 Nos.
83.	Ball peen hammer	2 lb	21 Nos.
84.	Bearing scraper Flat		3 Nos.
85.	Bearing scraper half round		3 Nos.
86.	Bearing scraper triangular		3 Nos.
87.	Bevel protractor		1 No.
88.	Blow lamp		1 No.
89.	Blow pipe		1 No.
90.	Blue goggles for gas cutting work		10 Nos.
91.	Box spanner set		3 sets
92.	BSF Taps with tap wrench		4 sets
93.	BSP die set (pipe)		4 sets
94.	BSW die (pipe)		3 Nos.
95.	BSP pipe die with stock		3 Nos.
96.	C clamp		1 No.
97.	Cable joining clamp		1 No.
98.	Calipers assorted sizes (inside/outside)		3 set
99.	Carpenter's clamp		1 No.
100.	Carpenter’s vice		1 No.
101.	Carpentry chisel different sizes		6 set
102.	Centre punch		6 Nos.
103.	Chain pulley block		1 No.
104.	Chain wrench		1 No.
105.	Check valve		1 No.
106.	Chisel set (Flat, Half round, Cross cut, Diamond)		3 sets
107.	Nose plier		1 No.
108.	Circlip plier inside		2 Nos.
109.	Circlip plier outside		2 Nos.
110.	Claw hammer	1/2kg	1 No.

111.	Cold chisel		2 Nos.
112.	Combination drill bit		1 No.
113.	Combination set		1 No.
114.	Combination spanner		1 No.
115.	Compass		1 No.
116.	Counter boring cutter		2 Nos.
117.	Counter sunk Cutter		2 Nos.
118.	Cross peen hammer		3
119.	Straight peen hammer		3
120.	Cutter gun for gas cutting		1 No.
121.	Cutting plier		2 Nos.
122.	Cuttogen, blow pipe with nozzles for gas welding and cutting		6 Nos.
123.	Depth gauge		3 Nos.
124.	Depth micrometer		1 No.
125.	Dial gauge with magnetic stand		1 No.
126.	Dial gauge stand – Inside		1 No.
127.	Dial test Indicator		1 No.
128.	Double end spanner		1 set
129.	Draw bolt		1 No.
130.	Parallel shank drill bit different sizes		3 set
131.	Taper shank drill bit different sizes		3 set
132.	Electrode holder		6 Nos.
133.	Electronic leak tester		1 No.
134.	Emery grinding wheel dresser		1 No.
135.	Engineer's Tri-square		6 Nos.
136.	Feeler gauge mm size		2 Nos.
137.	Fibre glass helmet		21 Nos.
138.	Flaring tool		1 set
139.	Flat chisel		21 Nos.
140.	Flat file rough & smooth different sizes		21 set
141.	Folding scale		1 No.
142.	Foot rule		3 Nos.
143.	Fuel injector nozzle cleaning bit		1 box
144.	Gas cutting torch cuttogen		6 Nos.
145.	Gas welding blow pipe low pressure different sizes		1 set
146.	Gas welding blow pipe with high		1 set

	pressure different sizes		
147.	Gas welding nozzles different sizes		4 set
148.	Grease gun		1 No.
149.	Green goggles		3 Nos.
150.	Green goggles for gas welding		3 Nos.
151.	Hacksaw frame	12"	21 Nos.
152.	Half round file rough & smooth different sizes		21 set
153.	Round file rough & smooth different sizes		21 set
154.	Triangular file rough & smooth different sizes		21 set
155.	Hand file rough & smooth different sizes		2 each
156.	Hand vice		2 Nos.
157.	Heavy duty screw driver (carpenters)		2 Nos.
158.	Hole punch different size		1 set
159.	Hydraulic jack		1 No.
160.	Needle file set rough & smooth		1 set
161.	Injector cup wrench, injector test equipment		1 each
162.	Inside caliper spring bow		1 No.
163.	Inside micrometer		1 No.
164.	Knife edge file	8" rough & smooth	6 Nos.
165.	Leather hand gloves		6 pairs
166.	Letter punch		1 set
167.	Magnetic stand		1 box
168.	Magnifying glass with handle		1 No.
169.	Measuring tape	3 mtrs. mm size	2 Nos.
170.	Metal cutting snips		1 No.
171.	Micrometer	0-25mm (outside)	1 No.
172.	Micrometer	25-50mm	1 No.
173.	Morse taper sleeve	0-1, 1-2, 2-3, 3-4	1 each
174.	Drill chuck with key		1 No.
175.	Nose plier		1 No.
176.	Number punche		1 set
177.	Odd leg caliper (Spring bow)		2 Nos.
178.	Offset screw driver		1 No.

