



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

COMPETENCY BASED CURRICULUM

MARINE ENGINE FITTER

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4



SECTOR – PRODUCTION & MANUFACTURING

MARINE ENGINE FITTER

Engineering Trade

(Revised in 2018)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

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Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

EN-81, Sector-V, Salt Lake City,

Kolkata – 700 091

ACKNOWLEDGEMENT

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

| List of Expert members contributed/ participated for finalizing the course curriculum of Marine Engine Fitter trade | | | |
|--|---|---|------------------------|
| S No. | Name & Designation Shri/Mr./Ms | Organization | Remarks |
| Industry Experts | | | |
| 1 | Madam S.K.P. Sodhi, Secretary | Labour Department, Port Blair, Andaman & Nicobar Administration | Chairman |
| 2 | Md. Mansoor, Principal | Govt. ITI, Dollygaunge, Port Blair | Member |
| 3 | Abhinoy Nandi, Dy. Director of Trg. | CSTARI, Kolkata | Member |
| 4 | P.P.Paul, Course In charge, Post Diploma Marine Engineering | Dr. B.R.Ambedkar Govt. Polytechnic, Port Blair | Member |
| 5 | T.S.Subraman, General Manager | Mak Logistics (P) Ltd., Port Blair | Member |
| 6 | C.S.Ashok, Managing Director | Inland Marine Works, Port Blair | Member |
| 7 | A.J.Paul, Instructor, Deck Cadet Course | Dr. B.R.Ambedkar Govt. Polytechnic, Port Blair | Member |
| 8 | C. Sanmughan, Master Mac Logistic | Mak Logistics (P) Ltd., Port Blair | Member |
| 9 | Commandant A.N.Jha, AHM | P M B | Member |
| 10 | Shajan Thomas, Course Co ordinator, Maritime Course | Dr. B.R.Ambedkar Govt. Polytechnic, Port Blair | Member |
| 11 | L. Senthil, Vocational Instructor | Govt. ITI, Dollygaunge, Port Blair | Member |
| 12 | CH. Venkateswar Rao, Vocational Instructor | Govt. ITI, Dollygaunge, Port Blair | Member |
| 13 | Jagga Rao (C/E), Faculty PDME | Dr. B.R.Ambedkar Govt. Polytechnic, Port Blair | Member |
| 14 | T. Narendranath, Vocational Instructor | Govt. ITI, Dollygaunge, Port Blair | Member |
| 15 | Shakeel Akhtar, Vocational Instructor | Govt. ITI, Dollygaunge, Port Blair | Member |
| 16 | N. Nath, Assistant Director of Training | CSTARI, Kolkata-91 | Coordinator cum member |



| List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern | | | |
|--|--|--|----------|
| 1. | R.N. Bandyopadhyaya, Director | CSTARI, Kolkata-91 | Chairman |
| 2. | K. L. Kuli, Joint Director of Training | CSTARI, Kolkata-91 | Member |
| 3. | K. Srinivasa Rao, Joint Director of Training | CSTARI, Kolkata-91 | Member |
| 4. | L.K. Mukherjee, Deputy Director of Training | CSTARI, Kolkata-91 | Member |
| 5. | Ashoke Rarhi, Deputy Director of Training | ATI-EPI, Dehradun | Member |
| 6. | S. Srinivasu, Assistant Director of Training | ATI-EPI, Hyderabad-13 | Member |
| 7. | Sharanappa, Assistant Director of Training | ATI-EPI, Hyderabad-13 | Member |
| 8. | Ramakrishne Gowda, Assistant Director of Training | FTI, Bangalore | Member |
| 9. | Goutam Das Modak, Assistant Director of Trg./Principal | RVTI, Kolkata-91 | Member |
| 10. | Venketesh. Ch. , Principal | Govt. ITI, Dollygunj, Andaman & Nicobar Island | Member |
| 11. | A.K. Ghate, Training Officer | ATI, Mumbai | Member |
| 12. | V.B. Zumbre, Training Officer | ATI, Mumbai | Member |
| 13. | P.M. Radhakrishna pillai, Training Officer | CTI, Chennai-32 | Member |
| 14. | A.Jayaraman, Training officer | CTI Chennai-32, | Member |
| 15. | S. Bandyopadhyay, Training Officer | ATI, Kanpur | Member |
| 16. | Suriya Kumari . K , Training Officer | RVTI, Kolkata-91 | Member |
| 17. | R.K. Bhattacharyya, Training Officer | RVTI, Trivandrum | Member |
| 18. | Vijay Kumar, Training Officer | ATI, Ludhiana | Member |
| 19. | Anil Kumar, Training Officer | ATI, Ludhiana | Member |
| 20. | Sunil M.K. Training Officer | ATI, Kolkata | Member |
| 21. | Devender, Training Officer | ATI, Kolkata | Member |
| 22. | R. N. Manna, Training Officer | CSTARI, Kolkata-91 | Member |
| 23. | Mrs. S. Das, Training Officer | CSTARI, Kolkata-91 | Member |
| 24. | Jyoti Balwani, Training Officer | RVTI, Kolkata-91 | Member |



Industrial Training Institute

Marine Engine Fitter

| | | | |
|-----|---------------------------------------|---|--------|
| 25. | Pragna H. Ravat, Training Officer | RVTI, Kolkata-91 | Member |
| 26. | Sarbojit Neogi, Vocational Instructor | RVTI, Kolkata-91 | Member |
| 27. | Nilotpal Saha, Vocational Instructor | I.T.I., Berhampore, Murshidabad, (W.B.) | Member |
| 28. | Vijay Kumar, Data Entry Operator | RVTI, Kolkata-91 | Member |



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1. COURSE INFORMATION

During the one years duration a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The broad components covered under Professional Skill & Professional Knowledge subjects are as below:

1st Semester - In this semester, the trainee learns about safety and environment, use of fire extinguishers, comply safe working practice and housekeeping and begin with the basic fitting skills sawing, filing, marking, chipping, drilling are imparted. Procedure to overhaul, run single / multi-cylinder I.C. engines and marine engines. Dismantle engine parts, reassemble and check the functions of valves & valve seats, oil pump, radiator and cooling system.

2nd Semester - In this semester trainee will be able to operate, maintain, overhaul and diagnose defects and trouble shooting of marine engine. Erection & installation of engines, starting and checking performance of engine. Overhaul air compressor, fuel feed & fuel injection ,lubrication system. Maintenance of battery, overhaul of distributor, starter motor, ignition systems and including simple electrical & electronic circuits.

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2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of Labour market. The vocational training programmes are running under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes under NCVT for propagating vocational training.

Marine Engine Fitter trade under CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of one year (02 semester) duration. It mainly consists of Domain area and Core area. In the Domain area, Trade Theory & Practical impart professional skills and knowledge, while Core area imparts Workshop Calculation and science, Engineering Drawing and 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 NCVT which is recognized worldwide.

Candidates need broadly to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform task 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 maintenance work.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).

2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of one year (02 semesters):

| S No. | Course Element | Notional Training Hours |
|-------|---------------------------------------|-------------------------|
| 1 | Professional Skill (Trade Practical) | 1200 |
| 2 | Professional Knowledge (Trade Theory) | 288 |
| 3 | Workshop Calculation & Science | 86 |
| 4 | Engineering Drawing | 129 |
| 5 | Employability Skills | 110 |
| 6 | Library & Extracurricular activities | 62 |
| 7 | Project work | 205 |
| 8 | Revision & Examination | |
| | Total | 2080 |

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by the Govt. of India from time to time. The employability skills will be tested in first two semesters only.

a) The **Internal Assessment** 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 template (Annexure – II).

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 NCVT at the end of each semester as per the guideline of Govt. of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for Practical is 60% & minimum pass percentage for Theory subjects is 40%. For the purposes of determining the overall result, 50% weightage is applied to the result of each semester examination.

