PUMP OPERATOR CUM MECHANIC

NSQF LEVEL- 6

SECTORS - AUTOMOTIVE

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

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(Engineering Trade)

SECTOR – AUTOMOTIVE

(Designed in 2021)

Version 1.0

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Developed By
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1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960's by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. "Pump Operator Cum Mechanic" CITS trade is applicable for Instructors of "Pump Operator Cum Mechanic" CTS Trade.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	**Engineering Technology**	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	**Training Methodology**	
	TM Practical	320
	TM Theory	200
	Total	**1600**

2.3 PROGRESSION PATHWAYS

- Can join as Instructor in Vocation Training Institute/ Technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

Sl. No.	Subject		Marks	Internal Assessment	Full Marks	Pass Marks	
						Exam	Internal Assessment
1	Trade Technology	Trade Theory	100	40	140	40	24
		Trade Practical	200	60	260	120	36
2	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
		Engineering Drawing	50	25	75	20	15
3	Training Methodology	TM Practical	200	30	230	120	18
		TM Theory	100	20	120	40	12
Total Marks			**700**	**200**	**900**	**360**	**120**

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while

undertaking the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

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

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.

(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***good*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***high*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**Pump Operator Cum Mechanic - CITS**
Trade Code	DGT/4052
NCO – 2015	2356.0100, 8211.0600
NSQF Level	Level-6
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in appropriate branches of Mechanical/ Civil Engineering from AICTE/ UGC recognized Engineering College / University. OR Diploma in appropriate branches of Mechanical / Civil Engineering from AICTE/ recognized board / Institution. OR National Trade Certificate in Pump Operator Cum Mechanic trade. OR National Apprenticeship Certificate in Pump Operator Cum Mechanic or related trades.
Minimum Age	18 years as on first day of academic session.
Space Norms	84 sq. mtr
Power Norms	11 KW
Instructors Qualification for	
1. Pump Operator Cum Mechanic - CITS Trade	B.Voc/Degree in Civil or Mechanical Engineering from recognized University with two years of experience in relevant field. OR 03 years Diploma in Civil or Mechanical from AICTE/recognized Board/ Institution or relevant Advanced Diploma (Vocational) from DGT with five years of experience in relevant field. OR NTC/ NAC in Pump Operator Cum Mechanic with seven years of experience in relevant field. **<u>Essential Qualification:</u>** National Craft Instructor Certificate (NCIC) Pump Operator Cum Mechanic trade, in any of the variants under DGT.
2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of

	technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any Engineering trade with seven years experience in relevant field. **Essential:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven years experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT
4. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 Years

Distribution of training on Hourly basis: (Indicative only)						
Total Hrs /week	**Trade Practical**	**Trade Theory**	**Workshop Cal. & Sc.**	**Engg. Drawing**	**TM Practical**	**TM Theory**
40 Hours	16 Hours	6 Hours	2 Hours	3 Hours	8 Hours	5 Hours

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools & equipment of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Pump Operator Cum Mechanic can read & explain about pump operator cum mechanic fundamentals and fluid transmission. The trainees have to participate in hands-on work and begin repairing different pumps.

Pump Operator Cum Mechanic water pump, impeller repair services and overhauls pump or water pumps for efficient performance as prime mover to drive machinery and equipment. Examine pumps 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. Repair impeller and assembles parts, doing supplementary tooling and other functions as necessary to ensure accuracy of fit. Installs assembled or repaired pump in position and connects shaft to propulsion system. Starts pump, tunes it up and observes performance noting different meter readings such as temperature, fluid level, water pressure, etc. and sets it to specified standard for optimum performance. Checks, adjusts and lubricates pump periodically and performs such other functions to keep pump in good working order. May solder or braze parts and service water pumps and nimpeller.

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

Additionally, since fluid pump are starting to incorporate electrical components, programs usually give students a chance to take courses in electrical systems and computer diagnostic software.

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

Reference NCO 2015:

a) 2356.0100 – Manual Training Teacher/ Craft Instructor
b) 8211.0600 - Assembler, Stationary Diesel Engine

5. LEARNING OUTCOME

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

5.1 TRADE TECHNOLOGY

1. Ensure implementation of safe working practices, environment regulation, housekeeping and demonstrate Identification.
2. Ensure marking dimensions using different types of fitting operation, and check dimensional accuracy.
3. Perform precision measurements on the components and compare parameters with specifications used in workshop practices.
4. Make and assemble components of different marking parts as per specification by different surface. Finishing operations using different fastening components, tools and check functionality.
5. Ensure marking dimensions, drill &tap blind holes, check the drill hole size using counter to remove broken tap.
6. Plan & set up for identify of different fitting & different types of gauges.
7. Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission and check functionality. (different damaged parts –pulley, gear, keys, jibs and shafts.
8. Demonstrate SMAW machine and perform different types of joints on MS flat.
9. Monitor the gas welding plant and perform different welding & cutting operation on MS Sheet.
10. Assess welding in butt, angle (45 degree) joint and Tee joint on MS pipe in different position.
11. Plan & perform testing, check connections, verify errors calibrate various instruments.
12. Assess Construction of simple electronic circuits and test for functioning.
13. Plan, execution& commissioning and check performance of various AC motors.
14. Test, service & troubleshoot various components of industrial programmable system of pumps and their control circuits.
15. Evaluate maintenance, diagnosis and servicing of fuel supply system in Petrol/diesel Engines.
16. Asses Service of Diesel Fuel System and check proper functionality (calibration of Mechanical and electrical pumps, checking injectors, filters).
17. Measure the functionality of vital components and assemblies of centrifugal, reciprocating, submersible & rotary pumps.
18. Select & Analyze various types of instruments and measure dimension of components and use different type of conventional & special tools.
19. Troubleshoot pumps.

