PUMP OPERATOR CUM MECHANIC

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – AGRICULTURE AND ALLIED SERVICES

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

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(Revised in 2018)

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NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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Co-ordinator for the course: Sh. Nirmalya Nath., ADT, CSTARI- Kolkata

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
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2.	S. Bandypadhyay, T.O.	ATI, Kolkata	Member

CONTENTS

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

2. TRAINING SYSTEM

2.1 GENERAL

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

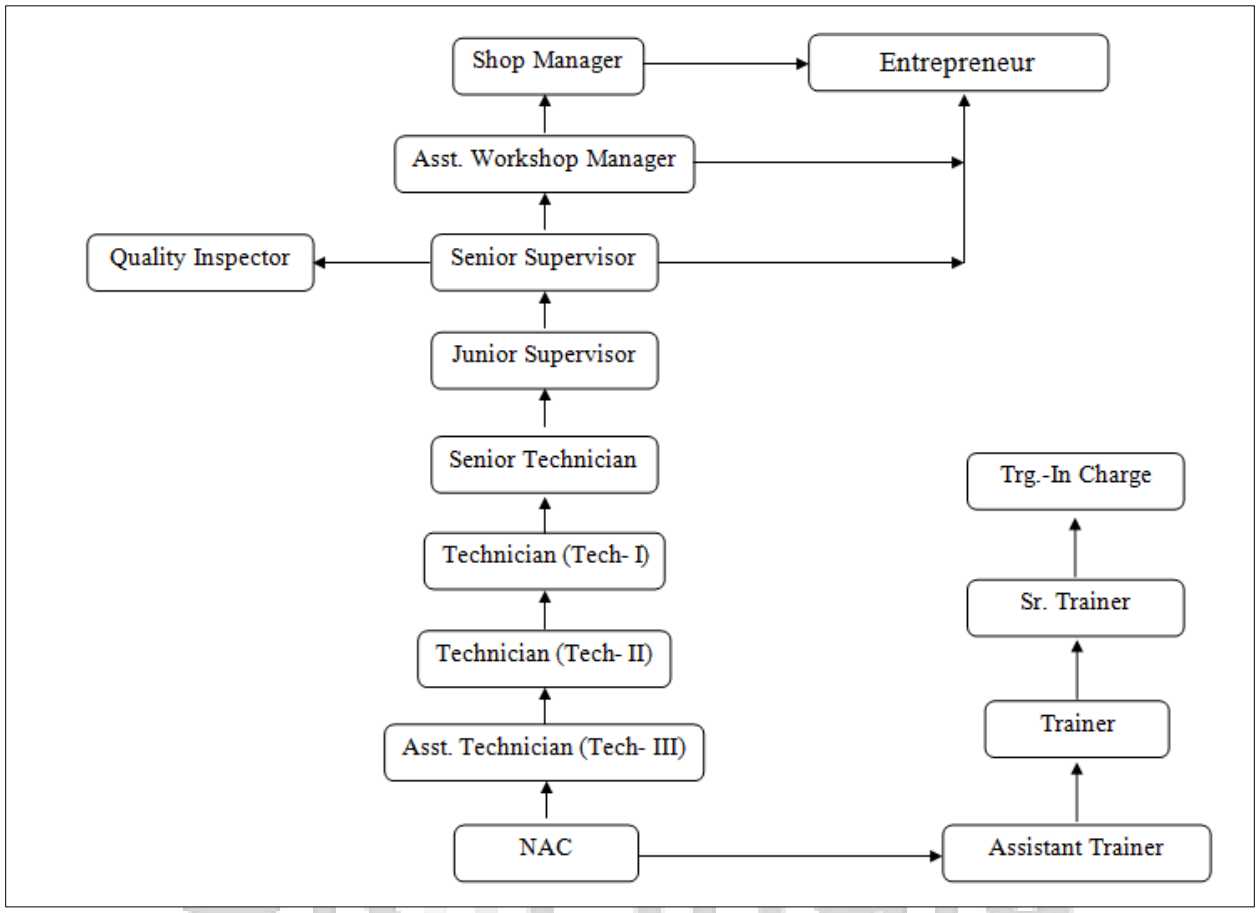
PUMP OPERATOR CUM MECHANIC trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the operation of pumps and valves as per specification for functioning, identify and rectify faults in it
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*) :-

Total training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	**Block– I**	**-----**	**Block – II**	**------**
Practical Training (On - job training)	**----**	**Block – I**	**------**	**Block – II**

A. Basic Training

For 02 yrs. course (Engg.) :-(**Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. course (Engg.) :-(**Total 03 months:** 03 months in 1st yr.)