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 assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

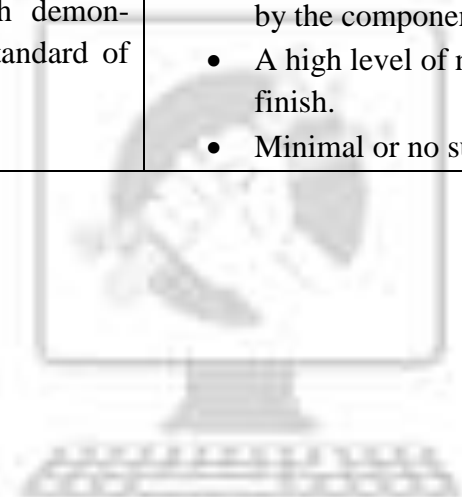
Assessment will be evidence based, comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

| Performance Level | Evidence |
|---|---|
| (a) Weightage 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. | <ul style="list-style-type: none"> • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • Below 70% tolerance dimension 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) Weightage 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. | <ul style="list-style-type: none"> • Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job. |

| | |
|---|---|
| | <ul style="list-style-type: none"> • A good level of neatness and consistency in the finish. • Little support in completing the project/job. |
| (c) Weightage in the range of above 90% to be allotted during assessment | |
| <p>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.</p> | <ul style="list-style-type: none"> • High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% tolerance dimension 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. |



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Brief description of Job roles:

Mechanic, Petrol Engine; Petrol Engine Fitter, locates defects, repairs, and overhauls stationary petrol engines for correct performance to drive pumps, generators, propulsion shafts, etc., checks engine to locate defects. Dismantles or partly dismantles it according to nature of defects and measures essential parts such as cylinder bore, crank pins, pistons etc., using cylinder gauge, micrometre and other appropriate tools. Gets cylinders rebored, valve seats refaced and liners filled if necessary. Fits and taps pistons in cylinders, decarbonises cylinder head and grinds valves using appropriate abrasives. Replaces or repairs worn out or damaged parts and assembles them, doing supplementary tolling as necessary to ensure accuracy of fit. Installs assembled or repaired engine in position, sets timings, fits accessories, adjusts tappets, carburettor, fan belt etc. and connects it to propulsion drive. Starts engine, tunes it precisely and runs it at prescribed or set standard making necessary adjustments. Observes different readings such as temperature, fuel level, oil pressure etc. for optimum performance. Checks, adjusts and lubricates equipment periodically and performs other operations to keep engine in good working order. May rebore engine, reface valve seats, anneal pipes, braze or solder parts etc.

Assembler, Stationary Diesel Engine assembles stationary diesel engine from finished components, makes adjustments, sets alignments, clearances etc. and ensures stipulated performance. Places diesel engine block on jig or other fixture using hoisting equipment. Fits or assembles various parts to engine block such as crank shaft, cam shaft, main bearing, connecting rods, timing gears pistons, fuel pump, atomiser, automatic timing mechanism, exhaust manifold suspension, etc. using spanners, wrenches, screw drivers and other special tools and devices. Collects various parts like nuts, bolts, washers etc. from nearby bins and fits or screws them to cylinder head. Checks assembled units or parts at every stage for prescribed accuracy, alignment, tolerance etc. using special tools. Records part number fitted or assembled to engine block and notes factual details or position regarding clearances, adjustments etc. made. Assembles other sub-assemblies like starter, alternator timing chain, heater assembly switch, radiator etc. Places assembled engine at central places for engine test. May conduct engine test on dynamo meter and note actual tuning conditions and make necessary adjustments. May overhaul and repair engines or other components.

Plan and organize assigned work and detect & resolve issues during execution in his own work area within defined limit. 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:

- a) 7233.0300
- b) 8211.0600

4. GENERAL INFORMATION

| | |
|--|---|
| Name of the Trade | MARINE ENGINE FITTER |
| NCO - 2015 | 7233.0300, 8211.0600 |
| NSQF Level | Level – 4 |
| Duration of Craftsmen Training | One year (Two semesters each of six months duration). |
| Entry Qualification | Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent. |
| Unit Strength (No. Of Student) | 16 (Max. supernumeraries seats: 5) |
| Space Norms | 5.25 sq. mt. per trainee. |
| Power Norms | 3 KW |
| Instructors Qualification for | |
| 1. Marine Engine Fitter Trade | <p>Degree in Marine / Mechanical Engineering from Recognized Engg. College/university with one year experience in the relevant field OR Diploma in Marine / Mechanical Engineering From recognized board of technical education with two years experience in the relevant field</p> <p style="text-align: center;">OR</p> <p>10th/Madhyamik pass + NTC/NAC in the Trade of "Marine Engine Fitter" with 3 years post qualification experience in the relevant field</p> <p>Desirable: - Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Marine Engine Fitter trade.</p> <p><i>Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</i></p> |
| 2. Workshop Calculation & Science | <p>Degree in Engineering with one year experience.</p> <p style="text-align: center;">OR</p> <p>Diploma in Engineering with two years experience.</p> <p>Desirable: Craft Instructor Certificate in RoD & A course under NCVT.</p> |

| 3.Engineering Drawing | Degree in Engineering with one year experience. OR Diploma in Engineering with two years experience. OR NTC / NAC in the Draughtsman (Mechanical) with three years experience. Desirable: Craft Instructor Certificate in RoD & A course under NCVT. | | | | | |
|--|---|--------------|---------------------|---------------|----------------------|---------------------------|
| 4.Employability Skill | MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes. AND Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above. OR Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes | | | | | |
| List of Tools and Equipment | As per Annexure – I | | | | | |
| Distribution of training on Hourly basis: (Indicative only) | | | | | | |
| Total hours /week | Trade practical | Trade theory | Work shop Cal. &Sc. | Engg. Drawing | Employability skills | Extra-curricular activity |
| 40 Hours | 25 Hours | 6 Hours | 2 Hours | 3 Hours | 2 Hours | 2 Hours |

5. NSQF LEVEL COMPLIANCE

NSQF level for Marine Engine Fitter trade under CTS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a. Process
- b. professional knowledge
- c. professional skill
- d. Core skill and
- e. Responsibility

The Broad Learning outcome of Marine Engine Fitter trade under CTS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

| LEVEL | Process required | Professional knowledge | Professional skill | Core skill | Responsibility |
|---------|---|--|--|---|---|
| Level 4 | work in familiar, predictable, routine, situation of clear choice | factual knowledge of field of knowledge or study | recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts | language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment | Responsibility for own work and learning. |

6. LEARNING/ ASSESSMENT OUTCOME

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

6.1. GENERIC LEARNING OUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. [*Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, elasticity*].
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. [*Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, Different Projections, Assembly drawing, Sectional views, Estimation of material*]
4. Select and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and execute the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Semester – I

9. 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, hack sawing, chipping, filing, drilling, Tapping]
10. Demonstrate different joining operations observing standard procedure. [Different joints – bolt joints, riveting, gas welding arc welding, brazing, lock nut, cotter split pin etc.]
11. Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality.

12. Overhaul Oil pump, Filters, Radiator, Cooling system and check functionality.

Semester – II

13. Overhaul air compressor, turbo charger and perform Gas charging & leak Testing of engine refrigeration.

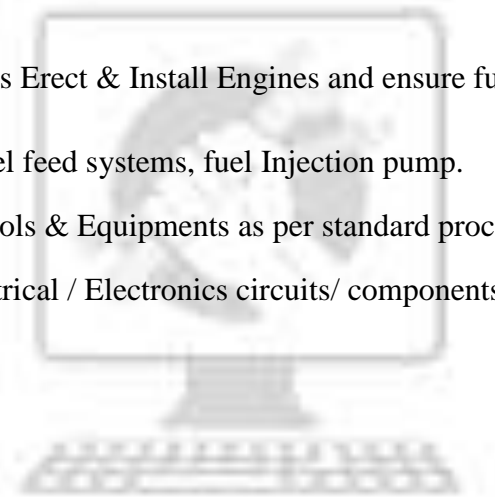
14. Check the cooling & lubrication system and conduct necessary maintenance as per requirement