6. COURSE CONTENT

SYLLABUS FOR PUMP OPERATOR CUM MECHANIC – CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 48 Hrs Theory 18 Hrs	Ensure implementation of safe working practices, environment regulation, housekeeping and demonstrate Identification.	1. Practical related to Safety and Health, Importance of maintenance and cleanliness of Workshop. 2. Interaction with health center and fire service station to provide demo on First aid and Fire safety, Use of fire extinguishers. 3. Demonstration on safe handling and Periodic testing of lifting equipment, and Safety disposal of used engine oil. 4. Rescue a person who is in contact with live wire and treat a person for electric shock/ injury.	Introduction to the Course duration, course content, study of the syllabus. General rule pertaining to the Institute. 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. Electrical safety tips. Rescue of person who is in contact with live wire. Treat a person for electric shock/ injury.
Practical 32 Hrs Theory 12 Hrs	Ensure marking dimensions using different types of fitting operation, and check dimensional accuracy.	5. Identification of tools & equipment as per specification for marking and sawing. 6. Marking outline, gripping suitably in vice jaws, hacksawing to given dimensions. 7. Sawing different types of metals of different sections. 8. Filing practice, surface filing, marking & straight and parallel lines with odd leg caliper and steel rule.	Linear measurement-its units, dividers, calipers, hermaphrodite, center punch, dot punch, their description and uses of different types of hammers. Description and uses & care of v-block, marking off table. Bench-vice construction, types, uses, care & maintenances, vice clamps, hacksaw frames &blades. Methods of using hacksaw. Files-Specifications, description, elements, grades, cuts, uses,

		9. Marking practice with dividers, odd leg caliper and steel rule circle, ARCs, parallel lines. 10. Marking, filing, filing square, and check using try square.	types of files, care &maintenance. Marking off and layout tools. Try square, punches, description, classification, care and maintenance. Calipers, types, construction, uses and maintenance, chisel, material, types, cutting edges.
Practical 32 Hrs Theory 12 Hrs	Perform precision measurements on the components and compare parameters with specifications used in workshop practices.	11. Measuring practice on Cam height, Camshaft Journal dia., crankshaft journal dia., Valve stem dia., piston diameter, and piston pin dia. With outside Micrometers. 12. Measuring practice on the height of the rotor of an oil pump from the surface of the housing or any other component measurement with depth micrometer. 13. Measuring practice on cylinder bore, connecting rod bore, inside diameter (ID) of a camshaft bearing with Telescope gauges.	Systems of measurement, Description, care & use of - Micrometers- Outside and depth micrometer, Micrometer adjustments, Vernier calipers, Telescope gauges, Dial bore gauges, Dial indicators, straightedge, feeler gauge, thread pitch gauge, vacuum gauge.
Practica 16 Hrs Theory 06 Hrs	Make and assemble components of different marking parts as per specification by different surface. Finishing operations using different fastening components, tools and check functionality.	14. Power tools: practice operation of power tools for fastening 15. Tightening of bolt, screw with specified torque. 16. Selection of tightening or loosening of screw/bolt as per suitability.	Screw, material, designation, specification, property, tools for tightening and loosening of screw/bolt. Bolt, torque wrench, screw joints, calculation and uses. Locking devices, nuts (lock nut, castle nut, description, description and uses.
Practical 64 Hrs Theory	Ensure marking dimensions, drill &tap blind holes, check the drill hole size using	17. Marking off and drill through holes. 18. Drill on M.S flat 19. Sharpening of drills	Drill material, types, taper shank, straight shank, parts and size. Drill angle-cutting angles of different materials

24 Hrs	counter to remove broken tap.	20. Counter sink, counter broken, ream, split fit, (three pieces of files). 21. Form internal threads with 22. taps to standard size (through holes and blind holes). 23. Demonstrate studs and bolts. 24. Prepare external thread with standard size Prepare nut match with bolts. 25. Form external threads with dies to size.	Drill holding devices, materials and their uses. Countersink, counter bore and spot facing tools and nomenclature. Reamer, materials, types (Hand and machine reamer). kinds, parts, and their uses. Determining hole size for reaming, reaming procedure. Screw thread terminology, parts, and their uses, screw pitch gauge, material, parts and uses.
Practical 16 Hrs Theory 06 Hrs	Plan & set up for identify of different fitting & different types of gauges.	26. Exercise on preparing different gauges by using radius, wire, snap, plug, ring and telescopic gauges with a specified accuracy. 27. Exercise on preparing different gauges by using radius, wire, snap, plug, ring and telescopic gauges with a specified accuracy.	Taps; British, (B.S.W, B.S.F, B.A & B.S.P) And metric (coarse & fine), material, parts Dies-British, matric and B.I.S standard, materials, parts, methods of using die stock, material parts and use. Concept of limits, fits tolerance and allowance –their definition and practical application in industry. Gauges, necessity, different types, description and uses of radius, wire, snap, plug, ring telescopic gauge.
Practical 64 Hrs Theory 24 Hrs	Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission and check functionality. (different damaged parts –pulley, gear, keys, jibs and shafts.	28. Dismantling and mounting of pulleys. 29. Point out and replace damaged keys. 30. Dismounting, repairing and damaged gears and mounting and check for workability.	Power transmission elements, The object of belts and their sizes, specification, materials. Selection of the type of belts with the consideration weather load and tension method of joining leather belts V- belts and their advantages, dressing and resin, creep and slipping calculation. Power transmission coupling,

			types-flanges, coupling, hook coupling and their different uses. Pulleys- types solid, split & "V" belt pulleys. Calculation for determining size crowning of faces loose and flat pulleys, jockey pulley, types of open & cross belt drive. Power transmission by gear, most common from spur gear, set names of some essential parts of the set D.P, P.C.D, V.R of gear set.
Practical 16 Hrs Theory 06 Hrs	Demonstrate SMAW machine and perform different types of joints on MS flat.	31. Perform and assess lap, Tee and corner joints on M.S. flat (10 mm thick flat) in horizontal position by SMAW.	Introduction of arc, gas and other welding process and their application.
Practical 32 Hrs Theory 12 Hrs	Monitor the gas welding plant and perform different welding & cutting operation on MS Sheet.	32. Monitor and review Lap Tee and square butt joint on MS sheet. (2 mm thick sheet) in horizontal position by OAW. 33. Monitor Oxy acetylene gas cutting (manual) straight, bevel and circular cutting on MS plate. (10 mm thick).	Arc welding power source, arc welding principle, type of weld joint, edge preparation and welding position. Gas welding principles, its techniques, filler rods, its specification and size. Gas welding fluxes, -types and functions. Gas Cutting
Practical 16 Hrs Theory 06 Hrs	Assess welding in butt, angle (45 degree) joint and Tee joint on MS pipe in different position.	34. Analyze pipe butt, Tee and angle joint on MS pipe outer diameter. (50mm *3mm) in down hand position by OAW.	Introduction of pipe welding up hill and downhill welding, horizontal welding. Importance of heat treatments and its methods.
Practical 32 Hrs Theory 12 Hrs	Plan & perform testing, check connections, verify errors calibrate various instruments.	**Electrical Measuring instruments** 35. Identify different types of electrical instruments. 36. Determine errors using PMMC and MImeters. 37. Test and calibrate different	Types – PMMC, MI Meters. Principle and construction. Digital meters. Megger & Earth tester. Calibrations of meters.

