



COMPETENCY-BASED CURRICULUM

FOR THE TRADE OF

PUMP OPERATOR CUM MECHANIC

UNDER

CRAFTSMAN TRAINING SCHEME (CTS)

IN SEMESTER PATTERN

**Government of India
Ministry of Skill Development and Entrepreneurship
Directorate General of Training**

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1. INTRODUCTION

India is one of the youngest nations in the world. Our youth are our strength. However, a challenge facing the country is that of skilling our youth as per the demands of the industry. Recognizing the need for quickly coordinating the skill development and entrepreneurship efforts of all concerned stakeholders, the Government of India created the Ministry of Skill Development and Entrepreneurship on 9th November, 2014. To create further convergence between the Vocational Training System through Industrial Training Institutes (ITIs) and the new skill initiatives of the Government, the Training and Apprenticeship Training divisions from the Directorate General of Employment and Training (DGET) under the Ministry of Labour and Employment stand transferred to the Ministry of Skill Development and Entrepreneurship (MSDE) with effect from 16th April, 2015. This move brings over 11000 ITIs and scores of other institutions, and the Apprenticeship and Training divisions, under the Ministry.

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training including Women's Vocational Training in our country. The Ministry conducts the vocational training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), Modular Employable Scheme (MES) under the Skill Development Initiative (SDI) Scheme, and Craftsmen Instructor Training Scheme (CITS) to cater the needs of different segments of the Labour market. The National Council for Vocational Training (NCVT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India. The day-to-day administration of the ITIs rests with the State Governments/ Union Territories.

- Training courses under the CTS is being offered through a network of more than 11000 Government and Private Industrial Training Institutes (ITIs) located all over the country with a total seating capacity of more than 16 Lakhs with an objective to provide skilled workforce to the industry in 126 trades. Skill development courses exclusively for women are also being offered under CTS and other schemes through Government and Private ITIs and Regional Vocational Training Institutes (RVTIs) for Women.
- The Apprentices Act, 1961 was enacted with the objective of regulating the program of apprenticeship training in the industry by utilizing the facilities available within for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart on the job training for school leavers, and ITI passed outs to develop skilled manpower for the industry.
- The Ministry is implementing the Employable Scheme (MES) under the Skill Development Initiative Scheme to provide vocational training to people to develop skilled manpower for the industry through a network of Vocational Training Providers (VTPs) located across the country.

Central Staff Training and Research Institute (CSTARI), Kolkata is the nodal institute for the development/revision of curricula under all vocational training schemes of the Ministry. National Instructional Media Institute (NIMI), Chennai is to make available instructional material in various trades for the use of trainees and trainers to ensure overall improvement in the standard of institutional training under the CTS and ATS schemes. The institute is actively involved in the development, production and dissemination of instructional media Packages (IMPs) comprising of books on Trade Theory, Trade Practical, Test/Assignment, and Instructor's Guide.

The National Skills Qualification Framework (NSQF), published in the Gazette of India on 27th December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main goal of the NSQF is to focus on competency-based qualifications, which in turn facilitate and enhance transparency, both within and between general and vocational streams. The National Skill Development Agency (NSDA) under the Ministry is responsible for anchoring and implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1) Process, (2) Professional knowledge, (3) Professional skill, (4) core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

The Ministry has set up Mentor Councils to focus on courses under NCVT in various sectors with representation from thought leaders among different stakeholders viz., industries, innovative entrepreneurs who have proved to be game-changers, academic/professional institutions, and champion ITIs for each of the sectors. The Mentor Council for each sector reviews curriculum, admission criteria, course duration, and requirement of trainers and assessment/evaluation systems for the sector on a continuous basis and make recommendations regarding the same. Sector-wise Core Groups are formed to plan and prepare the documentation for the competency-based curricula for the courses under each sector.

2. GENERAL INFORMATION

1	Qualification	PUMP OPERATOR CUM MECHANIC
2	N.C.O./NOS Code No.	7233.40
3	NSQF Level	Level 4
4	Duration of the course/qualification	1 year (Two Semester having duration of six months each)
5	Entry Qualification	Passed 10 th class examination with Maths and Science
6	Trainees per unit	16 + 30% super Numeric

Note:

- i) Out of the two Instructors required for a unit of 2(1+1), one must have Degree/Diploma, and other must have NTC/NAC qualifications, in the relevant field.
- ii) Qualification of the Instructor for WCS and ED must be as per the training manual.

Distribution of notional training hours of the training per week:

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

3. COURSE STRUCTURE

Name of the Qualification: PUMP OPERATOR CUM MECHANIC

Total duration of the course: 12 Months

Training duration details:

Course Elements	Hourly Distribution
Professional Skills	1100 HRS
Professional Knowledge	260 HRS
Workshop Calculation & Science	90 HRS
Engineering Drawing	130 HRS
Employability Skills	110 HRS
Extra Curricular Activities	90 HRS
In-plant Training/Project Work	120 HRS
Admission & Examination	80 HRS
Total	1980 hrs

4. JOB ROLES

4.1 Brief description

After successful completion of the above course, the trainee shall be able to perform the following skills with proper sequence.

- Repairs all types of pumps such as centrifugal, plunger types etc., according to specifications for pumping water, oil, air etc.,
- Dismantles pump using hand tools and examines mechanism to locate faults or damage, Repairs defective parts or obtains replacements, sets them in position and assembles pump.
- Tests reassembled or repaired unit for pressure, leakage etc., makes necessary adjustment and observes performance for appropriate yield of air, oil or water.
- May erect and install pumps at site and connect to motor power.
- May locate faults to electric system motor repaired such as rewinding of field coils or armatures by Electrician or Armature Winder. May specialise in repairing centrifugal or reciprocating pumps.
- Oil Engine Fitter repairs services and overhauls diesel or oil engines for efficient performance as prime mover to drive machinery and equipment. Examines engine to locate defects, using various tools and instruments.
- Dismantles or partly dismantles it to remove damaged or worn out parts and replaces or repairs them.
- Instals assembled or repaired engine in position and connects pulley or wheel to propulsion system. Starts engine, tunes it up and observes performance noting different meter readings. such as temperature, fuel level, oil pressure, etc. and sets it to specified standard for optimum performance.
- Checks, adjusts and lubricates engine periodically and performs such other functions to keep engine in good working order.
- May solder or braze parts and service diesel fuel pumps and injectors.
- Measures essential parts like cylinder, bores piston, sizes crank pins etc. using gauges, micrometer and other precision tools and gets cylinders re-bored, liners fitted, valve seats refaced, etc. as necessary.

Employment opportunities:

On successful completion of the course the candidates can either get employed, or become a self-employed Entrepreneur in any one of the following fields.

a) Wage Employment

1. Pump operator
2. Pump Service Mechanic
3. Pump Fitter in Pump Manufacturing Concern in Assembly Shop or Test Shop
4. Dealers service mechanic
5. Spare Parts Sales Assistant / Manufacturers' Representative
6. Laboratory Assistant

b) Self Employment

1. Pump Service Mechanic
2. Pump Operator
3. Spare Parts Salesman
4. Spare Parts Dealer

Further learning pathways:

- On successful completion of the course trainee can get themselves enrolled in Apprenticeship training in reputed Industrial organisation.
- The qualified candidates have scope for lateral entry into the Diploma courses offered by some of the State Governments

4.2 NOS & QP/NCO Mapping:

5. NSQF LEVEL COMPLIANCE

The Broad Learning outcomes of PUMP OPERATOR CUM MECHANIC trade under CTS 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. GENERAL TRAINING PLAN, EXAMINATION & PASS REGULATION

General Training Plan

The knowledge and skill components as stated in the section for 'learning outcomes' are to be imparted in accordance with the instructions in respect of the content and time structure.

Assessment

The assessment for the semester-based qualification is carried out by conducting formative assessments, and end-of-semester examinations, as per the guidelines given in the Curriculum. The internal assessments for theory subjects and practical are conducted for evaluating the knowledge and skill acquired by trainees and the behavioural transformation of the trainees as per the learning outcomes. Theory examinations are conducted in Trade Theory, Workshop Calculation & Science, Engineering Drawing and Employability Skills. Trade practical examinations are conducted by the respective State Governments. The details of the examination and assessment standard are in a latter section. NCVT prepares the question papers for the Trade practical. Candidates are to demonstrate that they can:

1. Read & interpret technical parameters/documentation, plan and organize work processes, and identify necessary materials and tools,
2. Perform a task/job with due consideration to safety rules, accident prevention regulations and environmental protection stipulations,
3. Apply Professional Knowledge, Core Skills, and Employability Skills while performing the task/job.
4. Check the task/job as per the drawing for proper functioning, and identify and rectify errors in the job, if any.
5. Document the technical parameters related to the task/job.

Pass regulation

For the purposes of determining the overall result, weightage of 25 percent is applied to each semester examination. The minimum pass percent for Practical is 60% & minimum pass percent for Theory subject is 40%.

7. LEARNING OUTCOMES

The following are minimum broad learning outcomes after completion of the PUMP OPERATOR CUM MECHANIC, course of 1 -year duration:

A. GENERIC OUTCOMES

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.
9. Understand and apply basic computer working, basic operating system, simulate part programme using simulation software and uses internet services to get accustomed & take benefit of IT developments in the industry.