15. Diagnosis engine faults Erect & Install Engines and ensure functionality.

16. Repair & maintain Fuel feed systems, fuel Injection pump.

17. Maintain shop floor tools & Equipments as per standard procedure.

18. Measure and test Electrical / Electronics circuits/ components and check performance.



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7. LEARNING OUTCOME WITH ASSESSMENT

| GENERIC LEARNING/ ASSESSABLE OUTCOME | |
|--|---|
| LEARNING/ ASSESSABLE OUTCOMES | ASSESSMENT CRITERIA |
| 1. Recognize & comply safe working practices, environment regulation and housekeeping. | 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. |
| | 1.2 Recognize and report all unsafe situations according to site policy. |
| | 1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures. |
| | 1.4 Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements. |
| | 1.5 Identify and observe site policies and procedures in regard to illness or accident. |
| | 1.6 Identify safety alarms accurately. |
| | 1.7 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. |
| | 1.8 Identify and observe site evacuation procedures according to site policy. |
| | 1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment. |
| | 1.10 Identify basic first aid and use them under different circumstances. |
| | 1.11 Identify different fire extinguisher and use the same as per requirement. |
| | 1.12 Identify environmental pollution & contribute to avoidance of same. |

| | |
|--|--|
| | 1.13 Take opportunities to use energy and materials in an environmentally friendly manner |
| | 1.14 Avoid waste and dispose waste as per procedure |
| | 1.15 Recognize different components of 5S and apply the same in the working environment. |
| | |
| 2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. <i>[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry, Mensuration, Trigonometry, Heat & Temperature, elasticity]</i> | 2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, heat & temperature, heat treatment. |
| | 2.2 Measure dimensions as per drawing |
| | 2.3 Use scale/ tapes to measure for fitting to specification. |
| | 2.4 Comply given tolerance. |
| | 2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials. |
| | 2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges. |
| | 2.7 Explain basic electricity, insulation & earthing. |
| | |
| 3. Interpret specifications, different engineering drawing and apply for different application in the field of work. <i>[Different engineering drawing-Geometrical construction, Dimensioning,</i> | 3.1 Read & interpret the information on drawings and apply in executing practical work. |
| | 3.2 Read & analyse the specification to ascertain the material requirement, tools, and assembly /maintenance parameters. |

| | |
|---|--|
| <p><i>Layout, Method of representation, Symbol, Different Projections, Assembly drawing, Sectional views, Estimation of material]</i></p> | <p>3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.</p> |
| | |
| <p>4. Select and measure dimension of components and record data.</p> | <p>4.1 Select appropriate measuring scale/tape/gauges.</p> |
| | <p>4.2 Measure dimension of the components/assembly & compare with given drawing/measurement.</p> |
| | |
| <p>5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.</p> | <p>5.1 Explain the concept of productivity and quality tools and apply during execution of job.</p> |
| | <p>5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.</p> |
| | <p>5.3 Knows benefits guaranteed under various acts</p> |
| | |
| <p>6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.</p> | <p>6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.</p> |
| | <p>6.2 Dispose waste following standard procedure.</p> |
| | |
| <p>7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.</p> | <p>7.1 Explain personnel finance and entrepreneurship.</p> |
| | <p>7.2 Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.</p> |
| | <p>7.3 Prepare Project report to become an entrepreneur for submission to financial institutions.</p> |

| 8. Plan and execute the work related to the occupation. | 8.1 Use documents, drawings and recognize hazards in the work site. |
|---|---|
| | 8.2 Plan workplace/ assembly location with due consideration to operational stipulation |
| | 8.3 Communicate effectively with others and plan project tasks |
| | 8.4 Execute the task effectively. |



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| SPECIFIC LEARNING/ ASSESSABLE OUTCOME | |
|---|--|
| LEARNING/ ASSESSABLE OUTCOMES | ASSESSMENT CRITERIA |
| Semester-I | |
| 9. 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, hack sawing, chipping, filing, drilling, Tapping] | 9.1 Observe safety procedure during all the operations as per the standard norms and guidelines. |
| | 9.2 Plan the various operations involved, identify the tools and instruments and make this available in time. |
| | 9.3 Obtain suitable raw material free from defects. |
| | 9.4 Mark the dimensions on the job with marking tools as per standards |
| | 9.5 Carryout the operations like hack sawing, chipping, filing etc as per the specification. |
| | 9.6 Inspect the finished job as per the standard procedure and to ensure dimensions are within prescribed limit. |
| 10. Demonstrate different joining operations observing standard procedure. [Different joints – bolt joints, riveting, gas welding arc welding, brazing, lock nut, cotter split pin etc.] | 10.1 Plan and select appropriate tools and materials for timely use. |
| | 10.2 Set the equipments observing safety |
| | 10.3 Perform joining as per requirement |
| | 10.4 Check the joint for conforming standard procedure of standard requirement |
| | 10.5 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| 11. Perform dismantling & assembling of multi- | 11.1 Plan & select appropriate tools equipment for the work and make it available timely. |

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| cylinder marine engine as per Makers' manual and check functionality. | 11.2 Dismantle the different components of multi cylinder marine engine. |
| | 11.3 Check for any defects/correctness & measure dimensions of the components using appropriate instruments. |
| | 11.4 Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work. |
| | 11.5 Solve problems during operation by selecting and applying basic methods, tools, materials and collect and organize information for quality output |
| | 11.6 Assemble components & check functionality of engine. |
| 12. Overhaul Oil pump, Filters, Radiator, Cooling system and check functionality. | 12.1 Understand the procedure of the dismantling, servicing and assembling of the oil Pumps. |
| | 12.2 Check the dismantled pumps and its parts and assemble the pumps in systematic order. |
| | 12.3 Check filters during cleaning and re-assembly and precautions to be taken while working |
| | 12.4 Identify Radiator, cooling system of Marine engine |
| | 12.5 Check water pump refitting, adjustment of fan belt tension and connection of water pump with radiator hoses & flushing cooling system of the engine |
| Semester-II | |
| 14. Overhaul air compressor, turbo charger and perform Gas charging & leak Testing of engine refrigeration. | 13.1 Demonstrate risks involved in working with compressed air for auxiliary purposes. |
| | 13.2 Overhaul Air compressor & Turbo charger |
| | 13.3 Check & measure components by using appropriate instruments |
| | 13.4 Charge gas to Refrigeration plants and check the performance |
| | 13.5 Perform leak testing and maintenance of compressor and connected equipments |
| 13. Check the cooling & lubrication system and conduct | 14.1 Identify various parts of cooling and lubrication system and their functions. |
| | 14.2 Plan & select appropriate tools to carry out the work |

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| necessary maintenance as per requirement. | 14.3 Remove the parts of cooling & lubrication system and perform required maintenance as per standard procedure. |
| | 14.4 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal. |
| | 14.5 Observe safety/ precaution during the work. |
| | 14.6 Test the cooling & lubrication system to check functionality |
| 14. Diagnosis engine faults Erect & Install Engines and ensure functionality. | 15.1 Plan & Collect relevant information to perform trouble shooting of Engine |
| | 15.2 Diagnose the various defect & fault of engine |
| | 15.3 Practice in erecting overhauled engines on stands & foundation |
| | 15.4 Starting engine on foundation and observing for permissible vibrations |
| 15. Repair & maintain Fuel feed systems, fuel Injection pump | 16.1 Select appropriate tools & equipment and make use of them timely manner |
| | 16.2 Dismantle fuel injector & feed pump |
| | 16.3 Assemble and adjust the feed pump & Injector |
| | 16.4 Test fuel feed system performance. |
| | 16.5 Check the fuel injection pump performance as per set procedure |
| 16. Maintain shop floor tools & Equipments as per standard procedure. | 17.1 Collect relevant information related to shop floor equipment performance. |
| | 17.2 Prepare Maintenance schedule to check daily, weekly, monthly for different Engines & Auxiliary Machines. |
| | 17.3 Record the shop floor equipment on their utilization and maintenance. |
| 17. Measure and test Electrical / Electronics circuits/ components and check performance. | 18.1 Study of AC & DC Current |
| | 18.2 Identify the Basic Electrical & Electronic Parts |
| | 18.3 Test for the simple circuits |
| | 18.4 Check the performance as set procedure |

SYLLABUS- MARINE ENGINE FITTER

First Semester–06 months

| Week No. | Ref. Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
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| 1 | Recognize and comply Safe Working Practice, Proficiency in Survival Technique, Elementary of First Aid, Fire Prevention and Fire Fighting, personal Safety and Social Responsibility, and Security Training | <ol style="list-style-type: none"> 1. Familiarization with the institutes. (07 hrs) 2. Importance of the trade machinery used in the trade - types of work done by students in the institute shop of the institute. (18 hrs) | <p>General introduction to the course- duration of the course and course content. Study of the syllabus general rules pertaining to the institute facilities- library working hours. Occupational Safety & Health Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections.</p> |
| 2. | -do- | <ol style="list-style-type: none"> 3. Description of safety equipment their use – safety rules to be observed in the repair shop. (07 hrs) 4. Accidents their causes. Fire extinguishers uses. (07 hrs) 5. Familiarization of the tools, machinery available in the repair shop. (05 hrs) 6. Their use and up keep importance of maintenance, cleanliness of workshop. Tools, jacks trays and hoses. (06 hrs) | <p>Importance – Safety or general precautions to be observed in the shop floor. Types of fire, class of fire, fire extinguishers used for different types and class of fire, storing and handling of inflammable materials- Elementary First Aid. Study of personal protective equipments used in Marine plant. Environmental pollution, sources, causes, consequences and controls.</p> |