		meters including Energy meter. Measure insulation resistance.	
Practical 16 Hrs Theory 06 Hrs	Assess Construction of simple electronic circuits and test for functioning.	**Basic Electronics** 38. Construct Rectifier circuits. 39. Check the different wave shape using CRO. 40. Design Simple circuit containing power diode & power transistor. 41. Construct UJT triggering circuit. 42. Use FET & MOSFET as an amplifier. 43. Verify truth tables of Logic gates.	Semi-conductor diodes, Characteristics Zener diode Rectifiers & filter circuits. Working principle and use of CRO Transistor, Amplifier & types. Basic concept of Power diode, power transistor. Introduction to- UJT, FET, SCR, DIAC, TRIAC, MOSFET, IGBT. Electronics–Number System, Logic gates.
Practical 16 Hrs Theory 06 Hrs	Plan, execution & commissioning and check performance of various AC motors.	**Three phase Induction motor** 44. Analyze connection of various starters. 45. Start, run & load ac 3 phase Squirrel cage & Wound rotor Induction motors for performance testing. 46. Check the change of direction of rotation. 47. Measure speed, torque, slip, current, power, PF etc.	Squirrel Cage & Wound Rotor: - Construction, parts, working principle. Concept of rotting magnetic field Applications. Types of starters- DOL, Star delta, Auto transformer starter etc. Rotor resistance type starter. Introduction to Speed control of 3 phase Induction motor. Torque-speed characteristics. Losses & efficiency.
Practical 32 Hrs Theory 12 Hrs	Test, service & troubleshoot various components of industrial programmable system of pumps and their control circuits.	**Industrial Wiring** 48. Demonstrate wiring of motors. 49. Test and service protective devices, control panel etc. 50. Demonstrate control cabinet/ control panel assembly, wiring, checking/buzzing & testing for the following exercises on 3 Ø induction motor. i) DOL starter with push button control. ii) Forward / Reverse starter	Wiring of Electrical Motor and Control Panel. Machine control cabinet /control panel layout, assembly & wiring Power & control circuits, control elements- Push button switches, contactor, overload Relay etc.

		Automatic Star/Delta starter.	
Practical 48 Hrs Theory 18 Hrs	Evaluate maintenance, diagnosis and servicing of fuel supply.	51. Maintenance, diagnosis and of basic petrol fuel system components. 52. Overhauling of fuel tank, mechanical fuel Pump, electrical pump, fuel filters, carburetors Testing of fuel pumps for proper functioning. 53. Maintenance, diagnosis and servicing of conventional diesel fuel system and its components. 54. Overhauling of fuel tank, fuel feed Pump, electrical pump, fuel filters, types of fuel injection pumps, governors, injector. 55. Testing of fuel feed pumps for proper functioning. 56. Servicing of fuel tanks, checking leaks in the fuel lines, draining of water separators. 57. Replacing of primary& secondary filters. 58. Phasing and calibration of fuel injection pump. 59. Testing of injectors for its proper functioning. 60. Setting fuel injection timing Bleeding diesel fuel system. 61. Maintenance, diagnosis and Servicing of lubrication system. 62. Changing engine oil and filter. 63. Tracing oil leak from the engine.	**FUEL SUPPLY SYSTEM IN PETROL ENGINE** Gasoline Fuel: properties of Gasoline fuel -combustion processes. Study about carburetor fuel system and its components such as fuel tank, mechanical fuel Pump, electrical pump, fuel filters, carburetors and its circuits etc. Importance of maintenance, diagnosis and Servicing carburetor fuel system and its components. Causes of failure of the carburetor fuel system and its components. Trouble shooting in carburetor fuel system and its components. Importance of testing of fuel pumps. **Fuel supply system in diesel engines.** Diesel fuel& its properties - combustion processes. Study about conventional diesel fuel system and its components such as fuel tank, fuel feed Pump, electrical pump, fuel filters, water separators, fuel injection pumps, governors, injectors etc. Importance of maintenance, diagnosis and Servicing diesel fuel system and its components. Causes of failure of the diesel fuel system and its components. Importance of testing of fuel feed pumps, FIP and injectors.

		64. Overhauling of oil pump, checking oil pressure relief valves for proper functioning. 65. Servicing oil coolers. 66. Checking oil galleries. 67. Oil pressure testing. 68. Removing of sludge by using flushing oil. 69. Maintenance, diagnosis and servicing of cooling system. 70. Flushing cooling system replacing coolant. 71. Tracing coolant leakage from the engine. 72. Checking cooling system for proper functioning. 73. Replacing/overhauling of water pump. 74. Checking thermostat valve. 75. Adjusting fan belt tension. 76. Checking radiator pressure cap for proper functioning. 77. Replacing/Servicing radiator. 78. Diagnosis of improper Operating temperature.	Importance of setting correct FIP timing. Importance of bleeding the fuel system. Trouble shooting in diesel fuel system and its components. **<u>Engine lubrication system</u>** Lubricant, types, application and its properties. Study about lubrication systems and its components such as oil sump, oil strainer, oil pump, relief valve, filter, bypass valve, oil cooler etc. Study about oil filtering systems. Importance of maintenance, diagnosis and Servicing lubricating system and its components. Causes of failure of the lubricating system and its components. Importance of testing of oil pumps. Importance of servicing oil filter. Importance of checking and setting correct oil pressure. Reasons for sludge formation and its prevention Trouble shooting in lubricating system and its components. **<u>Engine cooling system</u>** Coolant, types, and its properties. Importance of maintaining correct coolant-water ratio. Study about cooling systems and its components such as radiator, pressure cap, types of hoses, types of water pump, electric fan, thermostat, fan belts, temperature gauge, temperature sensoretc.