S No.	Course Element	Total Notional Training Hours	
		For 02 Yrs. course	For 01 Yr. course
1.	Professional Skill (Trade Practical)	550	275
2.	Professional Knowledge (Trade Theory)	240	120
3.	Workshop Calculation & Science	40	20
4.	Engineering Drawing	60	30
5.	Employability Skills	110	55
	Total (Including internal assessment)	**1000**	**500**

B. On-Job Training:-

For 02 yrs. Course (Engg.) :-(**Total 18 months:** 09 months in 1st yr. + 09 months in 2nd yr.)
Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. course (Engg.) :-(**Total 12 months**)
Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 yrs. course (Engg.)	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. course (Engg.)	500 hrs.	2080 hrs.	2580 hrs.

2.4 ASSESSMENT & CERTIFICATION:

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

a) **The Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India

from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work

standard of craftsmanship.	with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

PUMP OPERATOR CUM MECHANIC; Pump Operator; Pump House Attendant; Pump Driver; operates one or more power-driven machines for pumping, storing and supplying liquids or other fluid materials or for dewatering purposes. Starts pump, observes its operation and adjusts controls to maintain correct rate of pumping; stops pump when required quantity of fluid has been moved; cleans, oils and greases pump, tightens loose parts and performs other servicing tasks to keep pump and equipment in good running order and safe condition. May do minor repairs. May connect pipe lines from pump to vessel to be filled or emptied. May be designated according to type of pump operated or type of material (fluid) pumped, as PUMP OPERATOR, STEAM PUMP OPERATOR, DIESEL; PUMP OPERATOR (ELECTRIC); TUBE WELL OPERATOR.

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

Reference NCO:

i) NCO-2015 :3132.0600 - Pump Station Operator, Waterworks
ii) NCO-2015-7233.1300 - Mechanic, Pump

4. NSQF LEVEL COMPLIANCE

NSQF level for PUMP OPERATOR CUM MECHANIC trade under ATS: **Level 5**

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

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

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

a. Process
b. professional knowledge,
c. professional skill,
d. core skill and
e. Responsibility.

The Broad Learning outcome of PUMP OPERATOR CUM MECHANIC trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	PUMP OPERATOR CUM MECHANIC
NCO – 2015	3132.0600, 7233.1300
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related trades of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for PUMP OPERATOR CUM MECHANIC Apprenticeship	PUMP OPERATOR CUM MECHANIC

Note:

- *Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Pump Operator cum Mechanic course of 02 years duration under ATS.

Block I & II:-

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

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information.

3. 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.
4. Familiarization with plain/journal bearings, anti-friction bearings used on machine assembly. Specification mounting of bearing on shafts and in housing with proper fit & axis alignment. Use of proper tools. Removal of bearings from s hafts & housing by using pullers.
5. Cleaning up & removing old metal form bearing and replacing with new metal. Checking of shafts for alignment with dial indicator.
6. 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.
7. 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.
8. 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
9. 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.
10. Reconditioning of centrifugal pumps.
11. Identifying and rectifying defects of pump sets. Practice on preventive & scheduled maintenance of pump sets.
12. Making different types of keys for fitting pulleys, Assembling and dismantling of bushes, bearings and couplings maintaining safety.

Block – II

13. 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.
14. Inspecting and Quality Controlling of finished products.
15. Material management and estimating the cost of repairing and reconditioning of pump sets.

