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

COMPETENCY BASED CURRICULUM

PUMP OPERATOR CUM MECHANIC

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

SECTOR – CONSTRUCTION

PUMP OPERATOR CUM MECHANIC

(Engineering Trade)

(Revised in 2015)

Version: 1.1

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

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Developed By

Ministry of Skill Development and Entrepreneurship

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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.

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1. COURSE INFORMATION

During one-year duration of "Pump Operator cum Mechanic" trade, a candidate is trained on Professional Skill, Professional Knowledge and Employability Skill. In addition to this, a candidate is entrusted to undertake project work, extracurricular activities and on-the-job training to build up confidence. The broad components covered under Professional skill subject are as below: -

The trainee learns toapply safe working practices in an automotive work shop; make choices to carry out marking out the components for basic fitting operations in the work shop; use different types of tools and work shop equipment in the Auto workshop; perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices. He/ she is able to use different type of fastening and locking devices in a vehicle; cutting tools in the work shop following safety precautions while grinding; perform basic fitting operations used in the work shop practices and inspection of dimensions; produce sheet metal components using various sheet metal operations; perform basic electrical testing in a vehicle; perform battery testing and charging operations; construct basic electronic circuits and testing; manufacture components with different types of welding processes in the given job and inspect the auto component using Non destructive testing methods.

During the later phase the trainee is familiarized with the identification of hydraulic and pneumatic components in a vehicle. He/she is able to identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed; diagnose and troubleshoot Diesel Engines for mechanical &electrical causes; servicing of plain/journal bearings, anti-friction bearings; identify and check functionality of major components and assemblies of reciprocating pumps, rotary pumps. They are trained to ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy; use different types of conventional and special tools, hardware, fasteners and work shop equipment in the workshop; trouble shooting of pumps; identify and check functionality of major components and assemblies of centrifugal pumps; identify and check functionality of major components and assemblies of submersible pumps; carryout repairs in the fuel feed system; apply safe working practices and environment regulation in an automotive workshop; construct electrical circuits and test its parameters by using electrical measuring instruments etc.

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 programs are delivered under the aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programs of NCVT for propagating vocational training.

Pump Operator cum Mechanic trade under CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of one-year duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill, knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by NCVT 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 work with due consideration to safety rules, Govt. Bye laws and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the work
- Check the components as per drawing for functioning, identify and rectify errors in components.
- Document the technical parameters related to the work undertaken.

2.2 CAREER PROGRESSION PATHWAYS

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

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	1050
2	Professional Knowledge (Trade Theory)	252
3	Workshop Calculation & Science	84
4	Engineering Drawing	126
5	Employability Skills	110
6	Library & Extracurricular activities	58
7	Project Work	160
8	Revision & Examination	240
	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 year itself.

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 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

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 Practical is 60% & minimum pass percent for Theory 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 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 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.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracyachieved 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.	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracyachieved 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) Weightage in the range of above 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% accuracyachieved 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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3. JOB ROLE

Brief description of job roles:

Pump-Station Operator,Waterworks;operates pumping equipment to transfer raw water to treatment plant, or distribute processed water to residential, commercial, and industrial establishments: Turns valves, pulls levers, and flips switches to operate and control turbine-or motor-driven pumps that transfer water from reservoir to treatment plant, or to transfer processed water to consumer establishments. Reads flow meters and gauges to regulate equipment according to water consumption and demand. Inspects equipment to detect malfunctions, such as pump leaks or worn bearings. Repairs and lubricates equipment, using hand tools. Records data, such as utilization of equipment, power consumption, and water output in log. May operate equipment to treat and process raw water. May test water for chlorine content, alkalinity, acidity, or turbidity.

Pump Man (Petroleum Refining);controls pumps and manifold systems to circulate crude semi compressed and finished petroleum products, water and chemical solutions through processing and storage departments of refinery according to schedules or instructions and plans movement of product through lines of processing and storage unit, utilizing knowledge of interconnections and capacities of pipelines, valve manifolds, pumps and tanks. Synchronizes activities with other pump houses to assure continuous flow of products and minimum contamination between products. Starts battery of pumps, observes pressure and flow meter and turns valve to regulate pumping speeds according to schedules. Turns hand wheels to open line valves to direct flow of product. Signals by telephone to operate pumps in designed units to open and closed pipeline and tank valves and to gauge, sample and determine temperature of tank contents. Records operating data, such as products and quantities pumped, stocks used, gauging results and operating time. May blend oil and gasoline. May repair pumps, lines and auxiliary equipment.

Reference NCO-2015:

a) 3132.0600 - Pump-Station Operator, Waterworks
b) 3134.0300 - Pump Man (Petroleum Refining)

4. GENERAL INFORMATION

Name of the Trade	**Pump Operator Cum Mechanic**
NCO – 2015	3132.0600; 3134.0300
NSQF Level	Level-4
Duration of Craftsmen Training	One year
Entry Qualification	Passed 10th class examination with Mathematics and Science
Unit Strength (No. Of Student)	20
Space Norms	84 Sq. m
Power Norms	11 KW
Instructors Qualification for	
1. Pump Operator cum Mechanic Trade	Degree in Civil/ Mechanical Engineering from recognized university with one year experience in relevant field. **OR** Diploma in Civil/ Mechanical Engineering from recognized board/college with two-year experience in relevant field. **OR** NTC/NAC passed in the Trade of "Pump Operator cum Mechanic" with three-year post qualification experience in the relevant field. **Essential Qualification:** Craft Instructor Certificate in relevant trade under NCVT. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	Degree in Engineering with one year experience. **OR** Diploma in Engineering with two-year experience. **Essential Qualification:** Craft Instructor Certificate in RoD&A course under NCVT.
3. Engineering Drawing	Degree in Engineering with one year experience. **OR** Diploma in Engineering with two-year experience. **OR** NTC/ NAC in the Draughtsman (Mechanical / Civil) with three-year experience.

	<u>Essential Qualification</u>: Craft Instructor Certificate in RoD&A course under NCVT.
4. Employability Skill	MBA OR BBA with two-year experience OR Graduate in Sociology/ Social Welfare/ Economics with two-year experience OR Graduate/ Diploma with two-year 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	Workshop Cal. &Sc.	Engg. Drawing	Employability Skills	Extra-curricular Activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

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5. NSQF LEVEL COMPLIANCE

NSQF level for **Pump Operator cum Mechanic 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
e. Responsibility

The Broad Learning outcome of **Pump Operator cum Mechanic 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/ ASSESSABLE 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 LEARNINGOUTCOME

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.
3. Demonstrate knowledge of concept and principles of basic arithmetic, algebraic, trigonometric, statistics, co-ordinate system and apply knowledge of specific area to perform practical operations.
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics &pneumatics.
5. Read and apply engineering drawing for different application in the field of work.
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity &quality.
7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.

6.2. SPECIFIC LEARNING OUTCOME

9. Comply environment regulations and housekeeping in the work shop.
10. Apply safe working practices in an automotive work shop.
11. Make choices to carry out marking out the components for basic fitting operations in the work shop.
12. Use different types of tools and work shop equipment in the Auto workshop.
13. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.
14. Use of different type of fastening and locking devices in a vehicle.
15. Use cutting tools in the work shop, following safety precautions while grinding.
16. Perform basic fitting operations used in the work shop practices and inspection of dimensions.
17. Produce sheet metal components using various sheet metal operations.
18. Perform basic electrical testing in a vehicle.
19. Perform battery testing and charging operations.
20. Construct basic electronic circuits and testing.
21. Manufacture components with different types of welding processes in the given job.
22. Inspect the auto component using Non destructive testing methods.
23. Identify the hydraulic and pneumatic components in a vehicle.

24. Identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed.
25. Diagnose and Troubleshoot Diesel Engines for Mechanical & Electrical causes.
26. Servicing of plain/journal bearings, anti-friction bearings.
27. Identify and check functionality of major components and assemblies of reciprocating pumps.
28. Identify and check functionality of major components and assemblies of rotary pumps.
29. Ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy.
30. Use different types of conventional and special tools, hardware, fasteners and work shop equipment in the workshop.
31. Trouble shooting of pumps.
32. Identify and check functionality of major components and assemblies of centrifugal pumps
33. Identify and check functionality of major components and assemblies of submersible pumps.
34. Carryout repairs in the fuel feed system.
35. Apply safe working practices and environment regulation in an automotive workshop.
36. Construct electrical circuits and test its parameters by using electrical measuring instruments.
37. Identify and check functionality of major components and assemblies of A.C motors.
38. Write the different type of keyways, preparing keys to fit into key ways.
39. Identify, select, and use different types of knots.
40. Identify, select, use of different types of lifting tackles.
41. Identify and check functionality of major components and assemblies of bushes, bearing sand couplings.

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7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNINGOUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1. Recognize & comply with 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 of 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 withregard 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	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, heat & temperature, heat treatment.

the field of study including basic electrical. *[Different mathematical calculation & science - Work, Power & Energy, Algebra, Geometry, Mensuration, Trigonometry, Heat & Temperature, elasticity]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply with 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 and earthing.
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]*	3.1 Read and 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.
	3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and measure dimension of components and record data.	4.1 Select appropriate measuring scale/tape/gauges.
	4.2 Measure dimension of the components/assembly & compare with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts.
6. Explain energy conservation, global	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain

warming and pollution and contribute in day-to-day work by optimally using available resources.	sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.	7.1 Explain personnel finance and entrepreneurship.
	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 familiarize with the Policies/Programmes & procedure & the available scheme.
	7.3 Prepare Project report to become an entrepreneur for submission to financial institutions.
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 OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
9. Comply with environment regulations and housekeeping in the work shop.	9.1 Identify environmental pollution and contribute to the avoidance of instances of environmental pollution
	9.2 Carryout maintenance and cleaning of work shop and lifting equipment
	9.3 Take opportunities to use energy and materials in an environmentally friendly manner
	9.4 Avoid waste and dispose waste as per procedure.
	9.5 Recognize different components of 5S and apply the same in the working environment.
10. Apply safe working practices in an automotive work shop.	10.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy
	10.2 Recognize and report all unsafe situations according to site policy
	10.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	10.4 Identify, handle and store/dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements
	10.5 Identify and observe site policies and procedures in regard to illness or accident.
	10.6 Identify safety alarms accurately.
	10.7 Report supervisor/competent of authority in the event of accidents or sickness of any staff and record accident details correctly according to site accident/injury procedures
	10.8 Identify and observe site evacuation procedures according to site policy.
	10.9 Identify personal protective equipment (PPE) and use the same as per related working environment
	10.10 Identify basic first aid and use them under different circumstances.
	10.11 Identify different fire extinguishers and use the same as per requirement.
11. Make choices to carry out marking out the	11.1 Mark according to drawings by using marking tools on the work pieces.

components for basic fitting operations in the work shop.	11.2 Chip the job in accordance with standard specifications and tolerances
	11.3 Measure all dimensions in accordance with standard specifications and tolerances
12. Use different types of tools and work shop equipment in the Auto work shop.	12.1 Identify the different types of hand and power tools used in the automotive workshop
	12.2 Operate various tools and work shop equipment.
13. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices	13.1 Measure all dimensions in accordance with standard specifications and tolerances by using precision measuring instruments
	13.2 Measure the parameters related with the vehicle components for its effective operation by matching with manufacturer's specification using different gauges
14. Use of different type of fastening and locking devices in a vehicle	14.1 Identify the different type of fasteners and locking devices used in the vehicle
	14.2 Use different types of locking devices correctly
	14.3 Specify the bolt and nut threads
	14.4 Practice on removing the damaged studs and bolts
15. Use cutting tools in the work shop, following safety precautions while grinding.	15.1 Identify cutting tool materials and their application
	15.2 Plan and grind cutting and marking tools
	15.3 Measure the tool angles with gauges.
16. Perform basic fitting operations used in the work shop practices and inspection of dimensions	16.1 Mark according to drawing by using marking tools on flat surfaces.
	16.2 Hack saw and file the job using different methods and perform in accordance with the standard specifications and tolerance.
	16.3 Drilling and reaming on flat surfaces.
	16.4 Identify and use hand tools for internal and external threading with taps and dies
	16.5 Measure all dimensions in accordance with standard specification and tolerances

17. Produce sheet metal components using various sheet metal operations.	17.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner
	17.2 Plan and organize the work for different types of sheet metal operations.
	17.3 Mark according to drawing by using marking tools on flat surfaces.
	17.4 Produce components as per the drawing
	17.5 Ascertain and select tools, equipment and materials for the job and make this available for use in a timely manner
	17.6 Plan and organize the work for pipe bending operations.
	17.7 Perform bending, soldering and brazing operations in accordance with standard operating procedure using appropriate tools.
	17.8 Check accuracy/correctness of the job using appropriate measuring instruments.
18. Perform basic electrical testing in a vehicle.	18.1 Plan and organize the work for auto electrical component testing.
	18.2 Tracing the auto electrical components in a vehicle.
	18.3 Test continuity and voltage drop in the electrical circuits.
	18.4 Operate the electrical components in a vehicle and test lamps.
19. Perform battery testing and charging operations.	19.1 Ascertain and select tools and materials for the job.
	19.2 Comply with safety rules when performing the following operations.
	19.3 Plan and select different methods for charging the battery.
	19.4 Perform battery testing as per the operating procedure.
20. Construct basic electronic circuits and testing.	20.1 Plan and select different types of basic electronic components and measuring instruments.
	20.2 Construct and test the basic electronic gate circuits and its components as per the standard procedure.
21. Manufacture components with	21.1 Plan and select appropriate method to produce components with welding process.

different types of welding processes in the given job.	21.2 Comply with safety rules when performing the above operations.
	21.3 Mark according to the drawing using marking tools on the job.
	21.4 Select appropriate tools and equipment to perform the above operations.
	21.5 Set up and produce component as per standard operating procedure.
22. Inspect the auto component using Nondestructive testing methods	22.1 Classify different vehicle components by its manufacturing processes.
	22.2 Ascertain and select tools and equipment to do NDT test the given job.
	22.3 Plan and organize the work for nondestructive testing.
	22.4 Perform different types of nondestructive tests using appropriate testing equipment
	22.5 Observe safety/precaution during testing the job.
23. Identify the hydraulic and pneumatic components in a vehicle.	23.1 Comply with safety rules when performing the following operations.
	23.2 Locate and identify the hydraulic components in a vehicle.
	23.3 Locate and identify the pneumatic components in a vehicle.
24. Identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed.	24.1 Identify the components of given stationary Diesel Engine and its function
	24.2 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	24.3 Plan work in compliance with standard safety norms.
	24.4 Demonstrate possible solutions and agree tasks within the team.
	24.5 Identify different gauges fitted on the board and check for proper functioning.
	24.6 Perform daily checks before starting the engine.
	24.7 Start the engine and allow it to warm up.
	24.8 Identify the problem in functionality of Tachometer, Odometer, temp and Fuel gauge under ideal and on load condition fitted on board and record the reading and

	compare it with standard reading.
	24.9 Repair / Replace the defective gauges as per standard operating practice.
	24.10 Check for proper functionality.
	24.11 Stop the engine.
25. Diagnose and Troubleshoot Diesel Engines for Mechanical & Electrical causes	25.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner
	25.2 Plan work in compliance with standard safety norms.
	25.3 Carryout the diagnostic procedure by reviewing engine technical workshop manual, following the standard diagnostic procedure for Engine cranks but Not Starting. High Fuel Consumption Engine overheating, Low Power Generation, Excessive oil consumption Low/High Engine Oil Pressure, Engine Noise.
26. Servicing of plain/journal bearings, anti-friction bearings	26.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner
	26.2 Plan work in compliance with standard safety norms.
	26.3 Use the tools and equipment in the way specified by manufacturers to Mounting of bearing on shafts and in housing with proper fit & axis alignment.
	26.4 Carryout their Mounting of bearing on shafts and in housing with proper fit & axis alignment by reviewing: Technical data Removal and replacement procedures Legal requirements
	26.5 Cleaning up & removing old metal form bearing and replacing with new metal
	26.6 Checking of shafts for alignment with dial indicator
27. Identify and check functionality of major components and assemblies of	27.1 Select, care and use of PPE while dismantling and assembling of reciprocating pumps.
	27.2 Select tools and materials for the job and make this available for use in a timely manner