			Study about oil filtering systems.
Practical 32 Hrs Theory 12 Hrs	Asses Service of Diesel Fuel System and check proper functionality (calibration of Mechanical and electrical pumps, checking injectors, filters).	79. Maintaining fuel injection test bench further practice on overhauling. 80. Testing of different types inline fuel injection pump. 81. Further practice on servicing and testing different types of inline FIP, governors and injectors. 82. Servicing and testing different types of distributor type fuel injection pumps.	Importance of testing the pumps. Procedure for testing before dismantling. Procedure as per the manufacturer for dismantling, inspecting and assembling inline pump. Detailed description of procedure of servicing mechanically controlled distributor type, electronically controlled distributor type and solenoid valve controlled distributor type pumps- details of start assist systems. Procedure as per the manufacturer for dismantling, inspecting and assembling distributor pumps.
Practical 64 Hrs Theory 24 Hrs	Measure the functionality of vital components and assemblies of centrifugal, reciprocating, submersible & rotary pumps.	83. Remodeling of centrifugal pumps. 84. Pinpointing of different pumps, its components, prime movers. 85. Practice on operational safety. 86. Dismantling of reciprocating pumps- valves, pistons, cranks, seals etc. for inspection, repair &replacement. 87. Scrubbing of parts & assembling & Installing of reciprocating pumps. 88. Overhauling & recognizing of parts. 89. Sort out defects, repairing, and replacement of components. 90. Scrubbing, assembling,	Concept of centrifugal pump. Development and operation of centrifugal pump in series and parallel. Finding out defects and method to recondition centrifugal pump. Pumps- its importance for agricultural &industrial applications. Taxonomy of pumps, its prime movers, parts and operation safety. Taxonomy of reciprocating pump, construction and operation. Installation technique of reciprocating pump. Tools and equipment required& procedure. Submersible pump- Development, operation and selection of appropriate type. Procedure to recondition, install

		installing and testing of submersible pumps. 91. Finding out & sort out faults developed during operation. 92. Overhauling of rotary pumps- impeller, shaft, bearing etc. for inspection, Repair &replacement. 93. Scrubbing of parts and assembling. 94. Checking for alignment, clearance, etc., Priming technique and its application. 95. Installing, operating & testing of rotary pumps. 96. Maintenance of pumps and valves of general purpose and of corrosive fluids.	and test of submersible pumps. Causes of failures and remedial measures. Taxonomy of rotary pumps- Development and operation repairing procedure. Brief description of turbine & stage pumps, positive displacements and their merits. Meaning of priming and its effect. Installation techniques of rotary pump- procedure, tools and equipment required.
Practical 32 Hrs Theory 12 Hrs	Select & Analyze various types of instruments and measure dimension of components and use different type of conventional & special tools.	97. Selection of gasket, packing & gland materials, marking &cutting off gasket as per shape &profile. (8hrs) 98. Employment of gasket cement to stop leakage & for fixing. 99. Positioning of seals leather polythene, asbestos, rope rubber and mechanical seals. 100. Preservation of lubrication systems. 101. Fitting of flanges and assembling of pipe work, leak testing and rectification. 102. Utilization of tee, elbow, bend, socket, rectifiers and other pipe fittings. 103. Cutting threads for pipes.	Various types of valves-their interpretation, merit & its utilization Special pumps & glands used for corrosive fluids. Divergent gasket cement used to prevent leakage and merits of each over the other. Fundamentals of direct reading pressure and temperature measuring instruments. Method to read and application of pressure and temperature measuring instruments. Various seals- their utilization and places of application with excellence. 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.
Practical 32 Hrs Theory 12 Hrs	Troubleshoot pumps.	104. Positioning of stationary &coupled pumps, checking and correcting of alignment of pump with its prime movers and its serviceability test. 105. Experimenting of pumps for their delivery flow& pressure.	Installation methodology, align and testing of pumps for their serviceability. Abstraction of lightening torque for different sizes of bolts.
Project work/ Industrial visit/On the job training			
Revision & Examination			

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Science (Common for all Engineering CITS trades) (80 Hrs)
2. Engineering Drawing (Group I) (120 Hrs)
3. Training Methodology (Common for all trades) (320 Hrs + 200 Hrs)

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

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Ensure implementation of safe working practices, environment regulation, housekeeping and demonstrate Identification.	Identify lesson plan, demonstration plan, job plan, practice, evaluation etc. for training and use in timely manner.
	Select raw materials and visually inspect for defects.
	Explain technical English with broad details.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner.
	Recognize different components of 5S and apply the same in the working environment.
	Evaluate and observe site policies and procedures in regard to illness or electrical accident.
	Demonstrate basic first aid and use them under different circumstances.
2. Ensure marking dimensions using different types of fitting operation, and check dimensional accuracy.	Identify tools & instruments and equipment's for makeup and other equipment.
	Prepare the job for hacksawing , fitting, chiseling etc.
	Observe safety procedure as per standard norms.
	Measure all dimensions in accordance with standard specifications.
3. Perform precision measurements on the components and compare parameters with specifications used in workshop practices.	Ascertain and select tools and material
	Collect information related to standard procedure method and tools.
	Mark the components as per drawing
	Check dimensions by precision measuring instruments.
	Demonstrate possible solution in case of defects and standard specifications.
4. Make and assemble components of different mating parts as per specification by different surface. Finishing operations using different fastening components, tools and check	Select the tools for blind holes.
	Perform different operation like counter sink, counter bore and reaming.
	Observe safety precautions while working on drilling machine.
	Select the taps and dies for making different types of external and internal thread in a component.

functionality.	Demonstrate studs and bolts
5. Ensure marking dimensions, drill &tap blind holes, check the drill hole size using counter to remove broken taps.	Ascertain and tools for material for fastening
	Selection tightening or loosening of screw / bolt as per accessibility
	Observe safety norms.
	Perform different operation like counter sink, counter bore and reaming.
	Observe safety precautions while working on drilling machine.
6. Plan & set up for identify of different fitting & different types of gauges.	Select the tools for making different types of fitting as per required tolerances.
	Identify the tools for measurement by different gauges.
	Check proper gauge for proper size of job.
	Apply safety measures as per standard for measuring by gauges.
	Perform lapping and honing operations in different surface.
7. Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission and check functionality. different damaged parts – pulley, gear, keys, jibs and shafts.	Select, care and use of belt, pulley and gear while dismantling and assembling of belt, pulley and gear.
	Select tools and materials for the job and make this available for use In timely manner.
	Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of belt, pulley and gear.
	Carryout their Dismantling and assembling of belt, pulley and gear by reviewing: Technical data. Removal and replacement procedures. Legal requirements
8. Demonstrate SMAW machine and perform different types of joints on MS flat.	Plan and select the type and size of electrode welding current.
	Set SMAW machine and tack the pieces as per drawing.
	Deposit the weld and maintaining appropriate arc length electrode angle and welding speed.
	Clean the welded joint thoroughly.
9. Monitor the gas welding plant and perform different welding & cutting operations on MS Sheet.	Monitor and review Lap, Tee and square butt joint on MS sheet.(2 mm thick sheet) in horizontal position by OAW.
	Arc welding power source, arc welding principle, type of weld joint, edge preparation and welding position.
	Electrode- Coding of electrode as per IS and ASW
	Plan and mark on MS plate surface for straight/bevel/circular