179.	Oil can		1 No.
180.	Oil gun		1 No.
181.	Oil measuring can	100/200 ml	1 No.
182.	Oil stone		2 Nos.
183.	Orifice plates (assorted sizes)		2 Nos.
184.	Outside caliper(Spring bow)		2 Nos.
185.	Oxygen regulators-gas welding		6 Nos.
186.	Parallel shank end mill cutter		1 No.
187.	Screw driver bit different sizes		1 set
188.	Pin vice		1 No.
189.	Pipe die, pipe cutter & pulley black		2 each
190.	Pipe spanner		1 set
191.	Pipe vice		1 No.
192.	Pipe wrench		1 No.
193.	Pitch gauge		1 No.
194.	Plain goggles for welding		6 Nos.
195.	Radius gauge		1 No.
196.	Ratchet screw driver with bit		1 No.
197.	Ratchet square handle		1 No.
198.	Reamer	½"	3 Nos.
199.	Ring spanner different sizes		3 sets
200.	Screw driver with plastic handle		3 sets
201.	Screw spanner		2 Nos.
202.	Scriber		3 Nos.
203.	Scribing block		3 Nos.
204.	Single end spanner		1 set
205.	Sledge hammer		3 Nos.
206.	Slip joint pliers		1 No.
207.	Soft hammer small size		3 Nos.
208.	Soldering iron (for smithy)		6 Nos.
209.	Spirit level with wooden case		1 No.
210.	Steel tape		1 No.
211.	Straight edge	1 mtr.	1 No.
212.	Stud Remover (assorted sizes)		1 set
213.	Surface gauge		1 No.
214.	Surface plate	l' x l'	1 No.
215.	Swage punch	1/8" x -3/4"	1 set
216.	Swage top and bottom		2 Nos.

217.	Swaging tool	¼ x 5/8	1 No.
218.	Telescopic gauge different size		1 set
219.	Tongs flat		3 Nos.
220.	Tongs round		3 Nos.
221.	Tool bit holder		2 Nos.
222.	Tool box-set Refrigeration plant		1 No.
223.	Torque wrench		1 No.
224.	Torque wrench (ratchet type)		1 No.
225.	Trammel		1 No.
226.	Try square		21Nos.
227.	Tube cutter (Cu)		1 No.
228.	Tube spanners		1 set
229.	Universal scribing block (surface gauge)		1 No.
230.	V block with clamp		2 set
231.	Valve seat cutter (In a box)		1 set
232.	Valve seat grinding machine		1 No.
233.	V- block		2 Nos.
234.	Vernier caliper different sizes		3 Nos.
235.	Vernier height gauge		1 No.
236.	Vice grip plier		1 No.
237.	Welding accessories, cable, cable log, earth clamps, chipping hammer, wire brush welding hatch, and leather gloves		1 set
238.	Welding screen		6 Nos.
239.	Wire gauge (SWG)		1 No.
240.	Wooden mallet		6 Nos.
241.	Led wire	0.5 - 1.5 mm	As required
242.	Ear muffs / Ear plugs		6 sets
243.	Masonry drill bits		2 sets
244.	Bearing pulley extractor (assorted sizes)		1 set
245.	Safety Lamp		24 Nos.
246.	Mallet Hammer		10 Nos.
247.	Copper Hammer		10 Nos.
Workshop Furniture			
248.	Work bench	250 x 120 x 75 with four vices of 12.5cm	5Nos.

249.	Locker	8 drawers (standard size)	2Nos.
250.	Metal rack	180 x 150 x 45 cm	2Nos.
251.	Steel almirah/cupboard		1No.
252.	Black board and eraser		1No.
253.	Instructor desk or table		1No.
254.	Chair		1No.

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


कौशलं बलम्