B. SPECIFIC OUTCOMES

SEMESTER – I

1. Apply safe working practices in an automotive work shop.
2. Comply environment regulations and housekeeping in the work shop.
3. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.
4. Make choices to carry out marking out the components for basic fitting operations in the work shop.

5. Use different types of tools and work shop equipment in the Auto work shop.
6. Use of different type of fastening and locking devices in a vehicle.
7. Perform basic fitting operations used in the work shop practices and inspection of dimensions.
8. Grinding of cutting tools in the work shop.
9. Perform surface finishing operations in the given job.
10. Produce sheet metal components using various sheet metal operations.
11. Produce components using bending process in the given work piece.
12. Inspect the auto component using Nondestructive testing methods
13. Manufacture components with different types of welding processes in the given job.
14. Identify the hydraulic and pneumatic components in a vehicle.
15. Construct electrical circuits and test its parameters by using electrical measuring instruments.
16. Perform basic electrical testing in a vehicle.
17. Perform battery testing and charging operations.
18. Construct basic electronic circuits and testing.

SEMESTER - II

1. Apply safe working practices and environment regulation in an automotive work shop.
2. Use different types of conventional and special tools, hardware, fasteners and work shop equipment in the work shop.
3. Ascertain and select measuring instrument and measure dimension of components and evaluate for accuracy.
4. Identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed.
5. Carryout repairs in the fuel feed system
6. Diagnose and Troubleshoot Diesel Engines for Mechanical & Electrical causes
7. Servicing of plain/journal bearings, anti-friction bearings
8. Identify and check functionality of major components and assemblies of reciprocating pumps
9. Identify and check functionality of major components and assemblies of rotary pumps.
10. Identify and check functionality of major components and assemblies of centrifugal pumps
11. Identify and check functionality of major components and assemblies of submersible pumps
12. Trouble shooting of pumps
13. Write the different type of keyways, preparing keys to fit into keyways.
14. Construct electrical circuits and test its parameters by using electrical measuring instruments
15. Identify and check functionality of major components and assemblies of A.C motors
16. Identifying, selecting, use of different types of knots
17. Identifying, selecting, use of different types of lifting tackles
18. Identify and check functionality of major components and assemblies of bushes, bearings and couplings

8. ASSESSABLE OUTCOMES WITH ASSESSMENT CRITERIA

Note:

1. The training shall be conducted as per the syllabus.
2. The trainee shall demonstrate the competencies that are defined below in the assessable outcomes highlighted below.
3. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes on the basis of the formative assessment, Theory & Practical examinations, observation, and viva-voce.
4. The trainee shall be assessed for his/her achievement levels in all the assessable outcomes of the Employability Skills, Workshop Calculation & Science, and Engineering Drawing, on the basis of Theory Examinations, and for his/her ability to apply the concepts in Practical.
5. The assessable outcomes and assessment criteria will serve as a set of guidelines for Trainers, Paper setters, Moderators, and Assessors.

Assessable outcomes along with assessment criteria to be achieved after each semester and completion of qualification:

Generic assessable outcomes:

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly

	<p>according to site accident/injury procedures.</p> <p>1.8 Identify and observe site evacuation procedures according to site policy.</p> <p>1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.</p> <p>1.10 Identify basic first aid and use them under different circumstances.</p> <p>1.11 Identify different fire extinguisher and use the same as per requirement.</p> <p>1.12 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.</p> <p>1.13 Deploy environmental protection legislation & regulations</p> <p>1.14 Take opportunities to use energy and materials in an environmentally friendly manner</p> <p>1.15 Avoid waste and dispose waste as per procedure</p> <p>1.16 Recognize different components of 5S and apply the same in the working environment.</p>
2. Work in a team, understand and practice soft skills, technical English to communicate with required clarity.	<p>2.1 Obtain sources of information and recognize information.</p> <p>2.2 Use and draw up technical drawings and documents.</p> <p>2.3 Use documents and technical regulations and occupationally related provisions.</p> <p>2.4 Conduct appropriate and target oriented discussions with higher authority and within the team.</p> <p>2.5 Present facts and circumstances, possible solutions & use English special terminology.</p> <p>2.6 Resolve disputes within the team</p> <p>2.7 Conduct written communication.</p>
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.	<p>3.1 Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.</p> <p>3.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.</p>
4. Understand and explain basic science in the field of study including basic electrical, and hydraulics & pneumatics.	<p>4.1 Semester examination to test basic skills on science in the field of study including basic electrical and hydraulics & pneumatics.</p> <p>4.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.</p>
5. Read and apply engineering drawing for different application in the field of work.	<p>5.1 Semester examination to test basic skills on engineering drawing.</p> <p>5.2 Their applications will also be assessed during execution of assessable outcome and also tested during theory and practical examination.</p>
6. Understand and explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to	<p>6.1 Semester examination to test the concept in productivity, quality tools and labour welfare legislation.</p> <p>6.2 Their applications will also be assessed during execution of assessable outcome.</p>

improve productivity & quality.	
7. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	7.1 Semester examination to test knowledge on energy conservation, global warming and pollution. 7.2 Their applications will also be assessed during execution of assessable outcome.
8. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	8.1 Semester examination to test knowledge on personnel finance, entrepreneurship. 8.2 Their applications will also be assessed during execution of assessable outcome.
9. Understand and apply basic computer working, basic operating system, and uses internet services to get accustomed & take benefit of IT developments in the industry.	9.1 Semester examination to test knowledge on basic computer working, basic operating system and uses internet services. 9.2 Their applications will also be assessed during execution of assessable outcome.

Specific assessable outcomes:

Semester-I

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
1. Apply safe working practices in an automotive work shop.	1.1 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.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store/dispose off dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/competent of authority in the event of accidents 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 protective 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 extinguishers and use the same as per requirement.
2. Comply environment regulations and housekeeping in the work shop.	2.1 Identify environmental pollution and contribute to the avoidance of instances of environmental pollution.
	2.2 Carryout maintenance and cleaning of work shop and lifting equipment.
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner.
	2.4 Avoid waste and dispose waste as per procedure.
	2.5 Recognize different components of 5S and apply the same in the working environment.
3. Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	3.1 Measure all dimensions in accordance with standard specifications and tolerances by using precision measuring instruments.
	3.2 Measure the parameters related with the vehicle components for its effective operation by matching with manufacturer's specification using different gauges
4. Make choices to carry out marking out the components for basic fitting operations in the work shop.	4.1 Mark according to drawings by using marking tools on the work pieces.
	4.2 Chip the job in accordance with standard specifications and tolerances.
	4.3 Measure all dimensions in accordance with standard specifications and tolerances.
5. Use different types of tools and work shop equipment in the work shop.	5.1 Identify the different types of hand and power tools used in the automotive work shop.
	5.2 Operate various tools and work shop equipment.
6. Use of different type of fastening and locking devices in a vehicle	6.1 Identify the different type of fasteners and locking devices used in the vehicle.
	6.2 Use different types of locking devices correctly.
	6.3 Specify the bolt and nut threads.
	6.4 Practice on removing the damaged studs and bolts
7. Perform basic fitting operations used in the work shop practices and	7.1 Mark according to drawing by using marking tools on flat surfaces.
	7.2 Hack saw and file the job using different methods and perform in accordance with the standard specifications and

inspection of dimensions.	tolerances.
	7.3 Drilling and reaming on flat surfaces.
	7.4 Identify and use hand tools for internal and external threading with taps and dies.
	7.5 Measure all dimensions in accordance with standard specification and tolerances.
8. Grinding of cutting tools in the work shop	8.1 Identify cutting tool materials and their application.
	8.2 Plan and grind cutting and marking tools.
	8.3 Measure the tool angles with gauges.
9. Perform surface finishing operations in the given job.	9.1 Do surface finishing of the job to meet specifications by scraping.
	9.2 Sharpen the scraping tool by grinding.
	9.3 Check accuracy/correctness of the job using measuring instruments.
10. Produce sheet metal components using various sheet metal operations.	10.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	10.2 Plan and organize the work for different types of sheet metal operations.
	10.3 Mark according to drawing by using marking tools on flat surfaces.
	10.4 Produce components as per the drawing.
11. Produce components using bending process in the given work piece.	11.1 Ascertain and select tools, equipment and materials for the job and make this available for use in a timely manner.
	11.2 Plan and organize the work for pipe bending operations.
	11.3 Perform bending, soldering and brazing operations in accordance with standard operating procedure using appropriate tools.
	11.4 Check accuracy/correctness of the job using appropriate measuring instruments.
12. Inspect the auto component using Nondestructive testing methods	12.1 Classify different vehicle components by its manufacturing processes.
	12.2 Ascertain and select tools and equipment to do NDT test the given job.
	12.3 Plan and organize the work for nondestructive testing.
	12.4 Perform different types of nondestructive tests using appropriate testing equipment.
	12.5 Observe safety/precaution during testing the job.
13. Manufacture components with different types of welding processes in	13.1 Plan and select appropriate method to produce components with welding process.
	13.2 Comply with safety rules when performing the above operations.

the given job.	13.3 Mark according to the drawing using marking tools on the job.
	13.4 Select appropriate tools and equipment to perform the above operations.
	13.5 Set up and produce component as per standard operating procedure.
14. Identify the hydraulic and pneumatic components in a vehicle.	14.1 Comply with safety rules when performing the following operations.
	14.2 Locate and identify the hydraulic components in a vehicle.
	14.3 Locate and identify the pneumatic components in a vehicle.
15. Construct electrical circuits and test its parameters by using electrical measuring instruments.	15.1 Plan and organize the work for basic electrical operations.
	15.2 Select the tools, instruments and materials required to do the job.
	15.3 Comply with safety rules when performing the basic electrical operations.
	15.4 Perform electrical wire joints, form electrical circuits and test basic electrical parameters as per the circuit drawings and operating procedures.
16. Perform basic electrical testing in a vehicle.	16.1 Plan and organize the work for auto electrical component testing.
	16.2 Tracing the auto electrical components in a vehicle.
	16.3 Test continuity and voltage drop in the electrical circuits.
	16.4 Operate the electrical components in a vehicle and test lamps.
17. Perform battery testing and charging operations.	17.1 Ascertain and select tools and materials for the job.
	17.2 Comply with safety rules when performing the following operations.
	17.3 Plan and select different methods for charging the battery.
	17.4 Perform battery testing as per the operating procedure.
18. Construct basic electronic circuits and testing.	18.1 Plan and select different types of basic electronic components and measuring instruments.
	18.2 Construct and test the basic electronic gate circuits and its components as per the standard procedure.