reciprocating pumps.	27.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of reciprocating pumps.
	27.4 Carryout their Dismantling and assembling of reciprocating pumps by reviewing: Technical data removal and replacement procedures legal requirements
	27.5 Check for performance of reciprocating pumps
28. Identify and check functionality of major components and assemblies of rotary pumps.	28.1 Select, care and use of PPE while dismantling and assembling of rotary pumps.
	28.2 Select tools and materials for the job and make this available for use in a timely manner
	28.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of rotary pumps.
	28.4 Carryout their Dismantling and assembling of rotary pumps by reviewing: Technical data Removaland replacement procedures Legalrequirements
	31.1 Check for performance of rotary pumps.
29. Ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy.	29.1 Perform servicing of pumps & valves of given general purpose and of corrosive fluids.
	29.2 Select gasket, packing gland materials, mark & cut off gasket as per given shape & profile.
	29.3 Demonstrate us of gasket cement for fixing & stop leakage.
30. Use different types of conventional and special tools, hardware, fasteners and work shop equipment in the workshop.	30.1 Carryout maintenance of lubrication system.
	30.2 Perform fitting of flanges & assembling of given pipe work.
	30.3 Demonstrate use of tee, elbow, bend, socket, rectifiers and other pipe fittings for cutting threads & pipes.
31. Trouble shooting of pumps	31.1 Identity the common fault and take corrective action for reciprocating pumps, rotary pumps, centrifugal pumps and submersible pumps.
	31.2 Conduct appropriate and target oriented discussions with higher authority and within the team, where an replacement

	is uneconomic or unsatisfactory to perform.
	31.3 Use testing methods that comply with the manufacturer's requirements.
	31.4 Adjust the unit‟s components correctly where necessary to ensure that they operate to meet the specified operating requirements.
32. Identify and check functionality of major components and assemblies of centrifugal pumps.	32.1 Select, care and use of PPE while dismantling and assembling of centrifugal pumps.
	32.2 Select tools and materials for the job and make this available for use in a timely manner.
	32.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of centrifugal pumps.
	32.4 Carryout their Dismantling and assembling of centrifugal pumps by reviewing: Technical data Removaland replacement procedures Legalrequirements
	32.5 Check for performance of centrifugal pumps.
33. Identify and check functionality of major components and assemblies of submersible pumps.	33.1 Select, care and use of PPE while dismantling and assembling of submersible pumps.
	33.2 Select tools and materials for the job and make this available for use in a timely manner.
	33.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of submersible pumps.
	33.4 Carryout their Dismantling and assembling of submersible pumps by reviewing: Technical data Removal and replacement procedures Legal requirements
	33.5 Check for performance of submersible pumps.
34. Carryout repairs in the fuel feed system	34.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	34.2 Plan work in compliance with standard safety norms.
	34.3 Servicing the fuel tank & fuel pipe lines.

	34.4 Servicing of fuel pipes.
	34.5 Replace the air cleaner, fuel filter.
35. Apply safe working practices and environment regulation in an automotive workshop.	35.1 Explain the safety measures to be followed for given electrical work.
	35.2 Demonstrate treatment of electric shock in workshop.
36. Construct electrical circuits and test its parameters by using electrical measuring instruments.	36.1 Plan and organize the work for basic electrical operations.
	36.2 Select the tools, instruments and materials required to do the job.
	36.3 Comply with safety rules when performing the basic electrical operations.
	36.4 Perform electrical wire joints, form electrical circuits of series, parallel and combination of series & parallel circuits and test basic electrical parameters as per the circuit drawings and operating procedures.
37. Identify and check functionality of major components and assemblies of A.C motors	37.1 Select, care and use of PPE while dismantling and assembling of A.C motors.
	37.2 Select tools and materials for the job and make this available for use in a timely manner
	37.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of A.C motors.
	37.4 Carryout their Dismantling and assembling of A.C motors by reviewing: Technical data Removal and replacement procedures Legal requirements
	37.5 Measure speed of A.C motor using tachometer.
	37.6 Starting a single phase A.C motor with Direct on line (D.O.L)
	37.7 Starting a 3 phase motor with star-delta starter
	37.8 Checking for proper running of motor, overheating
38. Write the different type	38.1 Identify key as per given shaft, hub & keyways.

of keyways, preparing keys to fit into key ways.	38.2 Prepare keys to fit into key ways.
39. Identify, select & use of different types of knots.	39.1 Select, care and use of PPE while Practicing different types of knots.
	39.2 Select tools and materials such as hemp, manila, nylon, wire etc. for the different types of knots and make this available for use in a timely manner
	39.3 Detection of unsafe/defective conditions of ropes and knots.
40. Identify, select & use of different types of lifting tackles.	40.1 Select, care and use of PPE while Practicing use of different types of lifting tackles.
	40.2 Select tools and equipments such as Screw jacks, chain pulley block, crabs and winches, rollers and bars, levers, lashing and packing, Use of inclined plane, hydraulic trolleys for lifting practice.
	40.3 Care and maintenance of lifting equipment.
41. Identify and check functionality of major components and assemblies of bushes, bearings and couplings.	41.1 Select, care and use of PPE while dismantling and assembling of bushes, bearings and couplings.
	41.2 Select tools and materials for the job and make this available for use in a timely manner.
	41.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles bushes, bearings and couplings.
	41.4 Carryout their Dismantling and assembling of bushes, bearings and couplings by reviewing: Technical data Removal and replacement procedures Legal requirements
	41.5 Check and record results of performance of assembly.

8. SYLLABUS

SYLLABUS FOR PUMP OPERATOR CUM MECHANIC TRADE			
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
1	Comply with environment regulations and housekeeping in the work shop.	1. Familiarization with institute, Job opportunities in the automobile sector, Machinery used in Trade. (10hrs) 2. Types of work done by the students in the shop floor. (15hrs)	Admission & introduction to the trade: Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute, facilities available– Hostel, Recreation, Medical and Library working hours and time table
2	Apply safe working practices in an automotive work shop.	3. Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop.(5hrs) 4. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers.(5hrs) 5. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil. (10hrs) 6. Energy saving Tips of ITI electricity usage.(5hrs)	Occupational Safety & Health Importance Periodic testing of lifting equipment, Authorization of Moving &road testing vehicles. Energy conservation-Definition, Energy Conservation Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips.
3-5	Make choices to carry out marking out the components for basic fitting operations in the work shop.	7. Practice using all marking aids, like steel rule with spring calipers, dividers, scriber, punches, Chisel etc.(25hrs) 8. Layout a work piece- for line, circle, arcs and circles.(20hrs) 9. Practice to measure a wheel base of a vehicle with measuring tape.(30hrs)	Hand & Power Tools:- Marking scheme, Marking material-chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-prick punch, center punch, pin punch, hollow

			punch, number and letter punch. Chisel-flat, cross-cut.
5	Use different types of tools and work shop equipment in the Auto workshop.	10. Practice to measure valve spring tension using spring tension tester.(6hrs) 11. Practice to remove wheel lug nuts with use of an air impact wrench.(6hrs) 12. Practice on General workshop tools & power tools.(13hrs)	Hammer- ball peen, lump, mallet. Screw drivers-blade screwdriver, Phillips screw driver, Ratchet screwdriver. Allen key, bench vice & C-clamps, Spanners- ring spanner, open end spanner & the combination spanner, universal adjustable open end spanner. Sockets & accessories, Pliers - Combination pliers, multi grip, long nose, flat-nose, Nippers or pincer pliers, Side cutters, Tin snips, Circlip pliers, external circlips pliers. Air impact wrench, air ratchet, wrenches- Torque wrenches, pipe wrenches, car jet washers Pipe flaring &cutting tool, pullers-Gear and bearing.
6-7	Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	13. Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers.(5hrs) 14. Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other auto component measurement with depth micrometer.(5hrs) 15. Measuring practice on valve spring free length.(3hrs) 16. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges.(7hrs) 17. Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges.(6hrs) 18. Measuring practice to measure	Systems of measurement, Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

		wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator.(6hrs) 19. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge.(5hrs) 20. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge.(5hrs) 21. Practice to check engine manifold vacuum with vacuum gauge.(4hrs) 22. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.(4hrs)	
8	Use of different type of fastening and locking devices in a vehicle.	23. Practice on General cleaning, checking and use of nut, bolts, & studs etc. (15hrs) 24. Removal of stud/bolt from blind hole.(10hrs)	Fasteners- Study of different types of screws, nuts, studs & bolts, locking devices, Such as lock nuts, cotter, split pins, keys, circlips, lock rings, lock washers and locating where they are used. Washers & chemical compounds can be used to help secure these fasteners. Function of Gaskets, Selection of materials for gaskets and packing, oil seals.
9	Use cutting tools in the work shop, following safety precautions while grinding.	25. Practice on cutting tools like Hacksaw, file, chisel, sharpening of Chisels, center punch, safety precautions while grinding. (15hrs) 26. Practice on Hacksawing and filing to given dimensions. (10hrs)	Cutting tools :- Study of different type of cutting tools like Hacksaw, File- Definition, parts of a file, specification, Grade, shape, different type of cut and uses., OFF-hand grinding with sander, bench and pedestal grinders, safety precautions while grinding. Limits, Fits &Tolerances:- Definition of limits, fits & tolerances with examples used in auto components.

10 -11	Perform basic fitting operations used in the work shop practices and inspection of dimensions.	27. Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills. (8hrs) 28. Safety precautions to be observed while using a drilling machine. (10hrs) 29. Practice on Tapping a Clear and Blind Hole, Selection of tape drill Size, use of Lubrication, Use of stud extractor.(12hrs) 30. Cutting Threads on a Bolt/ Stud. (7hrs) 31. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.(13hrs)	Drilling machine - Description and study of Bench type Drilling machine, Portable electrical Drilling machine, drill holding devices, Work Holding devices, Drill bits. Taps and Dies: Hand Taps and wrenches, Calculation of Tap drill sizes for metric and inch taps. Different type of Die and Die stock. Screw extractors. Hand Reamers – Different Type of hand reamers, Drill size for reaming, Lapping, Lapping abrasives, type of Laps.
12	Produce sheet metal components using various sheet metal operations.	32. Practice on making Rectangular Tray. (8hrs) 33. Pipe bending, Fitting nipples unions in pipes.(10hrs) 34. Soldering and Brazing of Pipes. (7hrs)	Sheet metal - State the various common metal Sheets used in Sheet Metal shop Sheet metal operations - Shearing, bending, Drawing, Squeezing Sheet metal joints - Hem & Seam Joints Fastening Methods - Riveting, soldering, Brazing. fluxes used on common joints. Sheet and wire-gauges. The blow lamp- its uses and pipe fittings.
13	Perform basic electrical testing in a vehicle.	35. Practice in joining wires using soldering Iron.(6hrs) 36. Construction of simple electrical circuits.(8hrs) 37. Measuring of current, voltage and resistance using digital multimeter. (4hrs) 38. Practice continuity test for fuses, jumper wires, fusible links, circuit breakers.(7hrs)	Basic electricity, Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Mulitmeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings
14	-do-	39. Diagnose series, parallel, series-parallel circuits using Ohm’s law. (8hrs) 40. Check electrical circuit with a test lamp, perform voltage drop	Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits , Parallel circuits

		test in circuits using multimeter. (6hrs) 41. Measure current flow using multimeter/ammeter. (6hrs) 42. Use of service manualwiring diagram for troubleshooting. (5hrs)	and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.
15	Perform battery testing and charging operations.	43. Cleaning and topping up of a lead acid battery, Testing battery with hydrometer. (5hrs) 44. Connecting battery to a charger for battery charging.(3hrs) 45. Inspecting & testing a battery after charging.(5hrs) 46. Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. (7hrs) 47. Testing of relay and solenoids and its circuit.(5hrs)	Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, Heating effects, Thermo-electric energy, Thermisters, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
16	Construct basic electronic circuits and testing.	48. Identify and test power and signal connectors for continuity. (10hrs) 49. Identify and test different type of Diodes, NPN & PNP Transistors for its functionality. (10hrs) 50. Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches. (5hrs)	Basic electronics: Description of Semi conductors, Solid state devices- Diodes, Transistors, Thyristors, Uni Junction Transistors (UJT), Metal Oxide Field Effect Transistors (MOSFETs), Logic gates-OR, AND & NOT and Logic gates using switches.
17-18	Manufacture components with different types of welding processes in the given job.	51. Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding.(15hrs) 52. Setting of Gas welding flames. (10hrs) 53. Practice to make a straight beads and joints Oxy – Acetylene weldingFilm on Heat treatment process.(25hrs)	Introduction to welding and Heat Treatment Welding processes – Principles of Arc welding, brief description, classification and applications. Manual Metal Arc welding -principles, power sources, electrodes, welding parameters, edge preparation & fit up and welding techniques; Oxy – Acetylene welding - principles, equipment, welding

			parameters, edge preparation & fit up and welding techniques;. Heat Treatment Process– Introduction, Definition of heat treatment, Definition of Annealing, Normalizing, Hardening and tempering. Case hardening, Nitriding, Induction hardening and Flame Hardening process used in auto components with examples.
19	Inspect the auto component using Non destructive testing methods.	54. Practice on Liquid penetrant testing method and Magnetic particle testing method. (25hrs)	Non-destructive Testing Methods- Importance of Non-Destructive Testing In Automotive Industry, Definition of NDT, Liquid penetrant and Magnetic particle testing method – Portable Yoke method
20	Identify the hydraulic and pneumatic components in avehicle.	55. Identification of Hydraulic and pneumatic components used in vehicle.(6hrs) 56. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. (10hrs) 57. Identification of components in Air brake systems.(9hrs)	Introduction to Hydraulics & Pneumatics: - Definition of Pascal law, pressure, Force, viscosity. Description, symbols and application in automobile of Gear pump-Internal & External, single acting, double acting & Double ended cylinder; Directional control valves-2/2, 3/2, 4/2, 4/3 way valve, Pressure relief valve, Non return valve, Flow control valve used in automobile. Pneumatic Symbols, Description and function of air Reciprocating Compressor. Function of Air service unit (FRL- Filter, Regulator & Lubricator).
21	-do-	58. Identification of different type of Vehicle.(5hrs) 59. Demonstration of vehicle specification data.(5hrs) 60. Identification of vehicle information Number (VIN). (5hrs) 61. Demonstration of Garage,	Auto Industry - History, leading manufacturers, development in automobile industry, trends, new product. Brief about Ministry of Road transport & Highways, The Automotive Research Association of India (ARAI), National Automotive Testing and