	cutting.
	Select the nozzle size, working pressure of gases as per requirement. Set the marked plate properly on cutting table.
	Set the cutting plant and perform the cutting operation maintaining proper techniques and safety aspect.
10. Asses welding in butt, angle (45 degree) joint and Tee joint on pipe in different position.	Plan and prepare the development for specific type of pipe joint.
	Mark and cut the MS pipe as per development.
	Select the size of filler rod, size of nozzle, working pressure
	Set and tack the pieces as per drawing.
	Deposit the weld bead maintaining proper technique and safety aspect.
	Inspect the welder joint visually for poor penetration, uniformly of beed and surface defect.
11. Plan & perform testing, check connections, verify errors calibrate various instruments.	Extend the range of MC volt meter & ammeter.
	Monitor calibration of different meters viz. PMMC, MI etc.
	Measure insulation resistance.
12. Assess Construction of simple electronic circuits and test for functioning.	Identify the passive /active components by visual appearance, Code number and check testing for their condition.
	Identify the control and functional switches in CRO and assess measurement of the D.C. & A.C. voltage, frequency and time period.
	Assess construction and review testing of half &full wave rectifiers with and without filter circuits.
	Evaluate construction and testing of a UJT as relaxation oscillator & electronic timer.
	Assess construction of amplifier circuit using Transistor, FET and JFET and testing.
	Plan to construct and test the universal motor speed controller using SCR with safety.
	Appraise construction and testing of logic gate circuits.
13. Plan, execution& commissioning and check performance of various AC motors.	Assess circuit diagram drawing and connection of forward & reverse 3 phase squirrel cage induction motor.
	Plan to start, run and reverse an AC 3 phase squirrel cage induction motor by different type ofstarters.
	Evaluate measurement of the slip of 3 phase squirrel cage induction motor by tachometer for different output. Check Drawing of slip/load characteristics of the motor

	Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.
	Plot the speed torque (Slip/Torque) characteristics of slip ring induction motor.
	Monitor speed control of 3 phase induction motor.
	Demonstrate planning to connect start, run, control speed and reverse the DOR of different type of single phase motors.
	Assess installation of a single phase AC motor.
	Test continuity and insulation of various AC motors.
	Assess maintenance, service and troubleshooting of the AC motor & starter.
14. Test, service & troubleshoot various components of industrial programmable system of pumps and their control circuits	Evaluate the parts, trace the connection and test the control panels of the equipment.
	Assess assembling of the various parts of control panels.
	Explain the wiring as per the drawings including terminations.
	Assess troubleshooting and servicing of various controls in the panels.
	Ensure Compliance with safety & IE rules when performing the Industrial wiring.
	Monitor wire-up PVC Conduit wiring for lighting circuit & 3 phase motor circuit with due care and safety.
	Ensure termination to the feeder cable in bus bar & to service cable through plug-in box with due care and safety.
	Assess erection of a bus bar chamber on an angle iron board and wire-up for 3 phase induction motor with due care and safety.
15. Evaluate maintenance, diagnosis and servicing of fuel supply system in Petrol/diesel engines.	Assess deconstruct & assembling of fuel feed system along with other accessories.
	Assess overhauling of Fuel System and measure proper functionality.
	Examine and suggest possible optimization and differentiate their cost effectiveness.
	Contribute to constant development of work process in the related area.
	Appraise Engine throughput and set idling speed.
16. Asses service of diesel fuel system and check functionality (Calibration of mechanical and electronic pumps, checking injectors,	Maintenance of fuel feed pump, fuel injector pump.
	Examine injectors, measure the injection timing by the spill cut off method.

filters.)	
17. Measure the functionality of vital components and assemblies of centrifugal, reciprocating, submersible & rotary pumps	Pick, supervision and utilization of Process Pump & Equipment while dismantling and assembling of centrifugal pumps & reciprocating pumps.
	Choose tools and materials for the job and make this available for use in a timely manner.
	Use the tools and equipment in the way specified by manufacturers to Dismantle and assembles of centrifugal Pumps and reciprocating pumps.
	Carry out their deconstruction and assembling of centrifugal pumps and reciprocating pumps by reviewing: Technical data, Removal and renewal procedures of Legal requirements.
	Examine the throughput of centrifugal pumps & reciprocating pumps.
	Pick, supervision, and utilization of Process Pump & Equipment while dismantling and assembling of submersible pumps and rotary pumps.
	Choose tools and materials for the job and make this available for use in a timely manner.
	Utilization of the tools and equipment in the way specified by manufacturers to deconstruct and assembles of submersible pump & rotary pumps.
	Carryout their deconstruction and assembling of submersible pumps & rotary pumps by reviewing: Technical Data elimination and replacement procedures Legal requirements.
	Measure the through put of submersible pumps & rotary pumps.
18. Discover, select & Analyze various types of instruments and measure dimension of components and use different type of conventional & special tools.	Execute the servicing of pumps & valves of given general-purpose and of corrosive fluids.
	Choose gasket, packing gland materials, mark & cut off gasket as per given shape &profile.
	Illustration of gasket cements for fixing & stop leakage.
	Carryout maintenance of lubrication system.
	Conduct fitting of flanges & assembling of given pipe work.
	Illustrate the use of tee, elbow, bend, socket, rectifiers and other pipe fittings for cutting threads &pipes.
19. Troubleshoot pumps.	Point out the common fault and take corrective action for reciprocating pumps, rotary pumps, centrifugal pumps and submersible pumps.
	Regulate appropriate and target oriented discussions with higher

	authority and within the team, where a replacement is uneconomic or unsatisfactory to conduct.
	Application of testing methods that comply with the manufacturer's demand.
	Calibrate the unit's components error free where necessary to ensure that they operate to meet the designated operating specifications.