16. Assembling and testing for correct function. Inspecting & rectifying causes of failure of reciprocating, centrifugal, submersible, steam and vacuum pump.
17. 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.
18. 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.
19. Oil engine filter repair services and overhauling of diesel or oil engines for efficient performance.
20. Locating the faults to electric system and repairing the coil/rewinding.
21. Installation of assembled or repaired engine in position and connecting with propulsion system.
22. Starting of engine ,tuning it up and observe performances noting of different reading such as temperature, fuel level, oil pressure etc and setting it to specified standard for optimum performance.
23. Checking, adjusting and lubricating engines periodically and performance testing.
24. Repairing and reconditioning of diesel, petrol, kerosene engines, electric motors & steam turbine.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

electrical and apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Power transmission, Pressure]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, and dial gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts

6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I& II (Section:10)	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II**(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2.	Identification of tools &equipments as per desired specifications related to the trade(Hand tools , Fitting tools & Measuring tools) Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections.	**HAND & POWER TOOLS:-** Marking scheme, MARKING MATERIAL- chalk, Prussian blue. Cleaning tools- Scraper, wire brush, Emery paper, Description, care and use of Surface plates, steel rule, measuring tape, try square. Calipers-inside and outside. Dividers, surface gauges, scriber, punches-PRICK PUNCH, center punch, pin punch, hollow punch, number and

	Chipping flat surfaces and grinding various angles to chisels, filing flat surface. Grooving with Hammer and chisel. Marking and Drilling holes on flat pieces. Tapping as per simple drawing. Practice on General cleaning, checking and use of nut, bolts, & studs etc. Removal of stud/bolt from blind hole. Use of Lubrication, Cutting Threads on a Bolt/ Stud with die. Adjustment of two piece Die, Reaming a hole/ Bush to suit the given pin/ shaft, scraping a given machined surface.	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.
3-4	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.	Pump Industry in India - leading manufacturers, development in Pump Industry, trends, new product. Pumps-its importance for agricultural & industrial applications. Classification of pumps, its prime movers, parts and operation safety. Classification of reciprocating pump, construction and operation. Installation technique of reciprocating pump. Tools and equipment required & procedure.
5.	Familiarization with plain/journal bearings, anti-friction bearings used on machine assembly. Specification Mounting of bearing on shafts and in housing with proper fit & axis alignment. Use of proper tools. Removal of bearings from s hafts & housing by using pullers. Cleaning up & removing old metal form bearing and replacing with new metal. Checking of shafts for alignment with dial indicator.	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,
6-7	Dismantling of rotary pumps- impeller, shaft, bearing etc, for inspection, Repair &	Classification of rotary pumps-Construction and operation- repairing

	replacement. Cleaning of parts and assembling. Checking for alignment, clearance, etc., Priming technique and its application. Installing, operating & testing of rotary pumps.	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
8.	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	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
9.	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
10.	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. 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.
11.	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	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.

	pipes.	Procedure to fit flanges & for leak testing.
12..	Reconditioning of centrifugal pumps.	Principle of centrifugal pump. Construction and operation of centrifugal pump in series and parallel. Finding out defects and method to recondition centrifugal pump.
13.	**Internal Assessment/Examination 03days**	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

BASIC TRAINING (Block – II)
Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	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. Reconditioning of centrifugal pumps.	Method of install, align and testing of pumps for their serviceability. Concept of lightening torque for different sizes of bolts.
2-3.	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.	Submersible pump- construction, operation and selection of appropriate type. Procedure to recondition, install and test of submersible pumps. Causes of failures and remedial measures.
4.	Identifying and rectifying defects of pump sets. Practice on preventive & scheduled maintenance of pump sets.	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.
5.	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.	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.
6.	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 earthling	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

	wires. Measurement of electrical power and energy consumed for a definite period of time.	connection. Procedure to identify live, neutral, single phase and 3-phase power supply. Method to measure power and energy consumed by electrical appliances using wattmeter and Energy meter.
7.	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.
8.	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. 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. Care and maintenance of lifting equipment and safety to be observed by handling the equipment.	Specification and use of different types of ropes such as hemp, manila, nylon, wire etc. Specification and correct use of slings. Safety to be observed in use of ropes and slings. 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.