		Service station equipment- Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.(10hrs)	R&D Infrastructure Project (NATRIP), & Automobile Association. Definition: - Classification of vehicles based on load as per central motor vehicle rule, wheels, final drive, and fuel used, axles, position of engine and steering transmission, body and load. Brief description and uses of Vehicle hoists – Two post and four post hoist, Engine hoists, Jacks, Stands.
22-23	**In-plant Training**		
24-26	**Revision**		
27-28	Identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed.	62. Identification of different type of stationary Engine and their applications.(10hrs) 63. Familiarization with diesel engines, tools and equipment required for maintenance, engine parts and their handling technique.(12hrs) 64. Starting and stopping of engines.(8hrs) 65. Running of engines and checking temperatures, fuel oil pressure and consumption on load and enginespeed. (20hrs)	Pump Industry in India - leading manufacturers, development in Pump Industry, trends, new product. Principle of **Compression-ignition engine,** Spark Ignition Engine, differentiate between 4-stroke and 2 stroke, C.I engine and S.I Engine, Otto cycle and Diesel cycle. Different type of starting and stopping method of Diesel Engine. Technical terms used in engine, Engine specification
29	-do-	66. Cleaning of fuel tank, checking leaks in the fuel lines. (6hrs) 67. Cutting, flaring of tubes to make T & Elbow fitting using unions.(6hrs) 68. Fitting of lubrication pump oil filters, air filters, checking and adjusting of oil pressure. (8hrs) 69. Preventive maintenance & repairing.(5hrs)	Procedure to clean fuel tank & check leak in the fuel line. Lubrication system – types, description and advantages of each over others. Filters and oil coolers – their description functions and method to overhaul for efficient functioning.
30	Diagnose and Troubleshoot Diesel Engines for	70. Practice on troubleshooting in for Engine Not starting – Mechanical & Electrical causes.	**Troubleshooting :**Causes and remedy for Engine Not starting – Mechanical & Electrical causes,

	Mechanical & Electricalcauses.	(8hrs) 71. High fuel consumption, Engine overheating.(4hrs) 72. Low Power Generation, Excessive oil consumption. (7hrs) 73. Low/High Engine Oil Pressure, Engine Noise.(6hrs)	High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.
31	Servicing of plain/journal bearings, anti-friction bearings.	74. Familiarization with plain/ journal bearings, anti-friction bearings used on machine assembly. (3hrs) 75. Specification & selection for appropriate use.(3hrs) 76. Use of manufacturers catalogues. (3hrs) 77. Mounting of bearing on shafts and in housing with proper fit & axis alignment.(4hrs) 78. Use of proper tools.(3hrs) 79. Removal of bearings from shafts &housing by using pullers. Cleaning up & removing old metal form bearing and replacing with new metal. (5hrs) 80. Checking of shafts for alignment with dial indicator. (4hrs)	Types of belt drives, velocity ratio of belt drive. Horse Power transmitted by belt. Ratio & driving tension in a belt. Parallel & cross belt drive, open & cross belt drive, angular belt drive. Methods of fixing and uses. Description, types and application of bushes, bearing and couplings. Procedure to fit bushes, bearings and coupling safely.
32	Identify and check functionality of major components and assemblies of reciprocating pumps.	81. Identification of different pumps, its components, prime movers.(5hrs) 82. Practice on operational safety. (5hrs) 83. Dismantling of reciprocating pumps- valves, pistons, cranks, seals etc. for inspection, repair & replacement.(8hrs) 84. Cleaning of parts & assembling. Installing of reciprocating pumps. (7hrs)	Pumps-its importance for agricultural & industrial applications. Classification of pumps, its prime movers, parts and operation safety. Classification of reciprocating pump, construction and operation. Installation technique of reciprocating pump. Tools and equipment required &procedure.
33	Identify and check functionality of	85. Dismantling of rotary pumps- impeller, shaft, bearing etc, for	Classification of rotary pumps- Construction and operation-

	major components and assemblies of rotary pumps.	inspection, Repair & replacement.(7hrs) 86. Cleaning of parts and assembling. (5hrs) 87. Checking for alignment, clearance, etc., Priming technique and its application. (6hrs) 88. Installing, operating & testing of rotary pumps.(7hrs)	repairing procedure. Brief description of turbine & stage pumps, positive displacements and their advantages. Meaning of priming and its effect. Installation techniques of rotary pump-procedure, tools and equipments required
34	Ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy.	89. Servicing of pumps and valves of general purpose and of corrosive fluids.(7hrs) 90. Selection of gasket, packing & gland materials, marking & cutting off gasket as per shape &profile. (8hrs) 91. Using gasket cement to stop leakage & for fixing. (10hrs)	Different types of valves-their description, advantages & use. Special pumps & glands used for corrosive fluids. Different gasket cement used to prevent leakage and advantages of each over the other. Principle of direct reading pressure and temperature measuring instruments. Method to read and application of pressure and temperature measuring instruments.
35	Use different types of conventional and special tools, hardware, fasteners and work shop equipment in the workshop.	92. Installation of seals leather polythene, asbestos, rope rubber and mechanical seals. (6hrs) 93. Maintenance of lubrication systems.(5hrs) 94. Fitting of flanges and assembling of pipe work, leak testing and rectification. (5hrs) 95. Use of tee, elbow, bend, socket, rectifiers and other pipe fittings.(5hrs) 96. Cutting threads for pipes. (4hrs)	Various seals- their use and places of application with advantages. Lubrication-types of lubricant use & methods of lubrication. Various tools and accessories used in pipe fitting with their details. Use of protecting caps on threads. Pipe fitting technique. Procedure to fit flanges & for leak testing
36	Trouble shooting of pumps.	97. Installation of stationary & coupled pumps, checking and correcting of alignment of pump with its prime movers and its serviceability test. (15hrs) 98. Testing of pumps for their	Method of install, align and testing of pumps for their serviceability. Concept of lightening torque for different sizes of bolts.

		delivery flow& pressure. (10hrs)	
37	Identify and check functionality of major components and assemblies of centrifugal pumps.	99. Reconditioning of centrifugal pumps.(25hrs)	Principle of centrifugal pump. Construction and operation of centrifugal pump in series and parallel. Finding out defects and method to recondition centrifugal pump.
38	Identify and check functionality of major components and assemblies of submersible pumps.	100. Dismantling, identifying of parts.(5hrs) 101. Finding out defects, repairing, and replacement of components.(7hrs) 102. Cleaning, assembling, installing and testing of submersible pumps.(6hrs) 103. Finding out & rectifying faults developed during operation. (7hrs)	Submersible pump- construction, operation and selection of appropriate type. Procedure to recondition, install and test of submersible pumps. Causes of failures and remedial measures.
39	Carry out repairs in the fuel feed system.	104. Identifying and rectifying defects of pump sets.(5hrs) 105. Practice on preventive & scheduled maintenance of pump sets.(20hrs)	Defects in pump sets- procedure for detection of causes & rectification. Purpose and procedure for balancing of rotor. Procedure to be followed for preventive & scheduled maintenance, planning for spares and other stores.
40	Apply safe working practices and environment regulation in an automotive workshop.	106. Familiarization with the safety precautions to be followed for electrical work.(7hrs) 107. Treatment for electrical shock. Use of hand tools connected with electrical work and maintenance of electrical machines.(18hrs)	Safety rules to be followed in connection with electrical work. First aid when affected by electrical shock. Purpose, types, description and method to use common electrical hand tools.
41-42	Construct electrical circuits and test its parameters by using electrical measuring instruments.	108. Verification of Ohm's law. (8hrs) 109. Building up of electrical series, parallel and combination of series & parallel circuits. (10hrs) 110. Measurement of current, voltage resistance.(7hrs) 111. Exercise on fixing and	Description and method to use current, voltage and resistance measuring instruments and precaution to be taken. Insulation Tester- description, method to use and precautions to be taken. Alternating current- Definition explanation and advantages over. Direct current and vice-versa.