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT			
PUMP OPERATOR CUM MECHANIC - CITS (For batch of 25 candidates)			
S No.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Allen Key set of 12 pieces	2mm to 14mm	6+1 Nos.
2.	Calliper inside with spring	15 cm	6 +1 Nos.
3.	Callipers outside with spring	15 cm	6 +1 Nos.
4.	Center Punch.	10 mm. Dia. x 100 mm	6 +1 Nos.
5.	Dividers with spring	15 cm	6 +1 Nos.
6.	Electrician Screw Driver	250mm	6 +1 Nos.
7.	Hammer ball peen with handle	0.5 kg	6 +1 Nos.
8.	Hands file for Second cut flat	20 cm.	6 +1 Nos.
9.	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	6 +1 Nos.
10.	Pliers combination	20 cm.	6 +1 Nos.
11.	Screw driver Blade	20cm. x 9mm.	6 +1 Nos.
12.	Screw driver Blade	30 cm. x 9 mm.	6 +1 Nos.
13.	Scriber	15 cm	6 +1 Nos.
14.	Spanner D.E. set of 12 pieces	6mm to 32mm	6 +1 Nos.
15.	Spanner, ring set of 12	6 to 32 mm. (metric)	6 +1 Nos.
16.	Spanners socket with speed handle, T-bar, ratchet and universal set of 28 pieces with box	up to 32 mm	6 +1 Nos.
17.	Steel rule	30 cm inch and metric	6 +1 Nos.
18.	Steel tool box with lock and key (folding type)	400x200x150 mm	6 +1 Nos.
19.	Wire cutter and stripper		6 +1 Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
20.	Outside caliper	15 cm spring	2 Nos.
21.	Inside caliper	15 cm spring	1 No.
22.	Caliper	15 cm Hermaphrodite	4 Nos.
23.	Divider	15 cm spring	4 Nos.
24.	Screw Driver	15 cm	4 Nos.
25.	Cold Chisel Flat	12mm	4 Nos.

26.	Ball pane Hammer	0.45 kg with handle.	1 No.
27.	Ball pane Hammer	0.22 kg with handle	2 Nos.
28.	Half round File	15 cm llnd cut.	1 No.
29.	Dot punch	10 cm	1 No.
30.	Warding File	15 cm smooth	2 Nos.
31.	Knife edge File	15 cm smooth	2 Nos.
32.	File cant saw	15 cm smooth	1 No.
33.	File feather edge	15 cm smooth	4 Nos.
34.	File triangular	15 cm smooth	4 Nos.
35.	File round	20 cm 2nd cut	1 No.
36.	File square	15 cm 2nd cut	1 No .
37.	File square	25 cm 2nd cut	4 Nos.
38.	Feeler gauge	10 blades	4 Nos.
39.	File triangular	20 cm 2nd cut	4 each
40.	File Swiss type needle	set of 12	2 Nos.
41.	File half round	25 cm IInd cut	2 Nos.
42.	File round	30 cm bastard	2 Nos.
43.	File Card		4 Nos.
44.	Stone oil	15 cm x5 cm x2.5 cm	04 nos.
45.	Stone carborundum	15 cm x 5 cm x 5 cm x 4	02 nos.
46.	Oil Can	0.25 liters	02 nos.
47.	Pliers combination	15 cm	02 nos.
48.	Spanner Metric—worth D.E. set of 10 pcs.		06 nos.
49.	Spanner adjustable	15 cm	02 set
50.	Interchangeable ratchet socket set	12 mm driver	01 set
51.	Box spanner	6-25 mm set of 8 with Tommy bar.	01 set
52.	Clamp toolmaker	5cm and 7.5 cm set of 2	02 nos.
53.	Clamp "c"	5 cm	02 nos.
54.	Clamp "c"	10 cm	02 nos.
55.	Hand reamer adjustable cover	max 9,12,I8mm-set of 3	01 set
56.	Hand reamer taper	4-9mm set of 6or 4- 7mmset of 4	01 set
57.	Reamer parallel	12-16mm set of 5	01 no.

58.	Scraper flat	15cm	06 nos.
59.	Scraper 3 corner	15 cm	06 nos.
60.	Scraper half round	15 cm	06 nos.
61.	Chisel cold	9mm cross cut 9 mm diamond	06 each
62.	Chisel cold	19mm flat	06 nos.
63.	Chisel cold	9 mm round nose	06 nos.
64.	Extractor stud EZY-out		02 nos.
65.	Set combination	30 cm	02 nos.
66.	Micrometer	0-25mm out side	03 nos.
67.	Micrometer	25-50mm out side with 25 mm test piece	03 nos.
68.	Micrometer	50-75mmout side with 50mm test piece	02 nos.
69.	Micrometer in side	25-50mm	01 no.
70.	Vernier caliper	20 cm	03 nos.
71.	Vernier height gauges	30 cm	01 no.
72.	Vernier bevel protractor		01 no.
73.	Screw pitch gauge		01 no.
74.	Wire gauge, metric standard		01 no.
75.	Drill twist Taper Shank	6mm to 25 mmx1.5	01set
76.	Drill chuck	12mm	01 no.
77.	Wheel dresser (1 for 4 units)		01 no.
78.	Machine vice	10cm	01 no.
79.	Machine vice	15 cm	01 no.
80.	Sleeve drill Morse	0-1,1-2,2-3	01 set
81.	Bench Vice	12cm jaws	20 nos.
82.	Leg Vice	10cm jaw	02 nos.
83.	Fire Extinguisher		02 nos.

84.	Fire Buckets		02 nos.
85.	Wing Compass	25.4cm or 30cm	02 nos.
86.	Hand Hammer	01KG with handle	02 nos.
87.	Radius Gauges(Assorted)		13 nos.
88.	Dial Test Indicator	.0 l mm with magnetic stand	01no.
89.	Lathe Tools HSS Tipped set		02 no.
90.	Lathe Tools Bit HSS	6mm,8mm,10mm x 100mm	13 nos.
91.	Counter Boring and Counter sinking Tool		02 nos.
92.	Arm strong type bit holder RH		02 nos.
93.	Arm strong type bit holder LH		02 nos.
94.	Arm strong type bit holder Straight		02 nos.
95.	Engineers Try Square (Knife wedge) 150mm Blade.		01no.
96.	Steel Rule	30 cm to read metric	04 nos.
97.	Steel Rule	60 cm	04 nos.
98.	Straight edge	45 cm steel	02 nos.
99.	Surface Plate	45x45 cm Cl/granite	02 nos.
100.	Marking table	91x91x122 cm	01 no.
101.	Pipe wrench	22 cm	02 nos.
102.	Pipe wrench	7 cm and 15 cm with clamps	02 nos.
103.	Pipe vice	15 cm blade	02 nos.
104.	Adjustable pipe tap set BSP with die set cover pipe size	10x20 cm	02 nos.
105.	Wheel dresser (1 for 4 units)	15cm metal	01 no.
106.	Letter Punch	3mm set	01 no.
107.	Number Punch set	3mm	01 no.