Semester-II

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
19. Identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed.	19.1 Identify the components of given stationary Diesel Engine and its function
	19.2 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	19.3 Plan work in compliance with standard safety norms.

	19.4 Demonstrate possible solutions and agree tasks within the team.
	19.5 Identify different gauges fitted on the board and check for proper functioning.
	19.6 Perform daily checks before starting the engine.
	19.7 Start the engine and allow it to warm up.
	19.8 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.
	19.9 Repair / Replace the defective gauges as per standard operating practice.
	19.10 Check for proper functionality
	19.11 Stop the engine.
20. Carryout repairs in the fuel feed system	20.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	20.2 Plan work in compliance with standard safety norms.
	20.3 Servicing the fuel tank & fuel pipe lines
	20.4 Servicing of fuel pipes
	20.5 Replace the air cleaner, fuel filter
21. Diagnose and Troubleshoot Diesel Engines for Mechanical & Electrical causes	21.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	21.2 Plan work in compliance with standard safety norms.
	21.3 Carryout the diagnostic procedure by reviewing engine technical workshop manual, following the standard diagnostic procedure for. <ul style="list-style-type: none"> • Engine cranks but Not Starting. • High Fuel Consumption • Engine overheating, • Low Power Generation, • Excessive oil consumption, • Low/High Engine Oil Pressure, • Engine Noise.
22. Servicing of plain/journal bearings, anti-friction bearings	22.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	22.2 Plan work in compliance with standard safety norms.
	22.3 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.
	22.4 Carryout their Mounting of bearing on shafts and in housing with proper fit & axis alignment by reviewing: <ul style="list-style-type: none"> • Technical data • removal and replacement procedures • legal requirements
	22.5 Cleaning up & removing old metal form bearing and replacing with new metal
	22.6 Checking of shafts for alignment with dial indicator.
23. Identify and check functionality of major components and assemblies of reciprocating pumps.	23.1 Select, care and use of PPE while dismantling and assembling of reciprocating pumps.
	23.2 Select tools and materials for the job and make this available

	for use in a timely manner
	23.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of reciprocating pumps.
	23.4 Carryout their Dismantling and assembling of reciprocating pumps by reviewing: <ul style="list-style-type: none"> • Technical data • removal and replacement procedures • legal requirements
	23.5 Check for performance of reciprocating pumps
24. Identify and check functionality of major components and assemblies of rotary pumps.	24.1 Select, care and use of PPE while dismantling and assembling of rotary pumps.
	24.2 Select tools and materials for the job and make this available for use in a timely manner
	24.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of rotary pumps.
	24.4 Carryout their Dismantling and assembling of rotary pumps by reviewing: <ul style="list-style-type: none"> • Technical data • removal and replacement procedures • legal requirements
	24.5 Check for performance of rotary pumps.
25. Identify and check functionality of major components and assemblies of centrifugal pumps.	25.1 Select, care and use of PPE while dismantling and assembling of centrifugal pumps.
	25.2 Select tools and materials for the job and make this available for use in a timely manner
	25.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of centrifugal pumps.
	25.4 Carryout their Dismantling and assembling of centrifugal pumps by reviewing: <ul style="list-style-type: none"> • Technical data • removal and replacement procedures • legal requirements
	25.5 Check for performance of centrifugal pumps.
26. Identify and check functionality of major components and assemblies of submersible pumps.	26.1 Select, care and use of PPE while dismantling and assembling of submersible pumps..
	26.2 Select tools and materials for the job and make this available for use in a timely manner
	26.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of submersible pumps.
	26.4 Carryout their Dismantling and assembling of submersible pumps by reviewing: <ul style="list-style-type: none"> • Technical data • removal and replacement procedures • legal requirements
	26.5 Check for performance of submersible pumps.
27. Trouble shooting of pumps	27.1 Identity the common fault and take corrective action for reciprocating pumps, rotary pumps, centrifugal pumps and submersible pumps.
	27.2 Conduct appropriate and target oriented discussions with higher

	authority and within the team, where an replacement is uneconomic or unsatisfactory to perform
	27.3 Use testing methods that comply with the manufacturer's requirements.
	27.4 Adjust the unit's components correctly where necessary to ensure that they operate to meet the specified operating requirements.
28. Construct electrical circuits and test its parameters by using electrical measuring instruments.	28.1 Plan and organize the work for basic electrical operations.
	28.2 Select the tools, instruments and materials required to do the job.
	28.3 Comply with safety rules when performing the basic electrical operations.
	28.4 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.
29. Identify and check functionality of major components and assemblies of A.C motors	29.1 Select, care and use of PPE while dismantling and assembling of A.C motors
	29.2 Select tools and materials for the job and make this available for use in a timely manner
	29.3 Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of A.C motors .
	29.4 Carryout their Dismantling and assembling of A.C motors by reviewing: Technical data removal and replacement procedures legal requirements
	29.5 Measure speed of A.C motor using tachometer
	29.6 Starting a single phase A.C motor with Direct on line (D.O.L)
	29.7 Starting a 3 phase motor with star-delta starter
	29.8 Checking for proper running of motor, overheating
30. Identifying, selecting, use of different types of knots	30.1 Select, care and use of PPE while Practicing different types of knots
	30.2 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
	30.3 Detection of unsafe/defective conditions of ropes and knots.
31. Identifying, selecting, use of different types of lifting tackles.	31.1 Select, care and use of PPE while Practicing use of different types of lifting tackles
	31.2 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.
	31.3 Care and maintenance of lifting equipment
32. Identify and check functionality of major components and assemblies of bushes, bearings and couplings	32.1 Select, care and use of PPE while dismantling and assembling of bushes, bearings and couplings
	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 bushes, bearings and couplings
	32.4 Carryout their Dismantling and assembling of bushes, bearings and couplings by reviewing: <ul style="list-style-type: none"> • Technical data • removal and replacement procedures • legal requirements
	32.5 Check and record results of performance of assembly.

9. SYLLABUS CONTENT WITH TIME STRUCTURE

SYLLABUS FOR THE TRADE OF MECHANIC MOTOR CYCLE

9.1 Syllabus Content for Professional Skill & Knowledge

First Semester (Semester Code No. _____)

Duration: Six Months

Learning Objectives (1st Semester)

- Introduce the occupational safety & health risks and procedures in the trade
- Instruct the usage of measurement systems for engine components
- Instruct the usage of the right tools and equipment used in the workshop for marking, fitting, filing, cutting, drilling, reaming and welding
- Introduce the tolerances and fits and their applications in automotive engineering production.
- Instruct the Mechanical properties of materials, Heat treatment processes, Hydraulic and Pneumatic and their application in automotive Engineering.
- Introduce basic electricity and electronics

Detailed Syllabus:

Syllabus for Trade practical and Trade Theory

Week No.	Trade Practical (27 Hrs/week)	Trade Theory (5 Hrs/week)
1	Familiarisation with institute, Job opportunities in the automobile sector, Machinery used in Trade. Types of work done by the students in the shop floor.	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	Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. Interaction with health centre and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. Demonstration on safe handling and	Occupational Safety & Health Importance of Safety and general Precautions to be observed in the shop. Basic first aid, safety signs - for Danger, Warning, caution & personal safety message. Safe handling of Fuel Spillage, Fire extinguishers used for different types of fire. Safe disposal of toxic dust, safe handling and Periodic testing of lifting equipment, Authorization of Moving & road testing vehicles. Energy conservation-Definition, Energy Conservation

	Periodic testing of lifting equipment, and Safety disposal of Used engine oil. Energy saving Tips of ITI electricity Usage	Opportunities (ECOs)-Minor ECos and Medium ECOs, Major ECOs), Safety disposal of Used engine oil, Electrical safety tips.
3-5	Practice using all marking aids, like steel rule with spring calipers, dividers, scribe, punches, Chisel etc., Layout a work piece- for line, circle, arcs and circles. Practice to measure a wheel base of a vehicle with measuring tape. Practice to measure valve spring tension using spring tension tester Practice to remove wheel lug nuts with use of an air impact wrench Practice on General workshop tools & power tools.	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, scribe, punches-prick punch, center punch, pin punch, hollow punch, number and letter punch. Chisel-flat, cross-cut. Hammer- ball pein, 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	Measuring practice on Cam height, Camshaft Journal dia, crankshaft journal dia, Valve stem dia, piston diameter, and piston pin dia with outside Micrometers. 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. Measuring practice on valve spring free length. Measuring practice on cylinder bore, Connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges. Measuring practice on cylinder bore for taper and out-of-round with Dial bore gauges. Measuring practice to measure wear on crankshaft end play, crankshaft run out, and valve guide with dial indicator. Measuring practice to check the flatness of the cylinder head is warped or twisted with straightedge is used with a feeler gauge. Measuring practice to check the end gap of a piston ring, piston-to-cylinder wall clearance with feeler gauge.	Systems of measurement, Description, care & use of - Micrometers- Outside and depth mirometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge, tire pressure gauge.