		connecting switches holders, fuses, plugs sockets, Push buttons, etc.(12hrs) 112. Use of test lamp and neon tester. Identification of live, neutral and earthling wires. Measurement of electrical power and energy consumed for a definite period of time. (13hrs)	Concept and application of phase, star and delta connection. Procedure to identify live, neutral, single phase and 3-phase power supply. Method to measure power and energy consumed by electrical appliances using wattmeter and Energy meter
43	Identify and check functionality of major components and assemblies of A.Cmotors.	113. Identifying of A.C motors, their testing, identifying terminals, connecting running & reversing.(4hrs) 114. Measuring speed of A.C motor using tachometer with stop watch. Dismantling, assembling of A.C motors & identification of parts.(6hrs) 115. Starting a single phase A.C motor with Direct on line (D.O.L) starter.(4hrs) 116. Starting a 3 phase motor with star-delta starter. (4hrs) 117. Checking for proper running of motor, overheating etc. maintenance of motors use and connection of single phase preventer trouble shooting in circuit.(7hrs)	AC Motors – related terminology. Purpose, type, construction, operation, testing for correct functioning, maintenance and industrial applications. Trouble shooting & protection of induction motor.
44	Write the different type of keyways, preparing keys to fit into key ways.	118. Practice on making out key as per shaft, hub, keyways, preparing keys to fit into keyways.(25hrs)	Types of key and key ways, their uses and applications. Preparation of keys, allowable tolerance, clearances. Key fitting procedure-methods. Procedure for removing keys. Types & uses of key pullers.
45	Identify, select,& use different types of knots.	119. Identifying, selecting, use of different types of ropes such as hemp, manila, nylon, wire etc.(5hrs) 120. Practicing different types of knots and its applications. (6hrs)	Specification and use of different types of ropes such as hemp, manila, nylon, wire etc. Practicing different types of knots and its applications. Method of joining two ropes together for extension. Detection

		121. Method of joining two ropes, together for extension. (6hrs) 122. Detection of unsafe/defective conditions of ropes and knots.(8hrs)	of unsafe/defective conditions of ropes and knots. Specification and correct use of slings. Safety to be observed in use of ropes and slings.
46	Identify, select& use different types of liftingtackles.	123. Use of different types lifting tackles both mechanical and hydraulic such as – Screw jacks, chain pulley block, crabs and winches, rollers and bars, levers, lashing and packing. (10hrs) 124. Use of inclined plane, hydraulic trolleys etc.(8hrs) 125. Care and maintenance of lifting equipment and safety to be observed by handling the equipment.(7hrs)	Description, operation, purpose, application, care and use of Different types of lifting tackles for components of pump set. Precaution to be observed while using lifting tackles.
47	Identify and check functionality of major components and assemblies of bushes, bearing sand couplings.	126. Making different types of keys for fitting pulleys.(10hrs) 127. Assembling and dismantling of bushes, bearings and couplings maintaining safety.(15hrs)	Types of pulleys solid, split, "V" groove, step, cone, taper, guided and jockey or rider pulleys, their functions and uses. Procedure to assemble and dismantle pulleys and impellers from shafts following safety precautions
48-49	**In Plant Training**		
50-52	**Revision& Examination**		

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9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Duration: One Year		
S No.	**Workshop Calculation and Science**	**EngineeringDrawing**
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets. - Method of Folding of printed Drawing Sheet as per BIS SP:46-2003
2.	**Fractions**: Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments: their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins/ Clips.
3.	**Square Root**: Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines : - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	**Ratio &Proportion**: Simple calculation on related problems.	Free hand drawing of - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches.
5.	**Percentage**: Introduction, Simple calculation. Changing percentage to fraction and decimal & vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case. Dimensioning: Definition, types and methods of dimensioning (functional, non-functional and auxiliary),

		Types of arrowhead - Leader Line with text
6.	**Material Science**: Properties-Physical & Mechanical, Types–Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of wood (Iron), Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous Alloys.	Drawing of Geometrical Figures: Definition, nomenclature and practice of: - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
7.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight. Density,unit of density.Relation between mass, weight & density. Simple problems related to mass, weight, and density.	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple relatedproblems.	Method of presentation of Engineering Drawing - Pictorial View - Orthographic View - Isometric view
9.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Symbolic Representation used in the related trade (as per BIS SP:46-2003) of: - Fastener(Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
10.	**Basic Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
11.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semicircle Volume of solids – cube, cuboid, cylinder and Sphere.	**Dimensioning practice:** - The position of dimensioning (unidirectional, aligned, as per BIS SP:46-2003) Symbols preceding the value of the dimension and dimensional tolerance.

	Surface area of solids – cube, cuboid, cylinder and Sphere.	
12.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions. Drawing of Solid figures (Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
13.	**Elasticity:** Elastic & Plastic material. Stress & strain and their units. Young's modulus. Ultimate stress and breaking stress.	Free Hand sketch of hand tools and measuring tools used in the respective trades.
14.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, Scale of temperature, relations between different scale of temperature. Thermometer, pyrometer. Transmission of heat, conduction, convection, radiation. Thermal Conductivity, Heat loss and heat gain.	**Projections:** - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.
15.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, and their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. - Electrical insulating materials. - Basic concept of earthing.	Drawing of Orthographic projection in 3rd angle.
16.	**Levers and Simple Machines:** Levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.	Drawing of simple fastener (Rivet, Bolts, Nuts & Screw) - Riveted joints-Butt & Lap (Drawing one for each type).

17.	- Area of irregular surfaces. - Application related to shop problems.	Free hand sketching of simple objects related to trade.
18.	- Material weight and costing - problems related to trade.	- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries. - Simple exercises relating missing symbols. - Missing views
19.	- Heat treatmentand its necessity.	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related job/exercises with the dimensions from the given sample or models.
20.	-	Reading of fabricated engineering drawing

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9.2 EMPLOYABILITY SKILLS

CORE SKILL – EMPLOYABILITY SKILL	
Duration: 110 Hrs.	
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 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 the 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 Networking	Basic of Computer Networks (using real life examples), Definitions of

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, Webpage and Search Engines. Accessing the Internet using a 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 the phone. Nonverbal 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.
4. Entrepreneurship Skills	**Duration : 15 hrs.** **Marks : 06**
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-financial support agencies to familiarize with the Policies/ programs, 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/ 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 housekeeping, Practice of good housekeeping.
Quality Tools	Basic quality tools with a few examples.

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
PUMP OPERATOR CUM MECHANIC (For batch of 20 Candidates)			
A. TRAINEES TOOL KIT			
S No.	**Name of the Tools&Equipment**	**Specification**	**Quantity**
1.	Allen Key	set of 12 pieces (2mm to 14mm)	5+1 Nos.
2.	Caliper inside	15 cm Spring	6 Nos.
3.	Calipers outside	15 cm spring	6 Nos.
4.	Center Punch	10 mm. Dia. x 100 mm.	6 Nos.
5.	Dividers	15 cm Spring	6 Nos.
6.	Electrician Screw Driver	250mm	6 Nos.
7.	Hammer ball peen	0.5 kg with handle	6 Nos.
8.	Hands file	20 cm. Second cut flat	6 Nos.
9.	Philips Screw Driver	set of 5 pieces (100 mm to 300 mm)	6 Nos.
10.	Pliers combination	20 cm.	6 Nos.
11.	Screw driver	20cm.X 9mm. Blade	6 Nos.
12.	Screw driver	30 cm. X 9 mm. Blade	6 Nos.
13.	Scriber	15 cm	6 Nos.
14.	Spanner D.E.	set of 12 pieces (6mm to 32mm)	6 Nos.
15.	Spanner, ring	set of 12 metric sizes 6 to 32 mm.	6 Nos.
16.	Spanners socket with speed handle, T-bar, ratchet	universal upto 32mm set of 28 pieces with box	6 Nos.
17.	Steel rule	30 cm inch and metric	6 Nos.
18.	Steel tool box with lock and key (folding type)	400x200x150 mm	6 Nos.
19.	Wire cutter and stripper		6 Nos.
B. INSTRUMENT AND GENERAL SHOP OUTFIT			
20.	Adjustable spanner	Pipe wrench 350 mm	2 Nos.
21.	Air blow gun with standard accessories		1 No.