108.	Portable hand drill (electric)	0 to 6 mm	02 nos.
109.	Twist Drill straight shank	1.5 to 12 mm by 1/2 mm	01set
110.	Twist Drill straight shank	8 mm to 15 mm by 1/2 mm	01 set
111.	Taps and dies complete set in box B. A		01 no.
112.	Taps and dies complete set in box width-worth		01 no.
113.	Taps and dies complete set in box	3-18 mm set of 10	01 no.
114.	Adjustable pipe tap set BSP with die set cover pipe size	15,20,25,32,38,50mm	01 no.
115.	Wheel dresser (1 for 4 units)		01 no.
116.	Machine vice	10cm	01 no.
117.	Machine vice	15 cm	01 no.
118.	Power factor meter	Single phase-230 volt(Analog+Digital)	01 no Each
119.	Multimeter digital		5 Nos.
120.	Oil can	0.5/0.25 liter capacity	4 Nos.
121.	Oil pump for dismantling and assembling.		2 Nos.
122.	Oil Stone	15 cm x 5 cm x 2.5 cm	1 No.
123.	Oscilloscope	20MHz	2 Nos.
124.	Outside micrometer	0 to 25 mm	2 Nos.
125.	Outside micrometer	25 to 50 mm	2 Nos.
126.	Outside micrometer	50 to 75 mm	1 No.
127.	Outside micrometer	75 to 100 mm	1 No.
128.	Philips Screw Driver set of 5 pieces	100 mm to 300 mm	2 Nos.
129.	Pipe cutting tool		2 Nos.
130.	Pipe flaring tool		2 Nos.
131.	Pliers combination	20 cm.	2 Nos.

132.	Pliers flat nose	15 cm	2 Nos.
133.	Pliers round nose	15 cm	2 Nos.
134.	Pliers side cutting	15 cm	2 Nos.
135.	Portable electric drill Machine		1 No.
136.	Prick Punch	15 cm	4 Nos.
137.	Punch Letter 4mm (Number)		2 Sets
138.	Right cut snips	250mm	2 Nos.
139.	Rivet sets snap and Dolly combined	3mm, 4mm, 6mm	2 Nos.
140.	Scraper flat	25 cm	2 Nos.
141.	Scraper half round	25 cm	2 Nos.
142.	Scraper Triangular	25 cm	2 Nos.
143.	Scriber	15 cm	2 Nos.
144.	Scriber with scribing black universal		2 Nos.
145.	Set of stock and dies -Metric		2 Sets
146	Tinnman's Shear	450 mm x 600mm	2 Nos.
147	Sheet Metal Gauge		2 Nos.
148.	Tinnman's Shear	300mm	4 Nos.
149.	Soldering Copper	Hatchet type 500gms	2 Nos.
150.	Solid Parallels in pairs (Different size) in Metric		2 Nos.
151.	Spanner Clyburn	15 cm	1 No.
152.	Spanner D.E. set of 12 pieces	6mm to 32mm	4 Nos.
153.	Spanner T. flocks for screwing up and up-screwing inaccessible		2 Nos.
154.	Spanner, adjustable	15cm	2 Nos.
155.	Spanner, ring set of 12 metric sizes	6 to 32 mm.	4 Nos.
156.	Spanners socket with speed handle, T-bar, ratchet and universal		2 Nos.

157.	Spark lighter		2 Nos.
159.	Spark plug spanner 14mm x 18mm x Size		2 Nos.
160.	Starter motor axial type, pre-engagement type & Co-axial type		1Each
161.	Steel measuring tape in a case	10 meter	4 Nos.
162.	Straight edge gauge 2 ft.		2 Nos.
163.	Straight edge gauge 4 ft.		2 Nos.
164.	Stud extractor set of 3		2Sets
165.	Stud remover with socket handle		1 No.
166.	Surface gauge with dial test indicator plunger type	0.01 mm	4 Nos.
167.	Tachometer (Counting type)		1 No.
1.68	Tandem master cylinder with booster		4 Nos.
169.	Taps and Dies complete sets (5 types)		1 Set
170.	Taps and wrenches - Metric		2 Sets
171.	Telescope gauge		4 Nos.
172.	Temperature gauge with sensor	0-100 0C	2 Nos.
173.	Thermostat		2 Nos.
174.	Thread pitch gauge Metric		2 Nos.
175.	Timing lighter		2 Nos.
176.	Soldering Iron	25 watt, 65 watt, 125 watt	4 Nos each
177.	De soldering Gun		2 Nos
178.	Multi Meter (analog)	0 to 1000 M Ohms, 2.5 to 500 V	1 No
179.	Digital Multi Meter	3 ½ digit	4 Nos
180.	A.C. Voltmeter	M.I. 0 –500V A.C	1 No
181.	Milli Voltmeter		2 Nos
182.	Ammeter	MC 0-1A, 0-5 A, 0- 25 A	1 No
183.	A.C. Ammeter	M.I 0-10 -20 A, 0-15-25 A	2 Nos each
184.	Tachometer with stop watch	Analog + Digital	1 No each
185.	Tong Tester / Clamp Meter	0 – 100 amp. AC Analog+ Digital)	1No
186.	Megger	500 volts	1No
187.	Earth Tester	0-30 Ohm	2 Nos
188.	Contactor & auxiliary contacts	3 phase, 440 volt, 32 amp.	1 No each
189.	Torque wrenches	5-35 Nm, 12-68 Nm & 50-225 Nm	1Each
190.	Trammel	30 cm	2 Nos.
191.	Turbocharger cut sectional view		1 No.
192.	Tyre pressure gauge with holding nipple		2 Nos.
193.	Universal puller for removing pulleys, bearings		1 No.
194.	V' Block 75 x 38 mm pair with Clamps		2 Nos.
195.	Vacuum gauge	0 to 760 mm of Hg.	2 Nos.
196.	Valve Lifter		1 No.
197.	Valve spring compressor universal		1 No.