	Practice to check engine manifold vacuum with vacuum gauge. Practice to check the air pressure inside the vehicle tires is maintained at the recommended setting.	
8 & 9	Practice on General cleaning, checking and use of nut, bolts, & studs etc., Removal of stud/bolt from blind hole. Practice on cutting tools like Hacksaw, file, chisel, Sharpening of Chisels, center punch, safety precautions while grinding. Practice on Hacksawing and filing to given dimensions.	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. 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	Practice on Marking and Drilling clear and Blind Holes, Sharpening of Twist Drills Safety precautions to be observed while using a drilling machine. Practice on Tapping a Clear and Blind Hole, Selection of tap drill Size, use of Lubrication, Use of stud extractor. Cutting Threads on a Bolt/ Stud. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.	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	Practice on making Rectangular Tray. Pipe bending, Fitting nipples unions in pipes. Soldering and Brazing of Pipes.	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	Practice in joining wires using soldering Iron, Construction of simple electrical circuits, Measuring of current, voltage and resistance using digital multimeter, practice continuity test for fuses, jumper wires, fusible links, circuit breakers.	<u>Basic electricity</u> , Electricity principles, Ground connections, Ohm's law, Voltage, Current, Resistance, Power, Energy. Voltmeter, ammeter, Ohmmeter Multimeter, Conductors & insulators, Wires, Shielding, Length vs. resistance, Resistor ratings
14	Diagnose series, parallel, series-parallel circuits using Ohm's law, Check electrical circuit with a test lamp, perform voltage drop test in circuits using multimeter, measure	Fuses & circuit breakers, Ballast resistor, Stripping wire insulation, cable colour codes and sizes, Resistors in Series circuits, Parallel circuits and Series-parallel circuits, Electrostatic effects, Capacitors and its applications, Capacitors in series and parallel.

	current flow using multimeter /ammeter, use of service manual wiring diagram for troubleshooting.	
15	Cleaning and topping up of a lead acid battery, Testing battery with hydrometer, Connecting battery to a charger for battery charging, Inspecting & testing a battery after charging, Measure and Diagnose the cause(s) of excessive Key-off battery drain (parasitic draw) and do corrective action. Testing of relay and solenoids and its circuit.	Description of Chemical effects, Batteries & cells, Lead acid batteries & Stay Maintenance Free (SMF) batteries, Magnetic effects, <u>Heating effects</u> , Thermo-electric energy, Thermistors, Thermo couples, Electrochemical energy, Photo-voltaic energy, Piezo-electric energy, Electromagnetic induction, Relays, Solenoids, Primary & Secondary windings, Transformers, stator and rotor coils.
16	Identify and test power and signal connectors for continuity, Identify and test different type of Diodes, NPN & PNP Transistors for its functionality, Construct and test simple logic circuits OR, AND & NOT and Logic gates using switches.	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	Practice to make straight beads and Butt, Lap & T joints Manual Metal Arc Welding. Setting of Gas welding flames, practice to make a straight beads and joints Oxy – Acetylene welding Film on Heat treatment process	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 & 20	Practice on Liquid penetrant testing method and Magnetic particle testing method. Identification of Hydraulic and pneumatic components used in vehicle. Tracing of hydraulic circuit on hydraulic jack, hydraulic power steering, and Brake circuit. Identification of components in Air brake systems.	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 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	Identification of different type of Vehicle. Demonstration of vehicle specification data; Identification of vehicle information	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 R&D Infrastructure Project

	Number (VIN). Demonstration of Garage, Service station equipments.- Vehicle hoists – Two post and four post hoist, Engine hoists, <u>Jacks</u> , Stands.	(NATRIP), & Automobile Association. Definition: - Classification of vehicles on the basis of 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, <u>Jacks</u> , Stands.
22-23	In-plant Training	
24-25	Revision and Test	
26	NCVT Exam	

Second Semester (Semester Code No. _____)

Duration: Six Months

Learning Objectives (2nd Semester)

- Trouble shooting for diesel engines & its component and their repairing
- Write the different type of keyways, preparing keys to fit into keyways.
- Identifying, selecting, use of different types of ropes.
- Use of different types lifting tackles both mechanical and hydraulic.
- Removal of bearings from shafts & housing by using pullers.
- Dismantling and assembling of reciprocating pumps, rotary pumps, centrifugal pumps,
- Identifying and rectifying defects of pump sets.
- Practice on preventive & scheduled maintenance of pump sets.
- Building up of electrical series, parallel and combination of series & parallel circuits.
- Identifying of A.C motors, their testing.

Week NO.	Trade Practical (28 Hrs/week)	Trade Theory (6 Hrs/week)
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Detailed Syllabus:
Syllabus for Trade practical and Trade Theory

1 & 2	<p>Identification of different type of stationary Engine and their applications.</p> <p>Familiarisation with diesel engines, tools and equipment required for maintenance, engine parts and their handling technique. Starting and stopping of engines. Running of engines and checking temperatures, fuel oil pressure and consumption on load and engine speed.</p>	<p>Pump Industry in India - leading manufacturers, development in Pump Industry, trends, new product.</p> <p>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.</p> <p>Different type of starting and stopping method of Diesel Engine. Technical terms used in engine, Engine specification</p>
3.	<p>Cleaning of fuel tank, checking leaks in the fuel lines. Cutting, flaring of tubes to make T & Elbow fitting using unions. Fitting of lubrication pump oil filters, air filters, checking and adjusting of oil pressure. Preventive maintenance & repairing.</p>	<p>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.</p>
4.	<p>Practice on troubleshooting in for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.</p>	<p>Troubleshooting : Causes and remedy for Engine Not starting – Mechanical & Electrical causes, High fuel consumption, Engine overheating, Low Power Generation, Excessive oil consumption, Low/High Engine Oil Pressure, Engine Noise.</p>
5.	<p>Familiarization with plain/journal bearings, anti-friction bearings used on machine assembly. Specification & selection for appropriate use. Use of manufacturers catalogues.</p> <p>Mounting of bearing on shafts and in housing with proper fit & axis alignment.</p> <p>Use of proper tools. Removal of bearings from shafts & housing by using pullers.</p> <p>Cleaning up & removing old metal from bearing and replacing with new metal.</p> <p>Checking of shafts for alignment with dial indicator.</p>	<p>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.</p>
6.	<p>Identification of different pumps, its components, prime movers. Practice on operational safety Dismantling of reciprocating pumps- valves, pistons, cranks, seals etc. for inspection, repair & replacement. Cleaning of parts & assembling. Installing of reciprocating pumps.</p>	<p>Pumps-its importance for agricultural & industrial applications. Classification of pumps, its prime movers, parts and operation safety.</p> <p>Classification of reciprocating pump, construction and operation. Installation technique of reciprocating pump. Tools and equipment required & procedure.</p>
7.	<p>Dismantling of rotary pumps- impeller, shaft, bearing etc, for inspection, Repair & replacement. Cleaning of parts and assembling. Checking for alignment, clearance, etc., Priming technique and its application. Installing, operating & testing of rotary pumps.</p>	<p>Classification of rotary pumps- Construction and operation- 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</p>

8.	<p>Servicing of pumps and valves of general purpose and of corrosive fluids. Selection of gasket, packing & gland materials, marking & cutting off gasket as per shape & profile. Using gasket cement to stop leakage & for fixing</p>	<p>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.</p>
9.	<p>Installation of seals leather polythene, asbestos, rope rubber and mechanical seals. Maintenance of lubrication systems. Fitting of flanges and assembling of pipe work, leak testing and rectification. Use of tee, elbow, bend, socket, rectifiers and other pipe fittings. Cutting threads for pipes.</p>	<p>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</p>
10	<p>Installation of stationary & coupled pumps, checking and correcting of alignment of pump with its prime movers and its serviceability test. Testing of pumps for their delivery flow & pressure.</p>	<p>Method of install, align and testing of pumps for their serviceability. Concept of lightening torque for different sizes of bolts.</p>
11	<p>Reconditioning of centrifugal pumps.</p>	<p>Principle of centrifugal pump. Construction and operation of centrifugal pump in series and parallel. Finding out defects and method to recondition centrifugal pump.</p>
12	<p>Dismantling identifying of parts, finding out defects, repairing, and replacement of components, cleaning, assembling, installing and testing of submersible pumps. Finding out & rectifying faults developed during operation.</p>	<p>Submersible pump- construction, operation and selection of appropriate type. Procedure to recondition, install and test of submersible pumps. Causes of failures and remedial measures.</p>
13	<p>Identifying and rectifying defects of pump sets. Practice on preventive & scheduled maintenance of pump sets.</p>	<p>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.</p>
14	<p>Familiarization with the safety precautions to be followed for electrical work. Treatment for electrical shock. Use of hand tools connected with electrical work and maintenance of electrical machines.</p>	<p>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.</p>
15 & 16	<p>Verification of Ohm's law. Building up of electrical series, parallel and combination of series & parallel circuits. Measurement of current, voltage resistance. Exercise on fixing and connecting switches holders, fuses, plugs sockets, Push buttons, etc. Use of test lamp and neon tester. Identification of live, neutral and earthing wires. Measurement of electrical power and energy consumed for a definite period of time.</p>	<p>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. 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</p>