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| 3. | 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, hack sawing, chipping, filing, drilling, Tapping] | 7. Demonstration of the use of Fitter's Hand Tools, marking off with steel rules, calipers, scribe, dividers, dot & center punch, chipping in marked lines in a given piece, sharpening of chisels, center punch and dot punches to a correct angles. (25 hrs) | Systems of measurement conversion of English into metric measurement and vice versa – marking media - Chalk, Prussian Blue, Red lead and Tools used for marking e.g., steel rule, Try Square, etc. |
| 4. | -do- | 8. Hack sawing filling to given dimensions - filling true and square practice different types of filling operation - making and drilling clear and blind holes. (13 hrs) 9. Sharpening of twist drill, safety precautions to be observed while using a drilling machine. (12 hrs) | Types of hacksaw frames and blades - their selection and uses. Types of files and their uses. Care and maintenance of files. Types and sizes of drills - cutting angles and speeds of drills, calculation of tap drill sizes |
| 5. | -do- | 10. Tapping a clear and blind hole. selection of tap drill sizes. (10 hrs) 11. Use of lubrication cutting threads on a bolt/ stud adjustment of two piece die reaming a hole/bush to suit the given pin/shaft scraping a given mechanical surface.(15 hrs) | Taps & dies description use of different types of taps and dies - use of 'V' threads precautions while using taps and dies -description and use of different types of scrapers, reamers and emery papers. |
| 6. | -do- | 12. Correct measurement techniques of micrometer, vernier caliper, vernier bevel protector. (09 hrs) 13. Measuring diameter of pistons, main journals, crank pins, king pin big end, main bearings, cylinder bores using micrometer and vernier calipers. (09 hrs) 14. Measuring of thickness, machined flat surface, bars valve angles, head locating centers of | Study of construction of micrometer (outside & inside) and vernier caliper, vernier bevel protector. Calculation of least count for micrometer, vernier caliper and vernier bevel protector. Calculation of errors & correct dimension for Micrometer. Use and care of measuring instruments. Use of combination sets. |

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| | | a round bar with center head. (07 hrs) | |
| 7. | Demonstrate different joining operations observing standard procedure. [Different joints – bolt joints, riveting, gas welding arc welding, brazing, lock nut, cotter split pin etc.] | 15. Simple marking of sheet metal and cutting. (08 hrs) 16. Joining of sheet metal, parts by soft soldering, bending and folding. (08 hrs) 17. Practice in silver soldering.(09 hrs) | Study of sheet metal workers hand tools their description and uses. Use of sheet and wire gauges. Description of simple soldering & brazing, Use of fluxes for common joints - types of sheet metal joints - their uses. Study of blow lamp and its uses |
| 8. | -do- | 18. Practice in soldering, brazing, annealing, bending of pipes. Practice for nipples, union & other pipe joint. (25 hrs) | Difference between pipe & tubes. Types of pipe fitting (in marine) its purposes. Study about connecting two pipe pieces, branching, changing in diameter, direction & stopping the end of pipes. |
| 9. | -do- | 19. Exercise involving use of wrenches, pliers, screw drivers, and pliers -cleaning and lubrication of engine parts, location and identification of engine components.(25 hrs) | General description and construction of diesel engine - characteristics and classification working principles of 4 strokes cycle diesel and petrol engine. Comparisons between petrol and diesel engine. |
| 10. | -do- | 20. Practice on unserviceable diesel engine, removing jammed nuts and broken studs reconditioning and damaged stud hole fitting over sized stud. (25 hrs) | Two stroke cycle diesel engine types of scavenging uniflow and loop flow scavenge opposed copper piston engine differences between two stroke and four stroke cycle diesel engines. |

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| 11. | -do- | <p>21. Selection of materials for gaskets and packing - use of locking devices lock nuts, cot-ters, split pin, circlips, lock rings (15 hrs)</p> <p>22. Location where they are used inspection and checking leakage of air, fuel oil and exhaust in the engine. (10 hrs)</p> | <p>Engine details - cylinder materials - cylinder liners and their advantages, cylinder heads, description function, cares and maintenance - location combustion chamber in cylinder heads and also heater plugs and port and valve arrangements.</p> |
| 12. | Perform dismantling & assembling of multi-cylinder marine engine as per Makers' manual and check functionality. | <p>23. Practice on starting and stopping of diesel engines. (08 hrs)</p> <p>24. Use of speed counter in determining the engine speed /rpm of the engine. (08 hrs)</p> <p>25. Checking of temperature and pressure of oil and cooling water, exhaust gas temperature etc. (09 hrs)</p> | <p>Combustion chambers - open and closed types, advantages and disadvantages compression ratio & compression pressures, compression testing of cylinders and analysis of results & its importance.</p> |
| 13. | -do- | <p>26. Maintenance schedule to check - daily, weekly, monthly for different types of engines. (10 hrs)</p> <p>27. Writing procedure of inspection schedules -maintenance log book - details of maintenance work (15 hrs)</p> | <p>Need of maintenance, check up in IC engines - preparation of maintenance schedule from charts of popular makes of engine</p> |
| 14. | -do- | <p>28. Remove rocker arm assy. (05 hrs)</p> <p>29. Manifolds, and cylinder head - removing valves and its parts - cleaning and decarburizing - checking valve seat and valve guide - reconditioning valve seats and refacing valves - lapping valves on its seat - testing leakage of valve seat for leakage. (10 hrs)</p> <p>30. Inspection of cylinder head and manifold surfaces for lapping and cracks. (10 hrs)</p> | <p>Engine Valves & valves operation - mechanism - parts and function of each valve timing diagram, cam shaft and timing, gears - types of drives used in engines, chain tension and its importance, cylinder head and manifold construction and its function - water jackets passages.</p> |

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| 15. | -do- | <p>31. Dismantle of rocker arm assembly -clean and check shaft - bushes, pork and rocker arm for wear and cracks and reassemble. (08 hrs)</p> <p>32. Check valve springs, tappets push rods, tappet screws, and valve stem cap. (09 hrs)</p> <p>33. Reassembling of valve parts in sequence refit cylinder head and manifold, rocker arm assy., adjusting of valve clearances, starting of engine after decarburizing. (08 hrs)</p> | <p>Description and function of valve parts -maintenance material used - necessity of valve clearance prescribed by makers of engine - effect of incorrect clearance -common trouble and remedies reason for lapping of cylinder head.</p> |
| 16. | -do- | <p>34. Removing piston & connecting rod from engine - examine - piston ring grooves for wear - examine piston for cracks & distortions, clean oil holes. (08 hrs)</p> <p>35. Measuring piston ring clearances- check connecting rod for bend and twist and cylinder bore for taper and ovality and gudgeon pin bushes for wear. (08 hrs)</p> <p>36. Check elongation of BE bearing bolts. (09 hrs)</p> | <p>Piston and piston rings - function - types and material used recommended clearances for the rings and its necessity - precautions while fitting rings. Connecting rod – types function and material used - methods of fixing gudgeon pin on small end method of lubrication provided for small end bushes.</p> |
| 17. | -do- | <p>37. Removing crank shaft and cam shaft from engine - checking crank shaft for bend & twist. (04 hrs)</p> <p>38. Checking oil retainer and thrust surfaces for wear. (03 hrs)</p> <p>39. Measure crank shaft journal for wear. (03 hrs)</p> <p>40. Checking flywheel and mounting flange - spigot, bearing. (04 hrs)</p> <p>41. Check vibration damper for defects. (04 hrs)</p> <p>42. Check cam shaft for bend and crack. (03 hrs)</p> <p>43. Check crank shaft deflection. (04 hrs)</p> | <p>Crank shaft - construction and function material used - arrangements of crank pins and main journal - balancing method -flywheel - construction and its function and material used. Elementary knowledge of function of clutch and coupling units attached to flywheel.</p> |