22.	Air impact wrench with standard accessories		4 Nos.
23.	Air ratchet with standard accessories		4 Nos.
24.	Allen Key	set of 12 pieces (2mm to 14mm)	4 Nos.
25.	Ammeter	300A/ 60A DC with external shunt	4 Nos.
26.	Angle plate adjustable	250x150x175	1 No.
27.	Angle plate	size 200x100x200mm	2 Nos.
28.	Anvil	50 Kgs with Stand	1 No.
29.	Auto Electrical test bench		1 No.
30.	Battery –charger		2 Nos.
31.	Bearing and gear tester		2Nos.
32.	Belt Tensioner gauge		1 No.
33.	Blow Lamp	1 litre	2 Nos.
34.	Bradawl		2Nos.
35.	Caliper inside	15 cm Spring	4 Nos.
36.	Calipers outside	15 cm spring	4 Nos.
37.	Cam lock type screw driver		1No.
38.	Car Jet washer with standard accessories		1 No.
39.	Carge winches	3, 5 tonnes	1 No.
40.	Chain pipe wrench	65 m	2Nos.
41.	Chain Pulley Block	3 ton capacity with tripod stand	1 No.
42.	Chisel	10 cm flat	4 Nos.
43.	Chisels cross cut	200 mm X 6mm	4 Nos.
44.	Circlip pliers Expanding and contracting type	15cm and 20cm each	4 Nos.
45.	Clamps C	100mm	2 Nos.
46.	Clamps C	150mm	2 Nos.
47.	Clamps C	200mm	2 Nos.
48.	Cleaning tray	45x30 cm.	4 Nos.
49.	Compression testing gauge suitable for diesel Engine		2 Nos.
50.	Copper bit soldering iron	0.25 Kg	5 Nos.
51.	Crab		1No.

52.	Cylinder bore gauge capacity	20 to 160 mm	4 Nos.
53.	DC Ohmmeter	0 to 300 Ohms, mid scales at 20 Ohms	4 Nos.
54.	Depth micrometer	0-25mm	4 Nos.
55.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)		4 Nos.
56.	Different type of Engine Bearing model		1 set
57.	Digital Tonge Tester	0-20 A AC	2Nos.
58.	Dividers	15 cm Spring	4 Nos.
59.	Drift Punch Copper	15 cm	4 Nos.
60.	Drill point angle gauge		1 No.
61.	Drill twist	1.5 mm to 15 mm (various sizes) by 0.5 mm	4 Nos.
62.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
63.	Electric testing screw driver		2 Nos.
64.	Energy meter, AC, Single Phase,	5 Amps, 230 Volts	2Nos.
65.	Engineers square	700 mm	4Nos.
66.	Engineers stethoscope		1 No.
67.	Feeler gauge	20 blades (metric)	4 Nos.
68.	File flat	20 cm bastard	4 Nos.
69.	File, half round	20 cm second cut	4 Nos.
70.	File, Square	20 cm second cut	4 Nos.
71.	File, Square	30 cm round	4 Nos.
72.	File, triangular	15 cm second cut	4 Nos.
73.	Files assorted sizes and types including safe edge file (20 Nos)		2 set
74.	Flat File	25 cm second cut	4 Nos.
75.	Flat File	35 cm bastard	4 Nos.
76.	Flow meter	0-400 lt/min	2Nos.
77.	Forks clips	02 tones (copa)	1 No.
78.	Forks clips	05 tones (copa)	1 No.
79.	Foundation bolt		4Nos.
80.	Gasket hollow punches	5, 6, 8, 10, 12, 19, 25 mm dia.	1set

81.	Glow plug tester		2 Nos.
82.	Granite surface plate	1600 x 1000 with stand and cover	1 No.
83.	Grease Gun		2 Nos.
84.	Growler		2 Nos.
85.	Hacksaw frame adjustable	20-30 cm	10Nos.
86.	Hammer Ball Peen	0.75 Kg	4 Nos.
87.	Hammer Chipping	0.25 Kg	4 Nos.
88.	Hammer copper	1 Kg with handle	4 Nos.
89.	Hammer Mallet		4 Nos.
90.	Hammer Plastic		4 Nos.
91.	Hand key way broacher		1 No.
92.	Hand operated chain pulley block		1 No.
93.	Hand operated crimping tool	(i) for crimping up to 4mm and (ii) for crimping up to 10mm	2 Nos.
94.	Hand reamers adjustable	10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75to 14.25 mm and 14.25 to 15.75 mm	2sets
95.	Hand Shear Universal	250mm	2 Nos.
96.	Hand vice	37 mm	2 Nos.
97.	Hollow Punch	set of seven pieces 6mm to 15mm	2 sets each
98.	Hydraulic wheel and bearing puller		2Nos.
99.	Injector – Multi hole type, Pintle type		4 each
100.	Injector cleaning unit		1 No.
101.	Injector testing set (Hand tester)		1 No.
102.	Insulated Screw driver	20 cm x 9mm blade	4 Nos.
103.	Insulated Screw driver	30 cm x 9mm blade	4 Nos.
104.	Ladle	150mm Dia	1 No.
105.	Left cut snips	250mm	4 Nos.
106.	Level bottle (sprit)	150 ml.	1 No.
107.	Lifting jack screw type	3 ton capacity	4 Nos.
108.	Magneto spanner	set with 8 spanners	1 set
109.	Magnifying glass	75mm	2 Nos.
110.	Manila ropes	12, 20, 30 mm dia.	2 sets

111.	Marking out table	90X60X90 cm.	1 No.
112.	Masonary bit	(Assorted up to 12 mm)	2set
113.	Master test bars (different size)		1 No.
114.	Megger	500 V	2Nos.
115.	Mobile crank		1 No.
116.	Multimeter digital		5 Nos.
117.	Oil can	0.5/0.25 liter capacity	2 Nos.
118.	Oil Stone	15 cm x 5 cm x 2.5 cm	1 No.
119.	Outside micrometer	0 to 25 mm	4 Nos.
120.	Outside micrometer	25 to 50 mm	4 Nos.
121.	Outside micrometer	50 to 75 mm	1 No.
122.	Outside micrometer	75 to 100 mm	1 No.
123.	Philips Screw Driver	set of 5 pieces (100 mm to 300 mm)	2 sets
124.	Pin spanner set		2Nos.
125.	Pipe cutting tool		2 Nos.
126.	Pipe flaring tool		2 Nos.
127.	Pipe wrench	45 mm	2 Nos.
128.	Pliers combination	20 cm.	2 Nos.
129.	Pliers flat nose	15 cm	2 Nos.
130.	Pliers round nose	15 cm	2 Nos.
131.	Pliers side cutting	15 cm	2 Nos.
132.	Plumb bob		1 No.
133.	Pneumatic scraper with adjustable stroke		2 Nos.
134.	Portable electric drill Machine		1 No.
135.	Portable jack		1 No.
136.	Power Supply	0-12 v, lamp	1 No.
137.	Pressure gauge	0 -5 Kg/cm2	2 Nos.
138.	Prick Punch	15 cm	4 Nos.
139.	Punch Letter	4mm (Number)	2 set
140.	Radius Gauge, Metric		2 Nos.
141.	Ratchet chain pulley		1 No.

142.	Rawl plug tool & kit		2 Nos.
143.	Right cut snips	250mm	4 Nos.
144.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm		4 Nos.
145.	Rollers (steel tubes) from	40 to 65 mm dia.	5 Nos.
146.	Rotary pump working for dismantling and assembling		1 No.
147.	Scientific Calculator		2 Nos.
148.	Scraper flat	25 cm	2 Nos.
149.	Scraper half round	25 cm	2 Nos.
150.	Scraper Triangular	25 cm	2 Nos.
151.	Screw jacks		1 No.
152.	Scriber	15 cm	2 Nos.
153.	Scriber with scribing black universal		2 Nos.
154.	Self alignment roller ball bearing		2 Nos.
155.	Set of stock and dies - Metric		2 sets
156.	Shear legs (tripod)		1 No.
157.	Shear Tin Man‟s	450 mm x 600mm	4 Nos.
158.	Sheet Metal Gauge		2 Nos.
159.	Sher Tinmans	300mm	4 Nos.
160.	Single Phase	220 V Capacitor type AC Meter squirrel gage Induction motor	1 No.
161.	Soldering Copper Hatchet type	500gms	4 Nos.
162.	Solid Parallels in pairs (Different size) in Metric		2 Nos.
163.	Spanner Clyburn	15 cm	1 No.
164.	Spanner D.E.	set of 12 pieces (6mm to 32mm)	4 Nos.
165.	Spanner T. flocks for screwing up and up-screwing inaccessible		2 Nos.
166.	Spanner, adjustable	15cm.	2 Nos.
167.	Spanner, ring	set of 12 metric sizes 6 to 32 mm.	2 Nos.
168.	Spanners socket with speed handle, T-bar, ratchet and universal upto		2 Nos.
169.	Spark lighter		2 Nos.