9-10.	Identification of different type of stationary Engine and their applications. 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	Principle of Compression-ignition engine, Spark Ignition Engine, differentiate between 4-stroke and 2 stroke, C.I engine and S.I Engine, Otto cycle and Diesel cycle. Different type of starting and stopping method of Diesel Engine. Technical terms used in engine, Engine specification
11.	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	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.
12.	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.	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.
13.	**Revision & Internal Assessment**	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration : - 30 hrs.)**
1.	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
2.	**Material Science** : properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice
3.	**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	**Dimensioning**- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.
4.	**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view

5.	**Ratio &Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand
6.	**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. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1st angle and 3rd angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration : - 30 hrs.)**
1.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.
2.	**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.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.
3.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	Free hand Sketches for simple pipe line with general fittings.
4.	**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. Concept of earthling.	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.
5.	**Simple machines Transmission of power:** -Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols
6.	**Trigonometry:**	Free hand sketch of trade related

	Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	components / parts /cutting tool indicating angles.
7.	**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems.	
8.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I **(Duration – 55 hrs.)**	
1. English Literacy Duration : 20 Hrs. Marks : 09	
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on 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 Duration : 20 Hrs. Marks : 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	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. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills Duration : 15 Hrs.	Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude

Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills Duration : 15 Hrs. Marks : 06	
Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale &Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity Duration : 10 Hrs. Marks : 05	
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How 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 and Environment Education Duration : 15 Hrs. Marks : 06	
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.

Occupational Hazards	Basic Hazards, Chemical Hazards, Vibro acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation Duration : 05 Hrs.	Marks : 03
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools Duration : 10 Hrs.	Marks : 05
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for

	continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

BROAD LEARNING TO BE COVERED DURING ON – JOB TRAINING

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Repairs pumps of process machinery: examines pumps for malfunctioning and to locate damage or wear.
4. Carryout maintenance of different types of pumps & lifting tackles both mechanical and hydraulic.
5. Repair and maintenance of Prime mover.

Note: Actual training will depend on the existing facilities available in the establishments.

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

Block – I

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. 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.
4. Familiarization with plain/journal bearings, anti-friction bearings used on machine assembly. Specification mounting of bearing on shafts and in housing with proper fit & axis alignment. Use of proper tools. Removal of bearings from s hafts & housing by using pullers.
5. Cleaning up & removing old metal form bearing and replacing with new metal. Checking of shafts for alignment with dial indicator.
6. 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.
7. 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.

8. 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
9. 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.
10. Reconditioning of centrifugal pumps.
11. Identifying and rectifying defects of pump sets. Practice on preventive & scheduled maintenance of pump sets.
12. Making different types of keys for fitting pulleys, Assembling and dismantling of bushes, bearings and couplings maintaining safety.

Block – II

13. 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.
14. Inspecting and Quality Controlling of finished products.
15. Material management and estimating the cost of repairing and reconditioning of pump sets.
16. Assembling and testing for correct function. Inspecting & rectifying causes of failure of reciprocating, centrifugal, submersible, steam and vacuum pump.
17. 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.
18. 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.
19. Oil engine filter repair services and overhauling of diesel or oil engines for efficient performance.
20. Locating the faults to electric system and repairing the coil/rewinding.
21. Installation of assembled or repaired engine in position and connecting with propulsion system.
22. Starting of engine, tuning it up and observe performances noting of different reading such as temperature, fuel level, oil pressure etc and setting it to specified standard for optimum performance.
23. Checking, adjusting and lubricating engines periodically and performance testing.

24. Repairing and reconditioning of diesel, petrol, kerosene engines, electric motors & steam turbine.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