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| 18. | -do- | <p>44. Checking cylinder blocks surface -major cylinder bore for tapered and ovality. (04 hrs)</p> <p>45. Check main bearing for taper and ovality, clean oil gallery passage and oil pipe lines. (04 hrs)</p> <p>46. Check main bearing cap bolt holes. (05 hrs)</p> <p>47. Check cam shaft bearing and tappet bolts.(03 hrs)</p> <p>48. Descaling water passage and examine bursting disc. (03 hrs)</p> <p>49. Check cylinder head for warping. (06 hrs)</p> | <p>Description and function of cylinder block - material used for - cylinder & liners, effect of sea water with engine body, cylinder & liners. Construction of water jacket passage and wall thickness. Fixing of cylinder head and mountings. Fixing of accessories like oil pump, water pump, filters - oil flow passages and cleaning plugs.</p> |
| 19. | -do- | <p>50. Fixing of crank shaft and bearing and engine entablature. (12 hrs)</p> <p>51. Checking and adjusting of clearances end play etc. (13 hrs)</p> | <p>Engine bearing - classification and location - material used. Composition of bearing materials - shell bearing and their advantages - special bearing material for diesel engine application bearing failure and its causes - care and maintenance.</p> |
| 20. | -do- | <p>52. Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers recommendations for engines. (25 hrs)</p> | <p>Need for lubrication system for diesel engines – types used and layout of the system by pass & full flow arrangement – types of oil pumps, oil filters, oil coolers, common troubles – care and maintenance.</p> |
| 21. | -do- | <p>53. Reassemble all parts of engine in correct sequence and torque all bolts and nuts as per makers' recommendations for engines. (18 hrs)</p> <p>54. Fit accessories & start and run the engine on stands. (07 hrs)</p> | <p>Engine assembly procedure need for cleanliness and special tools and gauges used for engine assembling, practice – periods of decarburizing and overhauling engine in terms of hours of run or mileage – running in procedure of overhauled engines.</p> |

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| 22. | -do- | <p>55. Removing cylinder liners from cylinder block. (10 hrs)</p> <p>56. Practice in measuring and refitting new liners as per maker's recommendations. (09 hrs)</p> <p>57. Precautions while fitting new liners. (06 hrs)</p> | <p>Cylinder liners – construction & purpose – material used and finish provided types of liners in use – methods used to fit the same in cylinder bore, advantages of wet and dry liners wear pattern & allowable wear cylinder wear and its causes.</p> |
| 23. | Overhaul Oil pump, Filters, Radiator, Cooling system and check functionality. | <p>58. Overhauling of oil pump, oil filters, oil coolers, air cleaners and air filters. (09 hrs)</p> <p>59. Adjusting of oil pressure relief valves. (08 hrs)</p> <p>60. Changing oil in the sump, repairs to oil flow pipe line and unions. (08 hrs)</p> | <p>Friction - its meaning and importance methods to reduce friction in engines - use of lubricants - oil grease high detergent oil for diesel engine lubricants.</p> |
| 24. | -do- | <p>61. Removing radiator and water pump from engine, cleaning & reverse flushing. (09 hrs)</p> <p>62. Radiator testing thermostat and refitting on engine. (06 hrs)</p> <p>63. Overhauling – water pump refitting – adjusting fan belt tension and connecting water pump with radiator with hoses & flushing cooling system of the engine. (10 hrs)</p> | <p>Need for cooling an engine general description & types of air and water – cooling used in engine – 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.</p> |
| 25 | Revision | | |
| 26 | Examination | | |

Note: More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of welded items like boiler drum, ship building, heavy welded structures etc., may be shown to the trainees to give a feel of Industry and their future assignment.

SYLLABUS- MARINE ENGINE FITTER

Second Semester–06 months

| Week No. | Ref. Learning Outcome | Professional Skills (Trade Practical) With Indicative Hours | Professional Knowledge (Trade Theory) |
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| 27 | Overhaul air compressor, turbo charger and perform Gas charging & leak Testing of engine refrigeration. | 64. Dismantling air compressor and turbo chargers. (08 hrs) 65. Cleaning all parts -measuring wear - reassembling all parts and fitting them in the engine. (09 hrs) 66. Dismantling different types of pumps, checking and reassembling. (08 hrs) | Description & operation of Air compressor, turbo chargers and common troubles & maintenance. Description of different types of pumps (centrifugal, reciprocating, gear, screw, etc.) |
| 28 | -do- | 67. Basic procedure for gas charging, leak testing and general maintenance of marine engine refrigeration. (15 hrs) 68. Recommended procedure for application of paints to ship/vessel. (10 hrs) | Basic refrigeration system in marine - operation and maintenance. Marine paints its specialty, types, Indian standards, recommended paints for inside and outside of ships/vessel. Anti-fouling, leaching, pigment operation for paints. |
| 29 | Check the cooling & lubrication system and conduct necessary maintenance as per requirement | 69. Troubleshooting in cooling and lubrication system/engine checking up and correcting oil and water leaks. (15 hrs) 70. Changing defective packing and gaskets -testing functioning of thermostat. (10 hrs) | Step by Step method of diagnosis of troubles in the lubrication and cooling system, reasons for engine overheating & remedies for the same. Crank case contamination and crank case ventilation, flow test rate recommended for radiator. |
| 30 | Diagnosis engine faults Erect & Install Engines and ensure functionality. | 71. Diagnosis of engine faults like main bearing - noises piston pin noise flywheel knock & valve noise and crank noises and diesel knock. (25 hrs) | Reasons for excessive exhaust smoke overheating, vibration missing & hunting noises and its reasons for development of noises in engine, methods of rectification for noises for smooth working of the engine. |

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| 31 | -do- | 72. Diagnosis of engine faults like smoky, exhaust, overheating, heavy vibration, missing cylinders, exhaust noise, hunting characteristics of engine and erratic or irregular idling. (25 hrs) | Engine assembling practice for overhauling of engine - procedure, observations, precautions, alignments between spare parts, makers recommendation for setting of spare parts. |
| 32 | -do- | 73. Diagnosis of reasons for starting difficulty in a diesel engine and rectifying the faults. (25 hrs) | Starting methods used for starting diesel engines used for marine, brief description of each method - methods to eliminate starting difficulty in a diesel engine. |
| 33 | -do- | 74. Practice in erecting overhauled engines on stands & foundations. (06 hrs) 75. Preparation of templates of foundation holes of the engine base.(07 hrs) 76. Preparation of holding down bolts and nuts and boxes for foundation. (07 hrs) 77. Starting engine on foundation and observing vibrations. (05 hrs) | 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. |
| 34-35 | -do- | 78. Start engine adjust idling speed and damping device in pneumatic governor and venture control unit (10 hrs) 79. Checking performance of engine with off load adjusting timings. (15 hrs) | Power transmission system - types, belt pulley, chain, gear, coupling etc. Governors- pneumatic type- construction & operation - venturi unit and its purpose and action - precaution to be observed in attending to the governor- definition of rated speed - maximum speed -over run of governors- purpose of auxiliary venturi in the Governor - principle of idling damper. |

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| 36 | -do- | <p>80. Start engine-adjusting idle speed of the engine fitted with mechanical and hydraulic governors. (16 hrs)</p> <p>81. Checking-high speed operation of the engine. (09 hrs)</p> | <p>Mechanical governors, Their construction, function and operation under different load and speed and maintenance -common troubles and remedies including hydraulic governors.</p> |
| 37-38 | -do- | <p>82. Checking performance for missing cylinder by isolating defective injectors. – 20 Hrs</p> <p>83. Dismantle and replace defective parts and reassemble and tefit back to the engine. (15 hrs)</p> <p>84. Importance of correct setting of pressure - while assembling the unit and also fitting on to the engine. (15 hrs)</p> | <p>Fuel injection Nozzles description and operation of each type spray angles and orifices and their characteristic- injector Tester- construction and function types of tests and their purpose. Effects of incorrect setting of nozzles on engine performance.</p> |
| 39-40 | Repair & maintain Fuel feed systems, fuel Injection pump. | <p>85. Cleaning fuel tanks, checking leaks in the fuel lines. (10 hrs)</p> <p>86. 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).- (15 hrs)</p> | <p>Fuel feed system in diesels - Air injection and airless injection systems their general description and layout importance of water separators, constructional details of water separators (centrifuges).</p> |
| 41-42 | -do- | <p>87. Bleeding of air from the fuel lines servicing primary & secondary filters removing filters elements in pressure filters, overhauling of fuel valves. (25 hrs)</p> | <p>Fuel filters types & constructional details - reasons for using no. of filters sequence of replacement of filter elements -Importance of diesel fuel cleanliness - types of diesel fuel HSD & HFO - Description of oil fuel valves & their functions</p> |
| 43-44 | -do- | <p>88. Dismantling an unserviceable fuel injection pump. (09 hrs)</p> <p>89. Feed pump governor studying the parts and reassemble general maintenance of fuel injection Pumps. (16 hrs)</p> | <p>Constructional details of fuel injection pumps, feed pumps and governors - explanation of function and operation.</p> |