		meter.
17	Identifying of A.C motors, their testing, identifying terminals, connecting running & reversing. Measuring speed of A.C motor using tachometer with stop watch. Dismantling, assembling of A.C motors & identification of parts. Starting a single phase A.C motor with Direct on line (D.O.L) starter. Starting a 3 phase motor with star-delta starter. Checking for proper running of motor, overheating etc. maintenance of motors use and connection of single phase preventor trouble shooting in circuit.	AC Motors – related terminology. Purpose, type, construction, operation, testing for correct functioning, maintenance and industrial applications. Trouble shooting & protection of induction motor.
18	Practice on making out key as per shaft, hub, keyways, preparing keys to fit into keyways.	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.
19	Identifying, selecting, 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 of unsafe/defective conditions of ropes and knots.	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 of unsafe/defective conditions of ropes and knots. Specification and correct use of slings. Safety to be observed in use of ropes and slings.
20	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. Use of inclined plane, hydraulic trolleys etc. Care and maintenance of lifting equipment and safety to be observed by handling the equipment.	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.
21	Making different types of keys for fitting pulleys, Assembling and dismantling of bushes, bearings and couplings maintaining safety.	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
22-23	In Plant Training	
24-25	Revision and test	
26	NCVT Exam	

9.2 SYLLABUS CONTENT OF CORE SKILLS

First Semester
(Semester Code no. - 01)
Duration: Six Month

LEARNING OBJECTIVES OF 1ST SEMESTER

1. Demonstrate basic arithmetic to derive value of unknown quantity / variable.
2. Understand & apply engineering material, their classification, properties and applications in the day to day technical application.
3. Explain & apply speed, velocity, work, power & energy for application in field of work.
4. Understand & explain importance of engineering drawing, drawing instruments, their standard & uses.
5. Draw lines, geometrical figures, free hand sketches.
6. Understand and apply sizes & layout of drawing sheet, method of presentation of engineering drawing & symbolic representation as per BIS standards

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
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 <ul style="list-style-type: none"> - 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 <ul style="list-style-type: none"> - 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 : <ul style="list-style-type: none"> - 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.	Drawing of Geometrical Figures: Definition, nomenclature and practice of <ul style="list-style-type: none"> - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	Percentage : Introduction, Simple calculation. Changing percentage to decimal	Lettering and Numbering as per BIS SP46-2003: <ul style="list-style-type: none"> - Single Stroke, Double Stroke, inclined, Upper case and Lower case.

	and fraction and vice-versa.	
6.	Material Science : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	Dimensioning: <ul style="list-style-type: none"> - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
7.	Mass, Weight and Density : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of <ul style="list-style-type: none"> - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	Speed and Velocity : Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets <ul style="list-style-type: none"> - 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)
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.	Method of presentation of Engineering Drawing <ul style="list-style-type: none"> - Pictorial View - Orthogonal View - Isometric view
10.	-----	Symbolic Representation (as per BIS SP:46-2003) of : <ul style="list-style-type: none"> - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings

Second Semester
(Semester Code no. - 02)
Duration: Six Month

LEARNING OBJECTIVES OF 2ND SEMESTER

1. Demonstrate basic algebraic, mensuration, trigonometric facts and formulas to derive value of unknown quantity / variable.
2. Apply the factual knowledge of basic heat & temperature, basic electricity for day to day practical application.
3. Explain & apply principles of simple machine & levers for mechanical advantage, efficiency for practical application.
4. Draw & practice dimensioning, construction of solid figures and projections as per IS specifications.

Sl. No.	Professional Knowledge	Professional Knowledge & Skills
	Workshop Calculation and Science	Engineering Drawing
1.	Algebra : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	Mensuration : Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere.	Practice of Lettering and Title Block
3.	Trigonometry : Trigonometrical ratios, measurement of angles. Trigonometric tables	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
4.	Heat & Temperature : Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse& Parabola)

5.	<p>Basic Electricity: Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy.</p>	<p>Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.</p>
6.	<p>Levers and Simple Machines: levers and its types.</p> <p>Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.</p>	<p>Free Hand sketch of hand tools and measuring tools used in respective trades.</p>
7.		<p>Projections:</p> <ul style="list-style-type: none"> - 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.
8.		<p>Drawing of Orthographic projection from isometric/3D view of blocks</p>
9.		<p>Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)</p>
10.		<p>Drawing details of two simple mating blocks and assembled view.</p>

9.3 SYLLABUS CONTENT OF EMPLOYABILITY SKILLS

General Information

Name of the subject	: EMPLOYABILITY SKILLS																		
Applicability	: CTS- Mandatory for all trades ATS- Mandatory for fresher only																		
Hours of Instruction	110 Hrs.																		
Examination	: The examination shall be held at the end of semesters.																		
Instructor Qualification	<ul style="list-style-type: none"> • MBA or BBA with two years' experience or Graduate in Sociology/ Social Welfare/ Economics with Two years' experience or Graduate/ Diploma with Two years' experience and trained in Employability Skills from ITIs 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 DGET institutes 																		
Instructor	<p>One full time regular instructor shall be engaged on every 240 number of trainees for teaching the subject 'Employability Skills'. One additional full time regular instructor would be required on increase in every 240 trainees. Wherever the trainees are less than 240 or part thereof, a part-time instructor may be engaged to teach the subject. This has been illustrated in the table below:</p> <table border="1"> <thead> <tr> <th>S. No.</th> <th>Number of trainees</th> <th>Instructor (s) required</th> </tr> </thead> <tbody> <tr> <td>a)</td> <td>Less than 240</td> <td>One part-time Instructor</td> </tr> <tr> <td>b)</td> <td>240</td> <td>One full-time Instructor</td> </tr> <tr> <td>c)</td> <td>Between 240 and 480</td> <td>One full-time Instructor + One part-time Instructor</td> </tr> <tr> <td>d)</td> <td>Between 480 and 720</td> <td>Two full-time Instructors + One part-time Instructor</td> </tr> <tr> <td>e)</td> <td>Between 720 and 960</td> <td>Three full-time Instructors + One part-time Instructor</td> </tr> </tbody> </table>	S. No.	Number of trainees	Instructor (s) required	a)	Less than 240	One part-time Instructor	b)	240	One full-time Instructor	c)	Between 240 and 480	One full-time Instructor + One part-time Instructor	d)	Between 480 and 720	Two full-time Instructors + One part-time Instructor	e)	Between 720 and 960	Three full-time Instructors + One part-time Instructor
S. No.	Number of trainees	Instructor (s) required																	
a)	Less than 240	One part-time Instructor																	
b)	240	One full-time Instructor																	
c)	Between 240 and 480	One full-time Instructor + One part-time Instructor																	
d)	Between 480 and 720	Two full-time Instructors + One part-time Instructor																	
e)	Between 720 and 960	Three full-time Instructors + One part-time Instructor																	

Semester-wise Distribution of Topics (Employability Skill)

Course Duration	Topics		Examination
	Semester 1	Semester 2	
01 Year (Two semesters)	<ol style="list-style-type: none">1. English Literacy2. I.T. Literacy3. Communication Skills	<ol style="list-style-type: none">1. Entrepreneurship Skills2. Productivity3. Occupational Safety , Health, and Environment Education4. Labour Welfare5. Legislation6. Quality Tools	Final examination at the end of second semester

LEARNING OBJECTIVES OF 1ST SEMESTER

1. Read, write and communicate in English language for day to day work.
2. Communicate in written and oral and with required clarity ensuring that the information communicated is clear, concise and accurate.
3. Understand and apply basic computer working, basic operating system and uses internet services to get accustomed & take benefit of IT developments in the industry.

1. English Literacy	
Hours of Instruction: 20 Hrs.	
Marks Allotted: 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 know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	
Hours of Instruction: 20 Hrs.	
Marks Allotted: 09	
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The 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 of 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 and INTERNET	<p>Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication.</p> <p>Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT – ACT, types of cyber crimes.</p>
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3. Communication Skills

Hour of Instruction: 15 Hrs.Marks Allotted: 07

Topic	Contents
Introduction to Communication Skills	Communication and its importance
	Principles of Effective communication
	Types of communication – verbal, nonverbal, written, email, talking on 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

SEMESTER-II

LEARNING OBJECTIVES OF 2ND SEMESTER

1. Knowledge of business activities, ability to interact with consumers for development of businesses.
2. Understand and apply productivity, its benefits and factors affecting the productivity.
3. Follow and maintain procedures to achieve a safe working environment in line with occupational health, safety, environment regulations and Labour welfare legislation and requirements.
4. Understand and apply quality concepts as per ISO and BIS system and its importance.
5. Recognize different components of 5S and apply the same in the working environment.