PUMP OPERATOR CUM MECHANIC			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-19is required additionally)			
Sl. no.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
1	Allen Key	Set of 12 pieces (2mm to 14mm)	6 Nos.
2	Caliper inside	15 cm Spring	6 Nos.
3	Calipers outside	15 cm spring	6 Nos.
4	Center Punch	10 mm. Dia. x 100 mm.	6 Nos.
5	Dividers	15 cm Spring	6 Nos.
6	Electrician Screw Driver	250mm	6 Nos.
7	Hammer ball peen	0.5 kg with handle	6 Nos.
8	Hands file	20 cm. Second cut flat	6 Nos.
9	Philips Screw Driver	Set of 5 pieces (100 mm to 300 mm)	6 Nos.
10	Pliers combination	20 cm	6 Nos.
11	Screw driver	20cm.X 9mm. Blade	6 Nos.
12	Screw driver	30 cm. X 9 mm. Blade	6 Nos.
13	Scriber	15 cm	6 Nos.
14	Spanner D.E.	Set of 12 pieces (6mm to 32mm)	6 Nos.
15	Spanner, ring	Set of 12 metric sizes 6 to 32 mm	6 Nos.
16	Spanners socket with speed handle, T-bar, ratchet and universal	Upto 32 mm set of 28 pieces with box	6 Nos.
17	Steel rule	30 cm inch and metric	6 Nos.
18	Steel tool box with lock and key (folding type)	400x200x150 mm	6 Nos.
19	Wire cutter and stripper	15 cm	6 Nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20.	Adjustable spanner (pipe wrench)	350 mm	2 Nos.

21.	Air blow sun with standard accessories		1 No.
22.	Air impact wrench with standard accessories		4 Nos.
23.	Air ratchet with standard accessories		4 Nos.
24.	Allen Key	set of 12 pieces (2mm to 14mm)	4 Nos.
25.	Ammeter	300A/ 60A DC with external shunt	4 Nos.
26.	Angle plate adjustable	250x150x175	1 No.
27.	Angle plate size	200x100x200mm	2 Nos.
28.	Anvil with Stand	50 Kgs	1 No.
29.	Auto Electrical test bench		1 No.
30.	Battery -charger		2 Nos.
31.	Bearing and gear tester		2 Nos.
32.	Belt Tensioner gauge		1 No.
33.	Blow Lamp 1 litre		2 Nos.
34.	Bradawl		2 Nos.
35.	Caliper inside	15 cm Spring	4 Nos.
36.	Calipers outside	15 cm spring	4 Nos.
37.	Cam lock type screw driver		1 No.
38.	Car Jet washer with standard accessories		1 No.
39.	Carge winches	3. 5 tonnes	1 No.
40.	Chain pipe wrench	65 m	2 Nos.
41.	Chain Pulley Block- with tripod stand	3 ton capacity	1 No.
42.	Chisel	10 cm flat	4 Nos.
43.	Chisels cross cut	200 mm X 6mm	4 Nos.
44.	Circlip pliers Expanding and contracting type	15cm and 20cm each	4 Nos.
45.	Clamps C	100mm	2 Nos.
46.	Clamps C	150mm	2 Nos.
47.	Clamps C	200mm	2 Nos.
48.	Cleaning tray	45x30 cm.	4 Nos.
49.	Compression testing gauge suitable for diesel Engine		2 Nos.
50.	Copper bit soldering iron	25 W	5 Nos.
51.	crab		1 No.
52.	Cylinder bore aauae capacity	20 to 160 mm	4 Nos.
53.	DC Ohmmeter, mid scales at 20 Ohms	0 to 300 Ohms	4 Nos.

54.	Depth micrometer	0-2 5mm	4 Nos.
55.	Dial gauge type 1 Gr. A (complete with clamping devices and stand)		4 Nos.
56.	Different type of Engine Bearing model		1 set
57.	Digital Tone Tester	0-20 A AC	2 Nos.
58.	Dividers	15 cm Spring	4 Nos.
59.	Drift Punch Copper	15 Cm	4 Nos.
60.	Drill point angle gauge		1 No.
61.	Drill twist (various sizes) by 0.5 mm	1.5 mm to 15 mm	4 Nos.
62.	Electric Soldering Iron	230 V 60 watts 230 V 25 watts	2 each
63.	Electric testing screw driver		2 Nos.
64.	Energy meter	AC. Single Phase. 5 Amps. 230 Volts	2 Nos.
65.	Engineers square	700 mm	4 Nos.
66.	Engineers stethoscope		1 No.
67.	Feeler gauge (metric)	20 blades	4 Nos.
68.	File flat ,bastard	20 cm	4 Nos.
69.	File, half round ,second cut	20 cm	4 Nos.
70.	File. Square, second cut	20 cm	4 Nos.
71.	File. Square ,round	30 cm	4 Nos.
72.	File, triangular ,second cut	15 cm	4 Nos.
73.	Files assorted sizes and types including safe edge file (20 Nos)		2 set
74.	Flat File ,second cut	25 cm	4 Nos.
75.	Flat File bastard	35 cm	4 Nos.
76.	Flow meter ,Itinin	0-400	2 Nos.
77.	Forks clips 02 tonnes (copa)		1 No.
78.	Forks clips 05 tonnes (copa)		1 No.
79.	Foundation bolt		4 Nos.
80.	Gasket hollow punches	5. 6. 8. 10. 12. 19. 25 mm dia.	l set
81.	Glow plug tester		2 Nos.
82.	Granite surface plate with stand and cover	1600 x 1000	1 No.
83.	Grease Gun		2 Nos.
84.	Growler		2 Nos.
85.	Hacksaw frame adjustable	20-30 cm	10 Nos.
86.	Hammer Ball Peen	0.75 Kg	4 Nos.