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| 45 | -do- | <p>90. Removing a fuel injection pump from an engine. (10 hrs)</p> <p>91. Refits the pump to the engine reset timing -fill adjust slow speed of the engine. (15 hrs)</p> | Importance of fuel valve and pump timing and method of advancing and retarding and its effects on the firing. |
| 46 | Maintain shop floor tools & Equipments as per standard procedure. | <p>92. Repairing of grease guns oil cans-oil spray gun & other shop floor equipment. (10 hrs)</p> <p>93. Maintenance of drill press, pedestal grinder, valve reface and air compressor.- (15 hrs)</p> | Importance of periodical maintenance and upkeep of shop equipments. Preventive maintenance to avoid sudden and major failure. preparing maintenance charts for machineries and follow up. |
| 47 | -do- | <p>94. Repairing of injector tester, hoses, jacks and stands vacuum & compression gauges. (15 hrs)</p> <p>95. Maintenance of washing pumps, hydraulic presses phasing and calibrating machine. – (10 hrs)</p> | Safe working practice while using work shop tools. |
| 48 | Measure and test Electrical / Electronics circuits/ components and check performance. | <p>96. Practice in joining wires & soldering – 5 Hrs</p> <p>97. Forming simple electrical circuits. (04 hrs)</p> <p>98. Measuring of current, voltage and resistance. (04 hrs)</p> <p>99. Cleaning and topping up of a lead acid battery (04 hrs)</p> <p>100. Testing battery with hydrometer, cell tester connecting battery to charger. (08 hrs)</p> | BASIC ELECTRICAL WORK Simple electrical circuit series & parallel circuits - identification of alternating current and direct current meters - insulators and conductors - types of resistance - ohm's law and its application - common electrical terms and symbols-primary and secondary cells-lead acid battery description - construction -common troubles and remedy . Safe working practice while working on electrical systems. |
| 49 | -do- | <p>101. Studying electrical circuits in the engine assemble checking loose, open and short circuit in ignition circuits (04 hrs)</p> <p>102. Cleaning and testing spark plugs (06 hrs)</p> <p>103. Overhauling of distributor assemble (07 hrs)</p> <p>104. Checking and setting ignition timing. (08 hrs)</p> | Description of electrical circuits - ignition system and the components-purpose of induction coil, condenser, spark plugs-common troubles in ignition circuit and its remedy. |

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| 50 | -do- | <p>105. Removing dynamo from engine, dismantling, cleaning checking for defects, assembling and testing for monitoring action of dynamo & fitting to engine. (10 hrs)</p> <p>106. Removing starter motor from the engine. (07 hrs)</p> <p>107. Overhauling the starter motor and testing of starter motor. (08 hrs)</p> | <p>Description of charging circuit- operation of dynamo and regulator Unit- Ignition warning lamp-troubles & remedy in charging system.</p> <p>Description of starter motor circuit- constructional detail of starter motor, solenoid switches, common troubles and remedy in starter circuit.</p> |
| 51. | Revision | | |
| 52. | Examination | | |

Note: -

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of welded items like boiler drum, ship building, heavy welded structures etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

| First Semester Duration: Six Month | | |
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| S No. | Workshop Calculation and Science | Engineering Drawing |
| 1. | Simple workshop problems involving addition, subtraction, multiplication and division of whole numbers. | Introduction to Engineering Drawing and Blue Print Reading. Free hand sketching of straight lines, rectangles, squares. |
| 2. | Common fractions, additions, subtraction, multiplication and division of common fractions, | Free hand sketching of parallelogram, rhombus, polygons and circles. |
| 3. | Vulgar fractions, shop problems involving fractions. | Free hand sketching with dimensions and proportionate sketching of rectangles, square, parallelogram, rhombus, |
| 4. | Applied workshop problems involving fractions. | Free hand sketching with dimensions and proportionate sketching of circles, polygons. |
| 5. | Properties of ferrous metals their uses. Cast iron, wrought iron, plain and high carbon steel, high speed steel and alloy steel. | Reading of simple blue prints. Sketching of simple solids such as cubes, rectangular blocks, cylinders. |
| 6. | Properties of non -ferrous metals and their uses. Copper, zinc, lead, tin, brass, aluminum, bronze, soldering metals. | Free hand sketching of nuts - bolts - studs -with dimensions from samples. |
| 7. | Brief description of manufacturing process of non ferrous metals-copper, aluminum, zinc, tin. | Sketching of views of solid bodies such as square, rectangular blocks, hollow cylinders rings, cones. |
| 8. | F.P.S. & C.G.S. systems Metric weights and measurements, conversion factors. | Freehand sketching of pliers, washers, bolts, nut with dimensions from samples. Free hand sketching of four strokes - two strokes cycles. |

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| 9. | Shop problem on metric systems of weights and measurements. | Explanation of simple orthographic projection in third angle projection. |
| 10. | Meaning of tenacity, elasticity, malleability, brittleness, hardness, compressibility and ductility with example. | View of simple hollow and solid bodies with dimensions |
| 11. | Effect of alloying elements on properties of cast iron & steel. | Free hand sketching of valves, valves springs, valve assy. With dimensions. |
| 12. | Square root of perfect square and whole number of square root of decimals. | Simple iso metric view of object such as square, rectangle and cubes. |
| 13. | Shop problems involving square roots. | Free hand sketching of piston gudgeon pins rings and connecting rod with dimensions from samples |
| 14. | Ratio & proportions. Shop problem | Free hand sketching of crank shaft and flywheels with dimension from samples. |
| 15. | Mass - unit of mass force - absolute unit of force - weight of body, shop problems | Free hand sketching of cylinder block and cylinder head |
| 16. | Mass unit of mass, force, weight of body, shop problem. | Free hand sketching of bearing with dimensions from sample. |
| 17. | Example of useful and wasteful friction. | Free hand sketching of oil filters oil pumps, oil coolers with dimensions from samples. |
| 18. | Example of use and waste friction in engine applied problems. | Freehand sketching of examples of oil pumps, oil coolers with dimensions from samples. |
| 19. | | Freehand sketching of cylinder liners with dimensions from sample |
| 20. | Work, Unit of work engine power, Unit of power. | Freehand sketching of cylinder liners with dimensions from sample |
| 21. | Work, Unit of work engine power - Unit of power – shop problems. | Freehand sketching of water pump thermostatic valve & water jackets in the cylinder block. |

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| | Ratio & proportion | |
| Second Semester Duration: Six Month | | |
| 1. | Different forms of heat energy mechanical and electrical | Free hand sketching of 4 stroke cycle, 2 stroke cycle valve timing diagram. |
| 2. | Different forms of Heat Energy mechanical and Electrical their conversation from one to another with examples. | Freehand sketching of engine parts, fuel supply, ignition, lubrication and cooling system. |
| 3. | Measuring of Horse power IHP, FHP and applied shop problem | Views of solid & hollow bodies cut sections plane |
| 4. | Measuring of Horse power IHP, BHP, FHP and applied shop problem | Views of hollow & solid bodies cut sections plane |
| 5. | Effects of force on materials like bending twisting and shearing problems, | Practice on blue print reading |
| 6. | Torque - definition -example torque wrenches application problems involving torque values of engine. | Further practice on blue print reading |
| 7. | Shop problems on determination of volume & weight of simple bodies. | Freehand sketching of engine mountings templates & fixing brackets & Stands |
| 8. | Menstruation of areas volumes & weight calculation solid bodies, | Freehand sketching of water separators and fuel tanks with dimension from sample. |
| 9. | Center of gravity of bodies stable & unstable Neutrals & equilibrium Examples & problems on center of gravity. | Freehand sketching of fuel feed system and of filters. |
| 11. | Simple levers with examples ie. Bell- crank lever & other used in engine- Advantage in using them Problems on lever. | Freehand sketching of simple fuel injection pump with dimension from samples. |