4. Entrepreneurship skill Hour of Instruction: 15 Hrs.Marks Allotted: 06	
Topic	Content
Business & Consumer:	Types of business in different trades and the importance of skill, Understanding the consumer, market through consumer behavior, market survey, Methods of Marketing, publicity and advertisement
Self Employment:	Need and scope for self-employment, Qualities of a good Entrepreneur (values attitude, motive, etc.), SWOT and Risk Analysis
Govt Institutions :	Role of various Schemes and Institutes for self-employment i.e. DIC, SIDBI, MSME, NSIC, Financial institutions and banks
Initiation Formalities :	Project Formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment Procedure - Loan Procurement - Agencies - banking Process
5. Productivity Hour of Instruction: 10 Hrs.Marks Allotted: 05	
Productivity	Definition, Necessity, Meaning of GDP.

Benefits	Personal / Workman – Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.
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 & Environment Hour of Instruction: 15 Hrs.Marks Allotted: 06	
Safety & Health :	Introduction to Occupational Safety and Health and its importance at workplace
Occupational Hazards :	Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention
Accident & safety :	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 provisions of safety, health, welfare under legislation of India
7.Labour Welfare Legislation Hour of Instruction: 05 Hrs.Marks Allotted: 03	
Labour Welfare Legislation	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 Hour of Instruction: 10 Hrs.Marks Allotted: 05	
Quality Consciousness :	Meaning of quality, Quality Characteristic
Quality Circles :	Definition, Advantage of small group activity, objectives of Quality Circle, Roles and Functions of Quality Circles in organisation, 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.5S Principles of Housekeeping: SEIRI – Segregation, SEITON – Arrangement, SEISO – Cleaning, SEIKETSU – maintenance of Standards, SHITSUKE - Discipline

10. INFRASTRUCTURE

1. Instructors' Qualification	<p>a) Degree in Automobile/ Mechanical Engg./Electrical Eng from recognised college/University with one year experience in the relevant field.</p> <p style="text-align: center;">OR</p> <p>Diploma in Automobile/ Mechanical Engg /Electrical Engg From recognized board of technical education with two years experience in the relevant field</p> <p style="text-align: center;">OR</p> <p>10th Passed + NTC/NAC in the Trade of “Pump Operator Cum Mechanic” with 3 years post qualification experience in the relevant field</p> <p style="text-align: center;">and</p> <p>b) With “National Crafts Instructor Certificate”.</p>
Desirable qualification	Preference will be given to a candidate with CIC (Craft Instructor Certificate) in PUMP OPERATOR CUM MECHANIC Trade.
3. Space Norms	Space Area 100 Sq. Mt. (Including parking area)
4. Power Norms	11 KW
5.Tools, Equipment & General Machinery	(As per Annexure II)

Note:

- i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma, and other must have NTC/NAC qualifications.
- ii) Instructor qualification for WCS and E.D, as per the training manual.
- iii) The list of Tools, Equipment& General Machinery listed in Annexure – II is for a particular trade (MECHANIC MOTOR CYCLE) comprising of TWO semesters and not for a single semester.

11. ASSESSMENT STANDARD

11.1.ASSESSMENT GUIDELINES:

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

Assessment shall be evidence based comprising the following:

- 1) Job carried out in labs/workshop
- 2) Record book/ daily diary
- 3) Answer sheet for assessment
- 4) Viva-voce
- 5) Progress Chart
- 6) Attendance and punctuality
- 7) Assignment
- 8) Project work

Evidence of internal assessment should be preserved for an appropriate period of time for audit and verification by examination body.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work that demonstrates attainment of an acceptable standard of craftsmanship. In this work there is evidence of:

- Demonstration of good skill in the use of hand tools, machine tools, and workshop equipment
- Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- A fairly good level of neatness and consistency in the finish
- Occasional support in completing the project/job.

b) Weightage in the range of above 75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work that demonstrates attainment of a reasonable standard of craftsmanship. In this work there is evidence of:

- Good skill levels in the use of hand tools, machine tools, and workshop equipment

- 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- 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 under following performance level:

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. In this work there is evidence of:

- High skill levels in the use of hand tools, machine tools, and workshop equipment
- Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.
- A high level of neatness and consistency in the finish.
- Minimal or no support in completing the project.

11.2. INTERNAL ASSESSMENT (FORMATIVE ASSESSMENT)

Comp. No.	ASSESSABLE OUTCOME	INTERNAL ASSESSMENT Marks
GENERIC		
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 concepts of 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 the day to day work by optimally using available resources.	
8	Explain personnel finance, entrepreneurship, and manage/organize related task in the day to day work for personal & societal growth.	
9	Understand and apply basic computer working, basic operating system, and uses internet services to get accustomed & take benefit of IT developments in the industry.	
SPECIFIC		
SL NO.	ASSESSABLE OUTCOME	INTERNAL ASSESSMENT MARKS
1	Apply safe working practices in an automotive work shop	
2	Comply environment regulations and housekeeping in the work shop.	
3	Perform precision measurements on the components and compare parameters with specifications used in automotive work shop practices.	
4	Make choices to carry out marking out the components for basic fitting operations in the work shop.	
5	Use different types of tools and work shop equipment in the Auto work shop.	
6	Use of different type of fastening and locking devices in a vehicle	
7	Perform basic fitting operations used in the work shop practices and inspection of dimensions.	
8	Grinding of cutting tools in the work shop.	
9	Perform surface finishing operations in the given job.	

10	Produce sheet metal components using various sheet metal operations	
11	Produce components using bending process in the given work piece.	
12	Inspect the auto component using Nondestructive testing methods	
13	Manufacture components with different types of welding processes in the given job.	
14	. Identify the hydraulic and pneumatic components in a vehicle.	
15	Construct electrical circuits and test its parameters by using electrical measuring instruments.	
16	Perform basic electrical testing in a vehicle.	
17	Perform battery testing and charging operations.	
18	Construct basic electronic circuits and testing	
Sub-Total of Internal assessment for Semester- I		100
19	Identify and check functionality of stationary Diesel Engine - components, & engine performance on load and engine speed.	
20	Carryout repairs in the fuel feed system	
21	Diagnose and Troubleshoot Diesel Engines for Mechanical & Electrical causes	
22	Servicing of plain/journal bearings, anti-friction bearings	
23	Identify and check functionality of major components and assemblies of reciprocating pumps	
24	Identify and check functionality of major components and assemblies of rotary pumps	
25	Identify and check functionality of major components and assemblies of centrifugal pumps	
26	Identify and check functionality of major components and assemblies of submersible pumps	
27	Trouble shooting of pumps	
28	Construct electrical circuits and test its parameters by using electrical measuring instruments	
29	Identify and check functionality of major components and assemblies of A.C motors	
30	Identifying, selecting, use of different types of knots	
31	Identifying, selecting, use of different types of lifting tackles	
32	Identify and check functionality of major components and assemblies of bushes, bearings and couplings	
Sub-Total of Internal assessment for Semester- II		100
Total of Internal assessment		

Note: The generic outcome to be assessed along with the specific outcome.

11.3 FINAL ASSESSMENT- All India Trade TEST (SUMMATIVE ASSESSMENT)

- There shall be a single objective type Examination paper for the subjects Engineering Drawing and Workshop Calculation & Science.
- There shall be a single objective type Examination paper for the subjects Trade Theory and Employability Skills.
- The two objective type Examination papers as mentioned above shall be conducted by National Council for Vocational Training (NCVT), whereas examination for the subject Trade Practical shall be conducted by the State Governments. NCVT shall supply the Question Paper for the subject Trade Practical.

MARKING PATTERN		
Sl. No.	Subject for the trade test	Maximum marks for the each subject
	Practical	300
	Trade Theory	200 Objective type Written Test of 200 marks (Trade Theory 150 Marks & Employability Skills 50 marks)
	Employability Skills	
	Workshop Calculation and Science.	100 Objective Type Written test of 100 marks (Engineering Drawing 50 marks & Workshop Calculation and Science 50 marks)
	Engineering Drawing	
	Internal assessment	100
TOTAL:		700

Annexure - I
TRADE: Pump Operator Cum Mechanic

LIST OF TOOLS & EQUIPMNT

A. TRAINEES TOOL KIT per 4 Trainees FOR 20 TRAINEES +1 ISTRUCTOR

Sl.No.	Item with specification	Qty (Nos.)
1.	Allen Key set of 12 pieces (2mm to 14mm)	(5+1)
2.	Caliper inside 15 cm Spring	6
3.	Calipers outside 15 cm spring	6
4.	Center Punch 10 mm. Dia. x 100 mm.	6
5.	Dividers 15 cm Spring	6
6.	Electrician Screw Driver 250mm	6
7.	Hammer ball peen 0.5 kg with handle	6
8.	Hands file 20 cm. Second cut flat	6
9.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	6
10.	Pliers combination 20 cm.	6
11.	Screw driver 20cm.X 9mm. Blade	6
12.	Screw driver 30 cm. X 9 mm. Blade	6
13.	Scriber 15 cm	6
14.	Spanner D.E. set of 12 pieces (6mm to 32mm)	6
15.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	6
16.	Spanners socket with speed handle, T-bar, ratchet and universal upto 32 mm set of 28 pieces with box	6
17.	Steel rule 30 cm inch and metric	6
18.	Steel tool box with lock and key (folding type) 400x200x150 mm	6
19.	Wire cutter and stripper	6