87.	Hammer Chipping	0.25 Kg	4 Nos.
88.	Hammer copper ,with handle	1 Kg	4 Nos.
89.	Hammer Mallet		4 Nos.
90.	Hammer Plastic		4 Nos.
91.	Hand key way broacher		1 No.
92.	Hand operated chain pulley block		1 No.
93.	Hand operated crimping tool	i) for crimping up to 4mm and (ii) for crimping up to 10mm	2 Nos.
94.	Hand reamers adjustable	10.5 to 11.25 mm. 11.25 to 12.75 mm. 12.75to 14.25 mm and 14.25 to 15.75 mm	2sets
95.	Hand Shear Universal	250mm	2 Nos.
96.	Hand vice -	37 mm	2 Nos.
97.	Hollow Punch set of seven pieces	6mm to 15mm	2 sets each
98.	Hydraulic wheel and bearing puller		2 Nos.
99.	Injector - Multi hole type Pintle type		4 each
100.	Injector cleaning unit		1 No.
101.	Injector testing set (Hand tester)		1 No.
102.	Insulated Screw driver	20 cm x 9mm blade	4 Nos.
103.	Insulated Screw driver	30 cm x 9mm blade	4 Nos.
104.	Ladle	150mm Dia	1 No.
105.	Left cut snips	250mm	4 Nos.
106.	Level bottle (sprit).	150 ml	1 No.
107.	Lifting jack screw type	3 ton capacity	4 Nos.
108.	Magneto spanner set with S spanners		1 set
109.	Magnifying glass	75mm	2 Nos.
110.	Manila ropes	12. 20. 30 mm dia.	2 sets
111.	Marking out table.	90X60X90 cm	1 No.
112.	Masonry bit	(Assorted up to 12 mm)	2set
113.	Master test bars (different size)		1 No.
114.	Meager	500 V	2 Nos.
115.	Mobile crank		1 No.
116.	Multimeter digital		5 Nos.
117.	Oil can	0.5.0.25 liter capacity	2 Nos.
118.	Oil Stone	15 cm x 5 cm x 2.5 cm	1 No.
119.	Outside micrometer	0 to 25 mm	4 Nos.