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| 12. | Heat and temperature. scales -Fahrenheit and Centigrade- their conversions. Temperature measuring devices used in the shop. | Lettering numbers & alphabets and freehand sketching of feed pump. |
| 13. | Definition -stress, strain and modulus of elasticity, ultimate strength, type of stresses, factor of safety. examples and problems. | Freehand sketching of a pneumatic governor with dimensions from samples. |
| 14. | Definition -stress, strain and modulus of elasticity, ultimate strength, type of stresses, factor of safety. examples and problems. | Freehand sketching of mechanical governor with dimensions from sample. |
| 15. | Mechanical advantage velocity ratio and efficiency. example and problems. | Freehand sketching of different types of nozzles (cut section) lettering practice. |
| 16. | Determination mechanical advantage velocity ratio and efficiency screw jack wide pulley bully bumble wheel and inclined phasing. | Freehand sketching of grease gun horses - oil gun and service accessories. |
| 17. | Working Principle of simple machines. | Practice on blue print reading. |
| 18. | Electricity and its effects static electricity, AC and DC difference. | Freehand sketching of electrical symbols and drawing of simple electrical circuits. |
| 19. | Magnets natural and artificial types-poles of magnets-magnetic fields. | Freehand sketching of ignition circuit of a vehicle- sketching the circuit-line diagram of magneto ignition. |
| 20. | Definition of ampere, volt & ohm- Units of ampere, volt, ohm, ohm's law. Calculation based on ohm's law | Freehand sketching of charging system. Starting starter motor circuit and solenoid switch circuit |

9.2 EMPLOYABILITY SKILLS

| CORE SKILL – EMPLOYABILITY SKILL | |
|--------------------------------------|--|
| First Semester | |
| 1. English Literacy | Duration : 20 hrs Marks : 09 |
| Pronunciation | Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech) |
| Functional Grammar | Transformation of sentences, voice change, change of tense, spellings. |
| Reading | Reading and understanding simple sentences about self, work and environment |
| Writing | Construction of simple sentences Writing simple English |
| Speaking/ Spoken English | Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happenings, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing on messages and filling in message forms, greeting and introductions, office hospitality, resumes or curriculum vitae's essential parts, letters of application reference to previous communication. |
| 2. IT Literacy | Duration : 20 hrs Marks : 09 |
| Basics of Computer | Introduction, computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down computer. |
| Computer Operating System | Basics of Operating System, WINDOWS, User interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc., Use of common applications. |
| Word Processing and Worksheet | Basic operating of Word Processing, Creating, opening and closing documents, Use of shortcuts, Creating and Editing Text, Formatting the text, Insertion & creation of tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets. |
| Computer Network- | Basic of computer Networks (using real life examples), Definitions of |

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| ing and Internet | Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web browser, Website, Web page and Search Engines. Accessing the Internet using web browser, Downloading and printing web pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes. |
| 3. Communication Skills | |
| Duration : 15 hrs Marks : 07 | |
| Introduction to Communication Skills | Communication and its importance Principles of Effective communication Types of communication - verbal, non-verbal, written, email, talking on phone. Non-verbal communication- characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/discomfort. |
| Listening Skills | Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills. |
| Motivational Training | Characteristics essential to achieving success. The power of positive attitude. Self-awareness Importance of commitment. Ethics and values Ways to motivate oneself. Personal goal setting and employability planning. |
| Facing Interviews | Manners, etiquettes, dress code for an interview. Do's & Don'ts for an interview. |
| Behavioral Skills | Problem solving, confidence building, attitude. |
| Second Semester | |
| 4. Entrepreneurship Skills | |
| Duration : 15 hrs Marks : 06 | |

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| Concept of Entrepreneurship | Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, and the process of setting up a business. |
| Project Preparation & Marketing Analysis | Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution management. Difference between small scale & large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix. |
| Institution's Support | Preparation of project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/ Programmes, procedure & the available scheme. |
| Investment Procurement | Project formation, feasibility, Legal formalities i.e., Shop Act, Estimation & costing, Investment procedure - Loan procurement - Banking processes. |
| 5. Productivity | |
| | Duration : 10 hrs Marks : 05 |
| Benefits | Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard. |
| Affecting Factors | Skills, Working Aids, Automation, Environment, Motivation - How it improves or slows down productivity. |
| Comparison with Developed Countries | Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages. |
| Personal Finance Management | Banking processes, Handling ATM, KYC registration, Safe cash handling, Personal risk and insurance. |
| 6. Occupational Safety, Health and Environment Education | |
| | Duration : 15 hrs Marks : 06 |
| Safety & Health | Introduction to occupational safety and health importance of safety and health at workplace. |
| Occupational Hazards | Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygiene, Occupational Diseases/ |

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| | Disorders & its prevention. |
| Accident & Safety | Basic principles for protective equipment. Accident prevention techniques - control of accidents and safety measures. |
| First-Aid | Care of injured & sick at the workplaces, First-Aid & Transportation of sick person. |
| Basic Provisions | Idea of basic provision legislation of India. Safety, health, welfare under legislative of India. |
| Ecosystem | Introduction to Environment. Relationship between society and environment, Ecosystem and factors causing imbalance. |
| Pollution | Pollution and pollutants including liquid, gaseous, solid and hazardous waste. |
| Energy Conservation | Conservation of energy, re-use and recycle. |
| Global Warming | Global warming, climate change and Ozone layer depletion. |
| Ground Water | Hydrological cycle, Ground and surface water, Conservation and Harvesting of water. |
| Environment | Right attitude towards environment, Maintenance of in-house environment. |
| 7. Labour Welfare Legislation | |
| | Duration : 05 hrs Marks : 03 |
| Welfare Acts | Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act. |
| 8. Quality Tools | |
| | Duration : 10 hrs Marks : 05 |
| Quality Consciousness | Meaning of quality, Quality characteristic. |
| Quality Circles | Definition, Advantage of small group activity, Objectives of quality circle, Roles and function of quality circles in organization, Operation of quality circle. Approaches to starting quality circles, Steps for continuation quality circles. |
| Quality Management System | Idea of ISO 9000 and BIS systems and its importance in maintaining qualities. |
| House Keeping | Purpose of House-keeping, Practice of good housekeeping. |
| Quality Tools | Basic quality tools with a few examples. |

LIST OF TOOLS AND EQUIPMENT

MARINE ENGINE FITTER (For batch of 16 candidates)

A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-15 is required additionally)

| Sl. No. | Name of the Tool & Equipments | Specification | Quantity |
|---------|------------------------------------|----------------------------|----------|
| 1. | Hammer Ball peen | 0.75 Kg | 17 Nos. |
| 2. | Chisel cold flat | 19 mm X 200 mm | 17 Nos. |
| 3. | Steel rule | 15 cm (English and Metric) | 17 Nos. |
| 4. | Screw driver | 15 cm | 17 Nos. |
| 5. | Screw driver | 30 cm 9mm Blade | 17 Nos. |
| 6. | Screw driver | 20 cm 9mm Blade | 17 Nos. |
| 7. | Spanner D.E. | set of 12 metric 8-32 mm | 17 Nos. |
| 8. | Pliers combination | 15 cm | 17 Nos. |
| 9. | Centre Punch | | 17 Nos. |
| 10. | Hand File Flat | 200 mm (Second Cut) | 17 Nos. |
| 11. | Ring spanner | set of 12 metric 8-32 mm | 17 Nos. |
| 12. | Steel tool box with locks and keys | | 17 Nos. |
| 13. | Safety goggles | | 17 Nos. |
| 14. | Safety Helmets | | 17 Nos. |
| 15. | Hand Gloves (Leather) | | 17 Nos. |

B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required

TOOLS & EQUIPMENT

| | | | |
|-----|-----------------|-------|--------|
| 16. | Rule Steel | 30cm | 2 Nos. |
| 17. | Dividers Spring | 15 cm | 2 Nos. |
| 18. | Prick Punch | 15 cm | 4 Nos. |