170.	Spark plug spanner	14mm x 18mm x Size	2 Nos.
171.	Square box wrenches		1 No.
172.	Square T-wrenches		1 No.
173.	SRDG ball bearing, DRDG ball bearing, self aligning ball bearing,		1 No.
174.	Steel measuring tape	10 meter in a case	4 Nos.
175.	Steel rule	15 cm inch and metric	4 Nos.
176.	Steel rule	30 cm inch and metric	4 Nos.
177.	Steel wire Brush	50mmx150mm	5 Nos.
178.	Straight edge gauge	2 ft.	2 Nos.
179.	Straight edge gauge	4 ft.	2 Nos.
180.	Stud extractor	set of 3	2 sets
181.	Stud remover with socket handle		1 No.
182.	Surface gauge with dial test indicator plunger type	i.e. 0.01 mm	2 Nos.
183.	Tachometer (Counting type)		1 No.
184.	Taps and Dies complete sets (5 types)		1 set
185.	Taps and wrenches - UNC, UNF and metric		2 sets
186.	Telescope gauge		4
187.	Temperature gauge	0-100 deg c	2 Nos.
188.	Thermostat		2 Nos.
189.	Thimbles of different sizes		2 Nos.
190.	Thread pitch gauge Metric,		1 No.
191.	Threaded fastener type B		2 Nos.
192.	Threaded fastener type C		2 Nos.
193.	Threaded fastener type F		2 Nos.
194.	Three cell torch		2 Nos.
195.	Three Phase	50 Hz, 5 HP AC squirrel gage induction motor with star delta starter	1 No.
196.	Timing lighter		1 No.
197.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
198.	Trammel	30 cm	2 Nos.

199.	Travelling and gantry cranes		1 No.
200.	Tube expander	up to 62 mm	1 No.
201.	Universal puller for removing pulleys, bearings		1 No.
202.	V‟ Block	75 x 38 mm pair with Clamps	2 Nos.
203.	Vacuum gauge to read	0 to 760 mm of Hg.	2 Nos.
204.	vernier caliper	0-300 mm with least count 0.02mm	4 Nos.
205.	Vibrometer		2 Nos.
206.	Vice grip pliers		2 Nos.
207.	Voltmeter	AC to 500 V	2 Nos.
208.	Wall hoists		1 No.
209.	Water pump for dismantling and assembling		2 Nos.
210.	Wattmeter	AC/DC, 0 to 10 Kw	2 Nos.
211.	Wire Gauge (metric)		5 Nos.
212.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	1 No.
C. GENERAL INSTALLATION/ MACHINERIES			
213.	Arbor press hand operated	2 ton capacity	1 No.
214.	Back pull out type centrifugal pump		1 No.
215.	Bench lever shears	250mm Blade x 3mm Capacity	1 No.
216.	Centrifugal pump coupled with mono block set		1 No.
217.	Diesel engine	2 stroke vertical (up to 10 KW/ ISHP)	1 No.
218.	Diesel Engine	4 stroke vertical (up to about 10 KW/ISHP)	1 No.
219.	Diesel Engine Driven portable pump set		1 No.
220.	Diesel Engine upto	3.5 KW /4.5 HP fitted with pump	1 No.
221.	Discrete Component Trainer / Basic Electronics Trainer		1 No.
222.	Drilling machine bench to drill	up to 12mm dia along with accessories	1 No.
223.	Dual Magnetization Yoke	AC / HWDC, 230 VAC, 50Hz	1 set
224.	Gas Welding Table	1220mm x760mm	2 Nos.

225.	Grinding machine (general purpose) D.E. pedestal	with 300 mmdia wheels rough and smooth	1 No.
226.	Horizontal split casing pump		1 No.
227.	Hydraulic jack HI-LIFT type	3 ton capacity,	1 No.
228.	Hydraulic Leak Testing equipment		1 No.
229.	Injector Testing set (Hand Tester)		1 No.
230.	Liquid penetrant Inspection kit		1 set
231.	Multi stage pump		1 No.
232.	Overhead tank, pump, minimum	5000 litres with level indicators and piping layout	1 No.
233.	Pipe Bending Machine (Hydraulic type)	12mm to 30mm	1 No.
234.	Pneumatic rivet gun		2 Nos.
235.	Portable electric drill Machine		1 No.
236.	Reciprocating Pump working for dismantling and assembling		1 No.
237.	Spring tension tester		1 No.
238.	Submersible pump set, eight stage	upto 10 KW/ 15 HP	1 No.
239.	Tin smiths bench folder	600 x 1.6mm	1 No.
240.	Trolley type portable air compressor single cylinder	with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1 No.
241.	Welding plant Oxy-Acetylene complete (high pressure)		1 No.
242.	Welding Transformer	(150-300 Amps)	1 No.
D. LIST OFCONSUMABLES			
243.	Battery- SMF		As required
244.	Brake fluids		As required
245.	Chalk, Prussian blue.		As required
246.	Chemical compound for fasteners		As required
247.	Diesel		As required
248.	Different type gasket material		As required
249.	Different type of oil seal		As required
250.	Drill Twist (assorted)		As required
251.	Engine coolant		As required
252.	Engine oil		As required

253.	Emery paper	36–60 grit , 80–120	As required
254.	Gear oils		As required
255.	Hacksaw blade (consumable)		As required
256.	Hand rubber gloves tested for	5000 V	5 pair
257.	Holders, lamp teakwood boards, plug sockets,		As required
258.	Hydrometer		As required
259.	Lapping abrasives		As required
260.	Leather Apron		As required
261.	Petrol		As required
262.	Power steering oil		As required
263.	Radiator Coolants		As required
264.	Safety glasses		As required
265.	Steel wire Brush	50mmx150mm	As required
266.	Gloves for Welding (Leather and Asbestos)		As required
267.	Block of timber (various sizes)		As required
268.	Various type of seal required for pump assembly		As required
E. CLASS ROOM FURNITURE			
269.	Book shelf (glass panel)	6½ „ x 3‟ x 1½‟	As required
270.	Computer Chair		1+1 Nos.
271.	Computer Table		1+1 Nos.
272.	Desktop computer and related MS office software		1+1 Nos.
273.	Discussion Table	8‟ x 4‟ x 2½ „	2 Nos.
274.	Fire Extinguishers, first- aid box		As required
275.	Instructional Material – NIMI Books/Ref.books		Asrequired
276.	Internet connection with all accessories		Asrequired
277.	Laser printer		1 No.
278.	LCD projector/ LED /LCD TV (42”)		1 No.
279.	Multimedia DVD for Automotive application/subjects		As required
280.	Online UPS 2KVA		1 No.
281.	Stools		20 Nos.
282.	Storage Rack	6½ „ x 3‟ x 1½‟	As required
283.	Storage shelf	6½ „ x 3‟ x 1½‟	As required.

284.	Suitable class room furniture		As required
285.	Suitable Work Tables with vices		As required
286.	Tool Cabinet	6½ „ x 3‟ x 1½‟	2 Nos.
287.	Trainees locker	6½ „ x 3‟ x 1½‟	2 Nos. to accommodate 20 Lockers

Note: -

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *Quantity marked with * has been increased as per the batch size.*
3. *Internet facility is desired to be provided in the class room.*

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TOOLS & EQUIPMENT 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.
Note: Above Tools &Equipment not required, if Computer LAB is available in the institute		

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ANNEXURE-II

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:	**Examination:**	**Duration of the Trade/course:**
Learning Outcome:		

S No.	**Candidate Name**	**Father's/Mother's Name**	Safety Consciousness	Workplace Hygiene & Economical use of materials	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to Handle Tools/ Equipment/ Instruments/ Devices	Economical use of Materials	Working Strategy	Quality in Workmanship/ Performance	VIVA	**Total Internal Assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														