120.	Outside micrometer	25 to 50 mm	4 Nos.
121.	Outside micrometer	50 to 75 mm	1 No.
122.	Outside micrometer	75 to 100 mm	1 No.
123.	Philips Screw Driver set of 5 pieces	(100 mm to 300 mm)	2 sets
124.	Pin spanner set		2 Nos.
125.	Pipe cutting tool		2 Nos.
126.	Pipe flaring tool		2 Nos.
127.	Pipe wrench	45 mm	2 Nos.
128.	Pliers combination	20 cm.	2 Nos.
129.	Pliers flat nose	15 cm	2 Nos.
130.	Pliers round nose	15 cm	2 Nos.
131.	Pliers side cutting	15 cm	2 Nos.
132.	Plumb bob		1 No.
133.	Pneumatic scraper with adjustable stroke		2 Nos.
134.	Portable electric drill Machine		1 No.
135.	Portable jack		1 No.
136.	Power Supply	0-12 v. lamp	1 No.
137.	Pressure gauge	0 -5 Kg cm2	2 Nos.
138.	Prick Punch	15 cm	4 Nos.
139.	Punch Letter (Number)	4mm	2 set
140.	Radius Gauge. Metric		2 Nos.
141.	Ratchet chain pulley		1 No.
142.	Rawl plug tool & kit		2 Nos.
143.	Right cut snips	250mm	4 Nos.
144.	Rivet sets snap and Dolly combined 3mm, 4mm, 6mm		4 Nos.
145.	Rollers (steel tubes).	from 40 to 65 mm dia	5 Nos.
146.	Rotary pump working for dismantling and assembling		1 No.
147.	Scientific Calculator		2 Nos.
148.	Scraper flat	25 cm	2 Nos.
149.	Scraper half round	25 cm	2 Nos.
150.	Scraper Triangular	25 cm	2 Nos.
151.	Screw jacks		1 No.
152.	Scriber	15 cm	2 Nos.
153.	Scriber with scribing black universal		2 Nos.
154.	Self alignment roller ball bearing		2 Nos.

155.	Set of stock and dies - Metric		2 sets
156.	Shear legs (tripod)		1 No.
157.	Shear Tin Man's	450 mm x 600mm	4 Nos.
158.	Sheet Metal Gauge		2 Nos.
159.	squirrel gage Induction motor	Single Phase 220 V Capacitor type AC Motor	1 No.
160.	Soldering Copper Hatchet type	500 gms	4 Nos.
161.	Solid Parallels in pairs (Different size) in Metric		4 Nos.
162.	Spanner Clyburn	15 cm	1 No.
163.	Spanner D.E.	set of 12 pieces (6mm to 32mm)	4 Nos.
164.	Spanner T. flocks for screwing up and up-screwing inaccessible		2 Nos.
165.	Spanner, adjustable	15cm.	2 Nos.
166.	Spanner, ring	set of 12 metric sizes 6 to 32 mm.	2 Nos.
167.	Spanners socket with speed handle. T-bar. ratchet and universal upto		2 Nos.
168.	Spark lighter		2 Nos.
169.	Spark plug spanner	14mm x 18mm x Size	2 Nos.
170.	Square box wrenches		1 No.
171.	Square T-wrenches		1 No.
172.	SRDG ball bearing. DRDG ball bearing, self aligning ball bearing.		1 No.
173.	Steel measuring tape	10 meter in a case	4 Nos.
174.	Steel rule ,inch and metric	15 cm	4 Nos.
175.	Steel rule ,inch and metric	30 cm	4 Nos.
176.	Steel wire Brush	50mmx 150mm	5 Nos.
177.	Straight edge gauge	2 ft.	2 Nos.
178.	Straight edge gauge	4 ft.	2 Nos.
179.	Stud extractor set of 3		2 sets
180.	Stud remover with socket handle		1 No.
181.	Surface gauge with dial test indicator plunger type i.e. 0.01 nun		1 No.
182.	Tachometer (Counting type)		1 No.
183.	Taps and Dies complete sets (5 types)		1 set
184.	Taps and wrenches - UNC, UNF and metric		2 sets
185.	Telescope gauge		4 Nos.