B. Tools Instruments and General Shop outfits

Sl.No.	Item with specification	Qty. (Nos)
1.	Adjustable spanner (pipe wrench 350 mm)	2
2.	Air blow gun with standard accessories	1
3.	Air impact wrench with standard accessories	4
4.	Air ratchet with standard accessories	4
5.	Allen Key set of 12 pieces (2mm to 14mm)	4
6.	Ammeter 300A/ 60A DC with external shunt	4
7.	Angle plate adjustable 250x150x175	1
8.	Angle plate size 200x100x200mm	2
9.	Anvil 50 Kgs with Stand	1
10.	Auto Electrical test bench	1
11.	Battery –charger	2
12.	Bearing and gear tester	2
13.	Belt Tensioner gauge	1
14.	Blow Lamp 1 litre	2

15.	Bradawl	2
16.	Caliper inside 15 cm Spring	4
17.	Calipers outside 15 cm spring	4
18.	Cam lock type screw driver	1
19.	Car Jet washer with standard accessories	1
20.	Carge winches 3, 5 tonnes	1
21.	Chain pipe wrench 65 m	2
22.	Chain Pulley Block-3 ton capacity with tripod stand	1
23.	Chisel 10 cm flat	4
24.	Chisels cross cut 200 mm X 6mm	4
25.	Circlip pliers Expanding and contracting type 15cm and 20cm each	4
26.	Clamps C 100mm	2
27.	Clamps C 150mm	2
28.	Clamps C 200mm	2
29.	Cleaning tray 45x30 cm.	4
30.	Compression testing gauge suitable for diesel Engine	2
31.	Copper bit soldering iron 0.25 Kg	5
32.	crab	1
33.	Cylinder bore gauge capacity 20 to 160 mm	4
34.	DC Ohmmeter 0 to 300 Ohms, mid scales at 20 Ohms	4
35.	Depth micrometer 0-25mm	4
36.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)	4
37.	Different type of Engine Bearing model	1 set
38.	Digital Tonge Tester 0-20 A AC	2
39.	Dividers 15 cm Spring	4
40.	Drift Punch Copper 15 Cm	4
41.	Drill point angle gauge	1
42.	Drill twist 1.5 mm to 15 mm (various sizes) by 0.5 mm	4
43.	Electric Soldering Iron 230 V 60 watts 230 V 25 watts	2 each
44.	Electric testing screw driver	2
45.	Energy meter, AC, Single Phase, 5 Amps, 230 Volts	2
46.	Engineers square 700 mm	4
47.	Engineers stethoscope	1
48.	Feeler gauge 20 blades (metric)	4
49.	File flat 20 cm bastard	4
50.	File, half round 20 cm second cut	4
51.	File, Square 20 cm second cut	4
52.	File, Square 30 cm round	4
53.	File, triangular 15 cm second cut	4
54.	Files assorted sizes and types including safe edge file (20 Nos)	2 set
55.	Flat File 25 cm second cut	4
56.	Flat File 35 cm bastard	4
57.	Flow meter 0-400 lt/min	2
58.	Forks clips 02 tonnes (copa)	1
59.	Forks clips 05 tonnes (copa)	1
60.	Foundation bolt	4
61.	Gasket hollow punches 5, 6, 8, 10, 12, 19, 25 mm dia.	1set

62.	Glow plug tester	2
63.	Granite surface plate 1600 x 1000 with stand and cover	1
64.	Grease Gun	2
65.	Growler	2
66.	Hacksaw frame adjustable 20-30 cm	10
67.	Hammer Ball Peen 0.75 Kg	4
68.	Hammer Chipping 0.25 Kg	4
69.	Hammer copper 1 Kg with handle	4
70.	Hammer Mallet	4
71.	Hammer Plastic	4
72.	Hand key way broacher	1
73.	Hand operated chain pulley block	1
74.	Hand operated crimping tool (i) for crimping up to 4mm and (ii) for crimping up to 10mm	2
75.	Hand reamers adjustable 10.5 to 11.25 mm, 11.25 to 12.75 mm, 12.75 to 14.25 mm and 14.25 to 15.75 mm	2sets
76.	Hand Shear Universal 250mm	2
77.	Hand vice – 37 mm	2
78.	Hollow Punch set of seven pieces 6mm to 15mm	2 sets each
79.	Hydraulic wheel and bearing puller	2
80.	Injector – Multi hole type, Pintle type	4 each
81.	Injector cleaning unit	1
82.	Injector testing set (Hand tester)	1
83.	Insulated Screw driver 20 cm x 9mm blade	4
84.	Insulated Screw driver 30 cm x 9mm blade	4
85.	Ladle 150mm Dia	1
86.	Left cut snips 250mm	4
87.	Level bottle (sprit) 150 ml.	1
88.	Lifting jack screw type 3 ton capacity	4
89.	Magneto spanner set with 8 spanners	1 set
90.	Magnifying glass 75mm	2
91.	Manila ropes 12, 20, 30 mm dia.	2 sets
92.	Marking out table 90X60X90 cm.	1
93.	Masonry bit (Assorted up to 12 mm)	2set
94.	Master test bars (different size)	1
95.	Megger 500 V	2
96.	Mobile crank	1
97.	Multimeter digital	5
98.	Oil can 0.5/0.25 liter capacity	2
99.	Oil Stone 15 cm x 5 cm x 2.5 cm	1
100.	Outside micrometer 0 to 25 mm	4
101.	Outside micrometer 25 to 50 mm	4
102.	Outside micrometer 50 to 75 mm	1
103.	Outside micrometer 75 to 100 mm	1
104.	Philips Screw Driver set of 5 pieces (100 mm to 300 mm)	2 sets
105.	Pin spanner set	2
106.	Pipe cutting tool	2

107.	Pipe flaring tool	2
108.	Pipe wrench 45 mm	2
109.	Pliers combination 20 cm.	2
110.	Pliers flat nose 15 cm	2
111.	Pliers round nose 15 cm	2
112.	Pliers side cutting 15 cm	2
113.	Plumb bob	1
114.	Pneumatic scraper with adjustable stroke	2
115.	Portable electric drill Machine	1
116.	Portable jack	1
117.	Power Supply 0-12 v, lamp	1
118.	Pressure gauge 0 -5 Kg/cm ²	2
119.	Prick Punch 15 cm	4
120.	Punch Letter 4mm (Number)	2 set
121.	Radius Gauge, Metric	2
122.	Ratchet chain pulley	1
123.	Rawl plug tool & kit	2
124.	Right cut snips 250mm	4
125.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm	4
126.	Rollers (steel tubes) from 40 to 65 mm dia.	5
127.	Rotary pump working for dismantling and assembling	1
128.	Scientific Calculator	2
129.	Scraper flat 25 cm	2
130.	Scraper half round 25 cm	2
131.	Scraper Triangular 25 cm	2
132.	Screw jacks	1
133.	Scriber 15 cm	2
134.	Scriber with scribing black universal	2
135.	Self alignment roller ball bearing	2
136.	Set of stock and dies - Metric	2 sets
137.	Shear legs (tripod)	1
138.	Shear Tin Man's 450 mm x 600mm	4
139.	Sheet Metal Gauge	2
140.	Sher Tinmans 300mm	4
141.	Single Phase 220 V Capacitor type AC Meter squirrel gage Induction motor	1
142.	Soldering Copper Hatchet type 500gms	4
143.	Solid Parallels in pairs (Different size) in Metric	2
144.	Spanner Clyburn 15 cm	1
145.	Spanner D.E. set of 12 pieces (6mm to 32mm)	4
146.	Spanner T. flocks for screwing up and up-screwing inaccessible	2
147.	Spanner, adjustable 15cm.	2
148.	Spanner, ring set of 12 metric sizes 6 to 32 mm.	2
149	Spanners socket with speed handle, T-bar, ratchet and universal upto	2
150	Spark lighter	2
151	Spark plug spanner 14mm x 18mm x Size	2
152	Square box wrenches	1

153	Square T-wrenches	1
154	SRDG ball bearing, DRDG ball bearing, self aligning ball bearing,	1
155	Steel measuring tape 10 meter in a case	4
156	Steel rule 15 cm inch and metric	4
157	Steel rule 30 cm inch and metric	4
158	Steel wire Brush 50mmx150mm	5
159	Straight edge gauge 2 ft.	2
160	Straight edge gauge 4 ft.	2
161	Stud extractor set of 3	2 sets
162	Stud remover with socket handle	1
163	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	2
164	Tachometer (Counting type)	1
165	Taps and Dies complete sets (5 types)	1 set
166	Taps and wrenches - UNC, UNF and metric	2 sets
167	Telescope gauge	4
168	Temperature gauge 0-100 deg c	2
169	Thermostat	2
170	Thimbles of different sizes	2
171	Thread pitch gauge Metric,	1
172	Threaded fastener type B	2
173	Threaded fastener type C	2
174	Threaded fastener type F	2
175	Three cell torch	2
176	Three Phase 50 Hz, 5 HP AC squirrel gage induction motor with star delta starter	1
177	Timing lighter	1
178	Torque wrenches 5-35 Nm, 12-68 Nm & 50-225 Nm	1 each
179	Trammel 30 cm	2
180	Travelling and gantry cranes	1
181	Tube expander up to 62 mm	1
182	Universal puller for removing pulleys, bearings	1
183	V ² Block 75 x 38 mm pair with Clamps	2
184	Vacuum gauge to read 0 to 760 mm of Hg.	2
185	vernier caliper 0-300 mm with least count 0.02mm	4
186	Vibrometer	2
187	Vice grip pliers	2
188	Voltmeter AC to 500 V	2
189	Wall hoists	1
190	Water pump for dismantling and assembling	2
191	Wattmeter AC/DC, 0 to 10 Kw	2
192	Wire Gauge (metric)	5
193	Work bench 250 x 120 x 60 cm with 4 vices 12cm Jaw	1