198.	Vernier calliper	0-300 mm with least count 0.02mm	4 Nos.
199.	Vice grip pliers		2 Nos.
200.	Water pump for dismantling and assembling		4 Nos.
201.	Wire Gauge (metric)		2 Nos.
202.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	4 Nos.
C. GENERAL MACHINERY AND EQUIPMENT			
203.	AC Squirrel Cage Motor with stardelta starter and triple pole iron clad switch fuse with braketest arrangement with two spring balance 0 to 25 kg rating.	2 to 3 HP, 3-phase ,40volts, 50 cycles	2Nos
204.	AC phase-wound slip ring Motor with starter and switch with brake test arrangement with two spring balance 0 to 25 kg rating.	5 HP, 400 volts, 3-phase, 50 cycles	1No
205.	Arbor press hand operated	2 ton capacity	1 No.
206.	Back pull out type centrifugal pump		1 No.
207.	Bench lever shears	250mm Blade x 3mm Capacity	1 No.
208.	Centrifugal pump coupled with mono block set		1No .
209.	Diesel engine	4 stroke	1 No.
210.	Diesel Engine	2 stroke	1 No.
211.	Diesel Engine Driven portable pump set		1 No.
212.	Diesel Engine	5 HP fitted with pump	1 Set
213.	Discrete Component Trainer / Basic Electronics Trainer		1 No.
214.	Drilling machine bench to drill	0 to 25 mm capacity with drill chuck and key	1 No.
215.	Dual Magnetization Yoke	AC / HWDC, 230 VAC, 50Hz	1 set
216.	Gas Welding Table	1220mm x760mm	2 Nos.
217.	Grinding machine (general purpose) D.E. pedestal	300x40x50.8 mm	1 No.
218.	Horizontal split casing pump	3 HP	1 No.
219.	Hydraulic jack HI-LIFT type	5 ton capacity,	1 No.
220.	Hydraulic Leak Testing equipment		1 No.
221.	Injector Testing set (Hand Tester)		1 No.

222.	Liquid penetrant Inspection kit		1 set
223.	Multi stage pump		1 No.
224.	Overhead tank, pump, minimum	5000 litres with level indicators and piping layout	1 No.
225.	Pipe Bending Machine (Hydraulic type)	12mm to 30mm	1 No.
226.	Pneumatic rivet gun		2 Nos.
227.	Portable electric drill Machine		1 No.
228.	Reciprocating Pump working for dismantling and assembling		1 No.
229.	Spring tension tester		1 No.
230.	Submersible pump set, eight stage	upto 10 KW/ 15 HP	1 No.
231.	Tin smiths bench folder	600 x 1.6mm	1 No.
232.	Trolley type portable air compressor single cylinder	with 45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg/sq cm	1 No.
233.	Welding plant Oxy-Acetylene complete (high pressure)		1 No.
234.	Welding Transformer	150-300 Amps	1 No.
D. CONSUMABLE			
235.	Battery- SMF		As required
236.	Brake fluids		As required
237.	Chalk, Prussian blue		As required
238.	Chemical compound for fasteners		As required
239.	Diesel		As required
240.	Different type gasket material		As required
241.	Different type of oil seal		As required
242.	Drill Twist (assorted)		As required
243.	Emery paper - 36–60 grit , 80–120		As required

244.	Engine oil & Engine coolant		As required
245.	Gear oils		As required
246.	Hacksaw blade (consumable)		As required
247.	Hand rubber gloves tested for 5000 V		5 Pairs
248.	Holders, lamp teakwood boards, plug sockets,		As required
249.	Hydrometer		8 Nos.
250.	Lapping abrasives		As required
251.	Leather apron		5 Nos.
252.	Petrol		As required
253.	Power steering oil		As required
254.	Radiator Coolants		As required
255.	Safety glasses		As required
256.	Steel wire Brush 50mmx150mm		5 Nos.
257.	Various types of seals required for pump assembly		As required
E. CLASS ROOM FURNITURE FOR TRADE THEORY			
258.	Instructor's table and Chair (Steel)		1 Set
259.	Students chairs with writing pads		25Nos.
260.	White board size 1200mm X 900 mm		1 No.
261.	Instructors lap top with latest configuration pre-loaded with operating system and MS Office package.		1 No.
262.	LCD projector with screen.		1 No.
263.	Trainees locker	6½ ' x 3' x 1½'	1 Set each (optional)

ANNEXURE – I

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

List of Expert members participated for finalizing the course curriculum of Pump Operator Cum Mechanic (CITS) trade.			
S No.	**Name & Designation Shri/Mr./Ms.**	**Organization**	**Remarks**
Industry Experts			
1.	Dr. K C Vora Sr. Dy. Director & Head Arai Academy	The Automotive Research Association of India. S.No.102, Vetal Hill, off Paud Road, Kothrud, Pune	Chairman
2.	Jayanta Patra Sr. Manager	Micromatic Machine Tools (P) Ltd. 240/241,11th Main, 3rd Phase, Peenya Industrial Area, Bangalore.	Member
3.	Kashinath M. Patnasetty Head - Application Support Group	Ace Designers Ltd. Plot No. 7&8, Ii Phase Peenya Industrial Area, Bangalore	Member
4.	Suyog Fulbadave, Executive HR	Piaggio Vehicles Pvt. Ltd, Pune	Member
5.	Sunil Khodke Training Manager	Bobst India Pvt Ltd Pirangut, Mulashi, Pune	Member
6.	Lokesh Kumar Manger Training Academy	Volkswagen India Pvt Ltd Pune	Member
7.	Shriram Tatyaba Khaire Executive Engineering	Sulzer India Pvt Ltd. Kondhapuri, Shirur, Pune	Member
8.	Milind P Desai Sr. Shift Engineer	Atlas Copco (I) Ltd Dapodi, Pune	Member
9.	Shrikant Mujumdar DGM	John Deere India Pvt Ltd. Pune - Nagar Road, Sanaswadi, Pune	Member
10.	Milind Sanghai Team Manager	Alfa Laval India Ltd. Dapodi, Pune	Member
11.	Rajesh Menon Unit Manager	Alfa Laval India Ltd. Dapodi, Pune	Member
12.	N K A Madhubalan DGM - QC, QA & SMPS	Sandvik Asia Pvt. Ltd. Dapodi, Pune	Member
13.	Irkar Balaji, Sr. Engineer Mfg.	Premium Transmission Ltd. Chinchwad, Pune	Member
14.	Rajendra Shelke Sr. Engineer Mfg.	Premium Transmission Ltd. Chinchwad, Pune - 19	Member
15.	Bhagirath Kulkarni Manager Maintenance	Tata Ficosa Auto Sys Ltd Hinjawadi, Pune	Member
16.	Rohan More Hr & Admin	Tata Ficosa Auto Sys Ltd Hinjawadi, Pune	Member
17.	G. Venkateshwaran	Cummins India Ltd	Member


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