186.	Temperature gauge	0-100 de ac	2 Nos.
187.	Thermostat		2 Nos.
188.	Thimbles of different sizes		2 Nos.
189.	Thread pitch gauge Metric.		1 No.
190.	Threaded fastener type B		2 Nos.
191.	Threaded fastener type C		2 Nos.
192.	Threaded fastener type F		2 Nos.
193.	Three cell torch		2 Nos.
194.	Squirrel gage induction motor with star delta starter	Three Phase 50 Hz. 5 HP AC	1 No.
195.	Timing lighter		1 No.
196.	Torque wrenches	5-35 Km. 12-68 km & 50-225 Km	1 each
197.	Trammel	30 cm	2 Nos.
198.	Travelling and gantry cranes		1 No.
199.	Tube expander	up to 62 mm	1 No.
200.	Universal puller for removing pulleys, bearings		1 No.
201.	V" Block ,pair with Clamps	75 x 3S mm	2 Nos.
202.	Vacuum gauge	to read 0 to 760 mm of Hg.	2 Nos.
203.	Vernier caliper	0-300 mm with least count 0.02mm	4 Nos.
204.	Vibrometer		2 Nos.
205.	Vice grip pliers		2 Nos.
206.	Voltmeter	AC 0 to 500 V	2 Nos.
207.	Wall hoists		1 No.
208.	Water pump for dismantling and assembling		2 Nos.
209.	Wattmeter AC DC.	0 to 10 K\v	2 Nos.
210.	Wire Gauge (metric)		5 Nos.
211.	Work bench	250 x 120 x 60 cm with 4 vices 12cm Jaw	1 No.
C : GENERAL MACHINERY INSTALLATIONS			
1	Arbor press hand operated	2 ton capacity	1 No.
2	Back pull out type centrifugal pump		1 No.
3	Bench lever shears	250mm Blade x 3mm Capacity	1 No.
4	Centrifugal pump coupled with mono block set		1 No.

5	Diesel engine	2 stroke vertical (up to 10 KW ISHP)	1 No.
6	Diesel Engine 4 stroke vertical	(up to about 10 KW ISHP)	1 No.
7	Diesel Engine Driven portable pump set		1 No.
8	Diesel Engine ,fitted with pump	Upto 3.5 KW . 4.5 HP	1 No.
9	Discrete Component Trainer Basic Electronics Trainer		1 No.
10	Drilling machine bench to drill ,along with accessories	up to 12inm dia	1 No.
11	Dual Magnetization Yoke	AC: HWDC 230 VAC. 50Hz	1 set
12	Gas Welding Table	1220mm x760nini	2 Nos.
13	Grinding machine (general purpose) D.E. pedestal	300 mm dia wheels rough and smooth	1 No.
14	Horizontal split casing pump		1 No.
15	Hydraulic jack HI-LIFT type	3 ton capacity.	1 No.
16	Hydraulic Leak Testing equipment		1 No.
17	Injector Testing set (Hand Tester)		1 No.
18	Liquid penetrant Inspection kit		1 set
19	Multi stage pump		1 No.
20	Overhead tank. pump, with level indicators and piping layout	minimum 5000 litters	1 No.
21	Pipe Bending Machine (Hydraulic type)	12mm to 30mm	1 No.
22	Pneumatic rivet gun		1 No.
23	Portable electric drill Machine		1 No.
24	Reciprocating Pump working for dismantling and assembling		1 No.
25	Spring tension tester		1 No.
26	Submersible pump set, eight stage	upto 10 KW7 15 HP	1 No.
27	Tin smiths bench folder	600 x 1.6mm	1 No.
28	Trolley type portable air compressor single cylinder	45 liters capacity Air tank, along with accessories & with working pressure 6.5 kg sq cm	1 No.
29	Welding plant Oxy-Acetylene complete (high pressure)		1 No.
30	Welding Transformer	(150-300 Amps)	1 No.

Note: *In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training*.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: PUMP OPERATOR CUM MECHANIC

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

1) **Space Norms** : 45 Sq.m. (For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		20 Nos.
2.	Set square celluloid 45^o	(250 X 1.5 mm)	20 Nos.
3.	Set square celluloid 30^o-60^o mm)	(250 X 1.5	20 Nos.
4.	Mini drafter		20 Nos.
5.	Drawing board IS: 1444	(700mm x500 mm)	20 Nos.
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		20 Nos.
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board (size: 8ft. x 4ft.)		01
7	Trainer's Table		01
8	Trainer's Chair		01

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

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :			**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :			**Date of Assessment :**
Name & Address of the Industry :			**Assessment location: Industry / ITI**
Trade Name :	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness (15)	Workplace hygiene (5)	Attendance/ Punctuality (10)	Ability to follow Manuals/ Written instructions (5)	Application of Knowledge (10)	Skills to handle tools & equipment (10)	Economical use of materials (5)	Speed in doing work (10)	Quality in workmanship (15)	VIVA (15)	**Total internal assessment Marks**	**Result (Y/N)**
1														
2														