C. General Installation/ Machineries

Sl.No.	Item with specification	Qty (Nos.)
1.	Arbor press hand operated 2 ton capacity	1
2.	Back pull out type centrifugal pump	1

3.	Bench lever shears 250mm Blade x 3mm Capacity	1
4.	Centrifugal pump coupled with mono block set	1
5.	Diesel engine 2 stroke vertical (up to 10 KW/ ISHP)	1
6.	Diesel Engine 4 stroke vertical (up to about 10 KW/ISHP)	1
7.	Diesel Engine Driven portable pump set	1
8.	Diesel Engine upto 3.5 KW /4.5 HP fitted with pump	1
9.	Discrete Component Trainer / Basic Electronics Trainer	1
10.	Drilling machine bench to drill up to 12mm dia along with accessories	1
11.	Dual Magnetization Yoke : AC / HWDC, 230 VAC, 50Hz	1 set
12.	Gas Welding Table 1220mm x760mm	2
13.	Grinding machine (general purpose) D.E. pedestal with 300 mm dia wheels rough and smooth	1
14.	Horizontal split casing pump	1
15.	Hydraulic jack HI-LIFT type -3 ton capacity,	1
16.	Hydraulic Leak Testing equipment	1
17.	Injector Testing set (Hand Tester)	1
18.	Liquid penetrant Inspection kit	1 set
19.	Multi stage pump	1
20.	Overhead tank, pump, minimum 5000 litres with level indicators and piping layout	1
21.	Pipe Bending Machine (Hydraulic type) 12mm to 30mm	1
22.	Pneumatic rivet gun	2
23.	Portable electric drill Machine	1
24.	Reciprocating Pump working for dismantling and assembling	1
25.	Spring tension tester	1
26.	Submersible pump set, eight stage upto 10 KW/ 15 HP	1
27.	Tin smiths bench folder 600 x 1.6mm	1
28.	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
29.	Welding plant Oxy-Acetylene complete (high pressure)	1
30.	Welding Transformer (150-300 Amps)	1

D. List of consumable:

Sl. No.	Description	Quantity
1.	Battery- SMF	As required
2.	Brake fluids	As required
3.	Chalk, Prussian blue.	As required
4.	Chemical compound for fasteners	As required
5.	Diesel	As required
6.	Different type gasket material	As required
7.	Different type of oil seal	As required
8.	Drill Twist (assorted)	As required

	Engine coolant	As required
	Engine oil	As required
9.	Emery paper - 36–60 grit , 80–120	As required
10.	Gear oils	As required
11.	Hacksaw blade (consumable)	As required
12.	Hand rubber gloves tested for 5000 V	5 pair
13.	Holdings, lamp teakwood boards, plug sockets,	As required
14.	Hydrometer	As required
15.	Lapping abrasives	As required
16.	Leather Apron	As required
17.	Petrol	As required
18.	Power steering oil	As required
19.	Radiator Coolants	As required
20.	Safety glasses	As required
21.	Steel wire Brush 50mmx150mm	As required
22.	Gloves for Welding (Leather and Asbestos)	As required
23.	Block of timber (various sizes)	As required
24.	Various type of seal required for pump assembly	As required

E. Workshop Furniture

Sl. No.	Description	Quantity
1.	Book shelf (glass panel) 6½ ‘ x 3’ x 1½’	As required
2.	Computer Chair	1+1
3.	Computer Table	1+1
4.	Desktop computer and related MS office software	1+1
5.	Discussion Table 8’ x 4’ x 2½ ‘	2
6.	Fire Extinguishers, first- aid box	As required
7.	Instructional Material – NIMI Books/Ref.books	As required
8.	Internet connection with all accessories	As required
9.	Laser printer	1
10.	LCD projector/ LED /LCD TV (42”)	1
11.	Multimedia DVD for Automotive application/subjects	As required
12.	Online UPS 2KVA	1
13.	Stools	21
14.	Storage Rack 6½ ‘ x 3’ x 1½’	As required
15.	Storage shelf 6½ ‘ x 3’ x 1½’	As required.
16.	Suitable class room furniture	As required
17.	Suitable Work Tables with vices	As required
18.	Tool Cabinet - 6½ ‘ x 3’ x 1½’	2
19.	Trainees locker 6½ ‘ x 3’ x 1½’	2 Nos. to accommodate 20 Lockers

ANNEXURE-II

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. All questions of theory paper for the trade will be in objective type format.
2. Due care to be taken for proper & inclusive delivery among the batch. Some of the following method of delivery may be adopted:
 - a. Lecture
 - b. Lesson
 - c. Demonstration
 - d. Practice
 - e. Group discussion
 - f. Discussion with peer group
 - g. Project work
 - h. Industrial visit
3. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. May be adopted.
4. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.
5. Questions may be set based on following instructions:-

Sl. No.	Question on different aspect	Weightage in %age	Key Words may be like
1	Information received	25	What, Who, When
2	Knowledge	50	Define, Identify, Recall, State, Write, List & Name
3	Understanding	15	Describe, Distinguish, Explain, Interpret & Summarize
4	Application	10	Apply, Compare, Demonstrate, Examine, Solve & Use

6. Due weightage to be given to all the topics under the syllabus while setting the question paper.

13. LIST OF TRADE COMMITTEE MEMBERS

1	V Krishna Shankar, Gen. Manager, Ashok Leyland
2	G Satish Kumar, Manager, Ashok Leyland
3	GM Cholanrajan, Sr. Manager, Training, Lansun Toyota, Chennai
4	M Shanavas Khan, Hinduja Foundaries
5	Dr. Abhijit KR Mandal, National Automotive Testing and R&D Infrastructure Project, Global, Automotive Research center, Chennai
6	Vadivelan, National Automotive Testing and R&D Infrastructure Project, Global, Automotive Research center, Chennai
7	Anatharaman, Proprietor, Care Care Center, Chennai
8	MK Gupta, Maruthi Suzuki
9	Pandey, Director, SRFMTTI, Anathapur
10	P. Thangapalam, DM- Trg, Dailmer India
11	S Gopinath, Sr. Manager, Crompton Greaves
12	RA. Armstrong, TAFE
13	B Muthukumar, Toyoto Kirloskar, New Delhi
14	J Dharsan, Asst. Mgr, Toyoto Kirloskar, Bangalore
15	C Prakash, Sr. Gen. Manager, Ashok Leyland
16	P Palanivelan, Manger, TVS Sundram Fasteners ltd.
17	TN Umashankar, Head Manufacturing, Delphi TVS Ltd.
18	K Aravind,Regional Trainer,Bosch Ltd., Chennai
19	K Mohankumar, TAFE
20	M Sivaraman, Consultant, Delphi TVS

Representatives from Academic/Professional Institutions

21	Dr. Ramesh A Professor, D/o Mechanical Engineering Indian Institute of Technology Madras IIT P.O., Chennai 600 036
22	Dr. A.R. Mohanty Professor, D/o Mechanical Engg Indian Institute of Technology Kharagpur Kharagpur India - 721302
23	Dr. Shankar Ram C S Assistant Profesor D/o Engineering Design Indian Institute of Technology Madras IIT P.O., Chennai 600 036
24	Prof. Nilesh J Vasa, Professor, IIT Chennai
25	Prof. G. Balaganesh, Professor, IIT Chennai
26	J. Rajakumar,Principal,Brakes India
27	S Horlyok Chelladurai,Retd. ITI Principal

DGE&T Coordinator

28	Shri T.C. Saravanabava, Deputy Director General (AT), DGET Headquarters
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Core Group

29	Mr. K.S. Rao, JDT, NIMI, Chennai
30	* CSTARI
31	Mr. Yuvraj, DDT, ATI Chennai
32	Mr. G. Venkatesh, ADT, ATI Hyd
33	Mr. S.P. Rewaskar, ATI, Hyd
34	Mr. T.N. Rudra, TO, ATI, Howrah
35	Mr. N. Ramesh Kumar, TO, ATI, Chennai
36	Mr. Akhilesh Pandey, TO, ATI, Mumbai
37	Mr. Vijayaraju, TO, ATI, Hyd
38	Mr. R. Rajesh Kanna, TO, ATI Chennai

Champion ITIs

39	Mr. H.S. Kalara, Principal, Govt. ITI, Chandigarh
40	Mr. A. Duraiswamy, ATO, Govt. ITI, Coimbatore
41	Mr. W. Nirmal Kumar Israel, ATO, Govt. ITI, Trichy
42	Mr. K. Thaniarasu, ATO, Govt. ITI, Trichy
43	Mr. N. Durimurugan, TO, Govt. ITI, Chengalpattu
44	Mr. Ravindernath, Govt. ITI, Ambattur
45	Palanikumar, Govt. ITI, Pudukotai, TN