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| 19. | Chisel cross cut | 9x3 mm | 4 Nos. |
| 20. | Hammer ball Peen | 0.5 Kg | 4 Nos. |
| 21. | Hammer copper | 1 Kg with blade | 2 Nos. |
| 22. | Engineer square | 15 cm blade | 4 Nos. |
| 23. | Scriber | 15 cm | 4 Nos. |
| 24. | Scriber block universal | | 1 No. |
| 25. | Marking out tables | 90 cm x 60 cm x 90 cm (high) | 1 No. |
| 26. | Surface plate | 60 x 60 cm blade | 1 No. |
| 27. | Angle Plate | | 1 No. |
| 28. | Hacksaw frame | | 4 Nos. |
| 29. | V - block | 75 x 38 mm pair with clamps | 2 Nos. |
| 30. | Punch hollow | set of 6 | 2 sets |
| 31. | Number Punch | set 3 mm | 1 set |
| 32. | Letter Punch | set 3 mm | 1 set |
| 33. | Hand vice | 150 mm | 2 Nos. |
| 34. | Screw driver, Electrician | type 20cm size | 2 Nos. |
| 35. | File, flat | 35cm bustard | 2 Nos. |
| 36. | File, flat | 25 cm second cut | 2 Nos. |
| 37. | File flat | 20 cm smooth | 2 Nos. |
| 38. | File flat safe edge | 25 cm smooth | 2 Nos. |
| 39. | File, triangular | 15 cm second cut | 2 Nos. |
| 40. | File, half round | 40 cm second cut | 2 Nos. |
| 41. | File round | 30 cm, Second cut | 2 Nos. |
| 42. | File square | 20 cm second cut | 2 Nos. |
| 43. | Screw Pitch Gauge (BSW,BSP,BSF and Metric) | | 1 Set Each |

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| 44. | Drill, Twist, | metric 3mm to 12mm by 1mm parallel shank | 1 set |
| 45. | Taps and Dies complete | set in box B.A. ,B.S.W. ,BSF American and metric | 1 set |
| 46. | H.S.S Hand reamer, | adjustable 10.5 mm to 11.25 mm 11.25 mm to 12.75 mm 12.78mm to 14.25 mm and 14.25 to 15.75mm | Lset |
| 47. | Scraper, flat | 25 cm handled | 2 Nos. |
| 48. | Scraper half round | 25cm | 2 Nos. |
| 49. | Scraper triangular | 25cm | 2 Nos. |
| 50. | Micrometer outside | 0 to 150mm | 1 set |
| 51. | Micrometer (Inside) | 25mm to 150mm | 1 set |
| 52. | Vernier caliper Depth to read both inches and | set 25 or 20 cm inside out- side in mm | 1 Nos. |
| 53. | Hammer planishing | | 2 Nos. |
| 54. | Setting hammer | | 2 Nos. |
| 55. | Mallet (Wooden) | | 2 Nos. |
| 56. | Trammel | 30 cm | 1 No. |
| 57. | Blow lamp | 0.5 litre | 2 Nos. |
| 58. | Soldering iron | 120 watts | 2 Nos. |
| 59. | Soldering iron, copper | 225 gms (Fire heated) | 2 Nos. |
| 60. | Pliers nose (round and straight) | | 2 each |
| 61. | Snip straight | | 1 No. |
| 62. | Pot melting | | 2 Nos. |
| 63. | Poker | | 2 Nos. |
| 64. | Open Spanners, | double ended set of 12 me- tric size 8 to 32 | 4 set |

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| 65. | Spanners, double off-set double | set of 7 W/W from 3 mm to 13.5 mm | 4 set |
| 66. | Double open ended ignition spanner of B.A. | Ox 1 to 8x9 set of 5 Spanner, Clyburn 15cm | 1 set |
| 67. | Adjustable Spanner | 6inch, 12inch & 18 inches | 1 each |
| 68. | Box spanner | set upto 32 mm | 1 set |
| 69. | Spanners ring of set of | 6 S.I. | 1 set |
| 70. | Spanner for sparking plug | | 1 set |
| 71. | Pipe Ranches Stilson type | 6,12, 18 inches | 2 each |
| 72. | Set of Allen Key | 1 mm to 12 mm by 1mm | 2 set |
| 73. | Double open ended spanner American | A/F size from 7.5 mm x 99 mm to 19 mm x 20.5 mm set of 6 | 1 No. |
| 74. | Torque Wrench | | 1 No. |
| 75. | Drill Drift | 10mm x 150mm | 2 Nos. |
| 76. | Grease Gun | | 2 Nos. |
| 77. | Oil Can | 0.5 liter | 2 Nos. |
| 78. | Chain block | 1 ton capacity | 1 No. |
| 79. | Tray cleaning | 45 x 30 cm | 1 No. |
| 80. | Drilling machine pillar type capacity upto 20mm dia with motor | | 1 No. |
| 81. | Valve Grinding Stick (consumable) | | 6 Nos. |
| 82. | Valve seat cutting tools complete with guide & pilot bar (all angle) in a box | | 1 set |
| 83. | Extractor stud "ezy out" Type | | 1 set |
| 84. | Compression gauge | | 1 No. |
| 85. | Oil Stone (consumable) | | 2 Nos. |
| 86. | Piston Ring Remover and compressing tool | | 1 set each |

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| 87. | Fire extinguisher CO2, Mechanical Foam | | 1 each |
| 88. | Fire buckets and stands | | 1 No. |
| 89. | Tachometer (counting type) | | 1 No. |
| 90. | Puller set | 6 inch & 12 inch | 1 set |
| 91. | Lifting jack mechanical | 3 ton | 2 Nos. |
| 92. | Injection testing set (Hand operated) | | 1 No. |
| 93. | Injection cleaning kit | | 2 sets |
| 94. | Tube Expander with cutter (for copper tubes)s | | 1 Set |
| C. GENERAL MACHINERY | | | |
| 95. | Bench Grinder | with two 17.5 cm wheels | 1 No. |
| 96. | Arbor press hand operated | 2 ton capacity | 1 No. |
| 97. | Diesel engine cut away model two show working parts for demonstration | (One 2 stroke & one 4 stroke) | 1 No. |
| 98. | Diesel engine 4 stroke Multi cylinder | 4/6 vehicular type Indian Make contemporary model | 1 No. |
| 99. | Petrol engine (Running condition, car type) Indian make | | 1 No. |
| 100. | Diesel engine (Running condition) Stationary type | | 1 No. |
| 101. | Petrol engine vertical (2 stroke) | | 1 No. |
| 102. | Portable Hand Blower Electrically Operated | | 1 No. |
| 103. | Battery charger | | 1 No. |
| 104. | Hydrometer (consumable tool) | | 1 No. |
| D. WORKSHOP FURNITURE | | | |
| 105. | Work bench | 250x120x75 with four vices of 12.5 cm | 4 Nos. |

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| 106. | Locker | with 8 drawers (standard size) | 2 Nos. |
| 107. | Metal Rack | 180x150x45cm | 2 Nos. |
| 108. | Steel almirah / cupboard | | 1 No. |
| 109. | Black board and easel | | 1 No. |
| 110. | Instructor's Desk or table | | 1 No. |
| 111. | Chair | | 1 No. |

| TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS | | |
|--|--|-----------------|
| S No. | Name of the Equipment | Quantity |
| 1 | Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software | 10 Nos. |
| 2 | UPS - 500VA | 10 Nos. |
| 3 | Scanner cum Printer | 1 No. |
| 4 | Computer Tables | 10 Nos. |
| 5 | Computer Chairs | 20 Nos. |
| 6 | LCD Projector | 1 No. |
| 7 | White Board 1200mm x 900mm | 1 No. |
| <i>Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.</i> | | |

FORMAT FOR INTERNAL ASSESSMENT

| Name & Address of the Assessor: | | | Year of Enrollment: | | | | | | | | | | | |
|--|---------------------------------|------------------------|--|--------------------------------------|-------------------------|---|--------------------------|------------------------------------|-----------------------------|---------------------|------------------------|------|---------------------------------|--------------|
| Name & Address of ITI (Govt./Pvt.): | | | Date of Assessment: | | | | | | | | | | | |
| Name & Address of the Industry: | | | Assessment location: Industry / ITI | | | | | | | | | | | |
| Trade Name: | | Semester: | | Duration of the Trade/course: | | | | | | | | | | |
| Learning Outcome: | | | | | | | | | | | | | | |
| S No | Maximum Marks (Total 100 Marks) | | 15 | 5 | 10 | 5 | 10 | 10 | 5 | 10 | 15 | 15 | Total Internal Assessment Marks | Result (Y/N) |
| | Candidate Name | Father's/Mother's Name | Safety Consciousness | Workplace Hygiene | Attendance/ Punctuality | Ability to Follow Manuals/ Written Instructions | Application of Knowledge | Skills to Handle Tools & Equipment | Economical Use of Materials | Speed in Doing Work | Quality in Workmanship | VIVA | | |
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |