STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR

COMPETENCY BASED CURRICULUM
(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – Production and Manufacturing

Skill India
कौशल भारत-कुशल भारत

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

STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR

(Revised in 2018)

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Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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1. TATA Steel, Jamshedpur

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Sl. No.	Name & Designation Shri/Mr./Ms.	Organization	Mentor Council Designation
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CONTENTS

Sl. No.	Topics	Page No.
1.	Background	1-2
2.	Training System	3-7
3.	Job Role	8
4.	NSQF Level Compliance	9
5.	General Information	10
6.	Learning Outcome	11-15
7.	Learning Outcome with Assessment Criteria	16-18
8.	Syllabus	19-29
9.	Syllabus - Core Skill	30-37
	9.1 Core Skill – Workshop Calculation & Science and Engineering Drawing	30-33
	9.2 Core Skill – Employability Skill	34-37
10.	Details of Competencies (On-Job Training)	38-41
11.	List of Trade Tools & Equipment Basic Training - Annexure I	42-50
12.	Format for Internal Assessment -Annexure II	51

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.

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2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of 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.

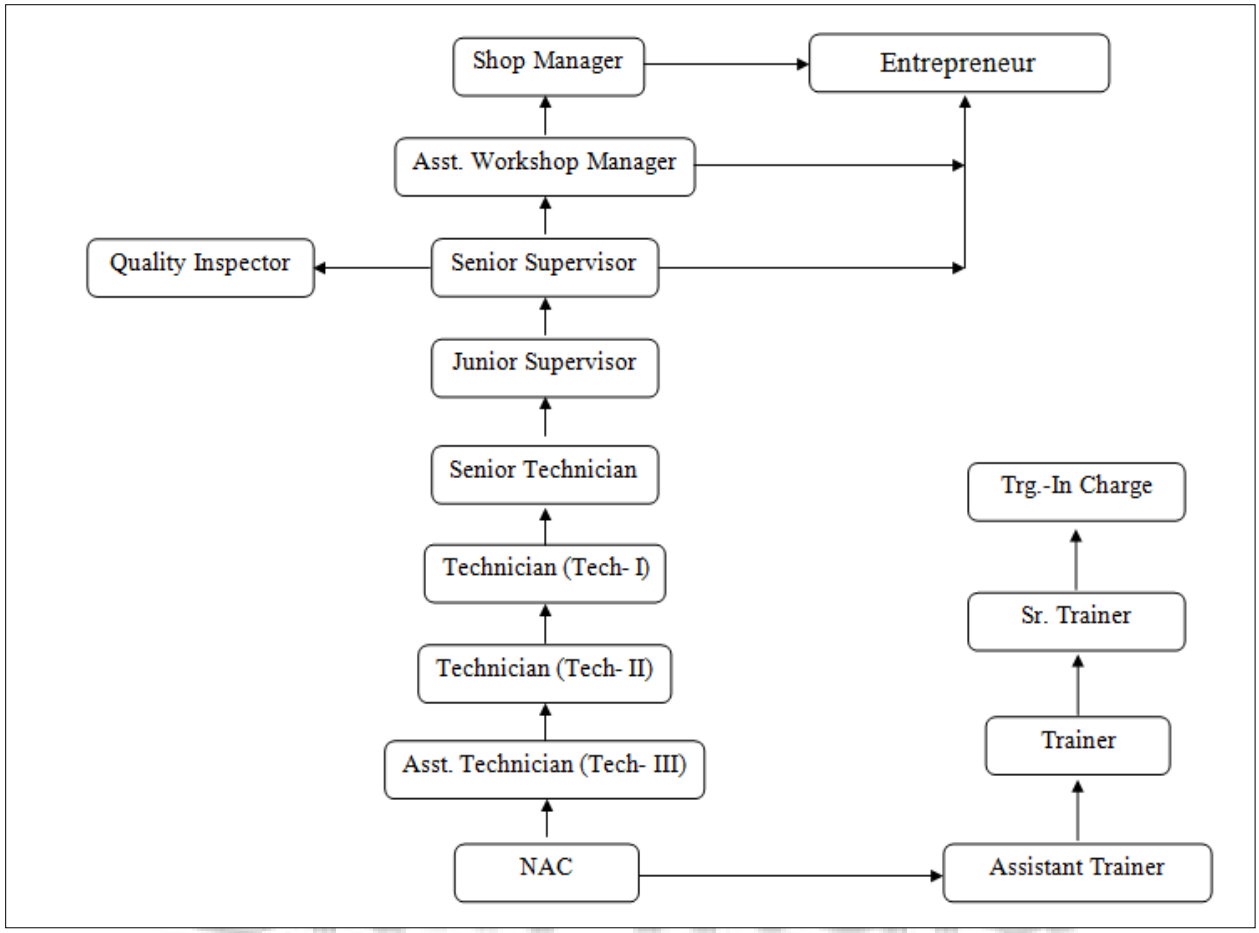
STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR trade under ATS is one of the courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills 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 job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- 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**

STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR

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 standard of craftsmanship.	• 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 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:

Turbine Operator, Steam; Turbo generator Operator, Steam operates steam powered turbine which drives generators for producing electricity. Starts of turbine by opening valve for supply of steam into turbine to rotate turbine wheels; runs turbine at low speed for pre-determined length of time and notifies switch-board operator when ready to run turbine at full working speed; increases speed of turbine and ensures that automatic regulator maintains correct working speed; notifies switch-board operator that turbine can be synchronized with other power units in plant. Observes gauges and meters to ensure proper handling of load by turbine and its proper functioning; alters power output of turbine and makes other adjustments as necessary. Cuts out unit evaporator to conduct blow down of turbine for periodic overhauling. May keep records of instrument readings. May repair and overhaul equipment and other auxiliaries.

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.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference **NCO**-2015: **3131.0300**

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4. NSQF LEVEL COMPLIANCE

NSQF level for STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR 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 STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR 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	STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR
NCO-2015	**3131.0300**
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 trade 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	NIL
CTS trades eligible for STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR Apprenticeship	NA

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 STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR 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, Centre of gravity, 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, Method of representation, Symbol, scales, Different Projections, Assembly drawing, 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. Introduction to elementary knowledge of feed water system and boiler feed pump, draught system of boilers, fuel system, steam network and turbine and visit at site.
4. Study of different parts & fittings of a boiler such as steam and water drums, stoker gauge, water tubes and flow tubes, high and low water level alarm, gauge glasses, soot blowers, safety valves etc. Forced draught, induced draught, balanced draught and secondary draught fans, Air pre-heater, chimney, water walls, water wall tubes, boiler bank tubes, primary and secondary super heaters, Attemperator, down comer and riser tubes, de-aerator, LP and HP dosing pumps, DM water plant and water chemistry, coal mills and coal handling plats, cooling towers & economizer, boiler controls, etc.
5. Measurement of temperature, pressure, vacuum, draught, flow using appropriate instruments for different system.
6. Uses, methods of jointing, checking of joints for leakage and remedy thereof.
7. Study of different parts of turbine; study the features of construction of blades, nozzles, governor parts, condensers, ejectors, etc. Study of different types of pumps, compressors and their parts. Different types of valves.
8. Boiler & their Auxiliaries:

   a) Working and management of steam boilers; economizers and air heater.
   b) Correct use of various types of cocks, mounting and fittings used in boilers.
   c) Functions of feed pumps.
   d) Operation of fans, blowers, feed pumps including starting and stopping.
   e) Operation of fuel preparation equipment, fuel feeding indicators and recorders orsat apparatus, smoke density drive and draft regulation of proper combustion.
   f) Operation of ash discharge disposal system in boiler.
   g) Water level control in boiler operation, blow-down of boiler.
   h) Control of steam pressure and steam flow.
   i) Operation of super heater and control of super heated steam temperature.
   j) Starting and commissioning of boilers, banking and shutting down.
   k) Periodical cleaning and inspection of boilers.
   l) Preparation of boiler for testing, inspection, hydraulic, and steam test.

m) Draining of steam lines - the danger of water logging and precautions to be observed in starting of steam lines.
n) Testing the correctness of water gauges - replacement of gauge glass.
o) Detection of false water level and knowledge of alarm device.
p) Use of safety valve, easing operation, use of blow down cock or valve, and adjustment of high steams and low water safety alarm.
q) Checking and renewal of gland packings and mechanical seals of pumps, valve chest and working knowledge of feed pumps and/or injectors.
r) Use of thermometers and pressure gauges, vacuum gauges steam and water flow meters, pyrometers, fuel meters, CO_2 indicators and recorders, orsat apparatus, smoke-density meter.
s) Boiler safety precautions.

9. CONTROL ROOM & ELECTRICAL SYSTEMS:

a) Starting of power plant equipment, such as fans, pumps, compressors, etc. Control room operations, such as operation of switch gear, control of turbo alternator load, excitation etc.
b) Building up of voltage and synchronizing, alternator with operation of field rheostat, voltage regulator, governor control, synchroscope etc.
c) Alternator cooling system air cooling, hot air stator water cooling and cold air temperature, air cooler, hydrogen cooling system (if available) normal pressures and temperature control and changing of hydrogen cylinders, method of regenerating hydrogen drier (if available) , safety precautions, (if hydrogen cooling exists).
d) Study of methods of boiler control and turbine control. Method of loading an alternator, meger power factor control of machines running in parallel.
e) Use of emergency lighting, fire protection, handling of power failure and breakdown.

10. PERFORMANCE IMPROVEMENT IN OPERATION

Losses in boiler and turbine, Insulation of boiler, turbine and pipelines, Insulation in penthouse of boiler.

11. RELIABILTY OF BOILER OPERATION

Creep in boiler tube materials, boiler tube failures, Safety valve floating of boiler, Know-how of Remaining Life Assessment of boiler.

Block – II

12. Turbine and Auxiliaries:

a) Explanation on Turbine & construction of different parts, back-pressure turbine. PRDS operation, Advantage of back pressure turbine over pressure reducing station for process steam.
b) Study of steam cylinder, steam chest, diaphragms rotor blades, discs, glands, coupling, bearing etc.
c) Method of gland sealing - steam seals, water seals, clearances, sealing pressure regulators and controls.
Lubrication system - oil tank, oil strainers, centrifugal filters and oil coolers, cleaning of oil coolers and oil strainers, oil piping, method of jointing -oil pumps, jack-oil pump, gear pumps, reciprocating pumps and centrifugal pumps, main oil pumps and auxiliary oil pumps, methods of dismantling & assembling. Contamination control of lubricating oil.
d) Turbine bearings, bearing clearances and blue matching, monitoring of parameters of bearing.

13. Turbine auxiliaries such as condensers, ejectors, extraction pumps, C.W. pumps etc.
    a) Condensers - water flow, steam flow, constant water level control starting a condensing plant or stopping it. Care and precautions to prevent loss of vacuum, causes of loss of vacuum, remedies, air leakages, condenser cleaning methods.
    b) Pumps - centrifugal and reciprocating, starting a centrifugal pump. Different methods of priming, putting the pumps on load, starting a reciprocating pump, care and maintenance of running pumps.
    c) Air ejectors - different types, steam, hydraulic, starting ejectors, sequence of operation, stopping it, starting an ejector in conjunction with a condensing plant,
    d) Function and use of evaporators, drain collers and feed heaters, putting them into operation and taking them out of operation, maintenance of proper feed water temperature.
    e) Atmospheric relief valve and other safety devices.
    f) Compressors, operation, care and maintenance.
    g) Cooling water system.
    h) Reheat and regenerative system.

14. Study, operation and adjustment of turbine governor, different types, method of working of synchronizing governor, over speed governor, speed limit governor and emergency shut-off devices, Electro-hydraulic governer. The trainee must get a thorough practical idea of manual remote control of governors.

15. Turbine plant operation - starting an condensing plant, starting a steam turbine from cold condition, method of running up to speed necessity of slow and uniform heating, critical speed avoiding, vibration at critical speeds, care to be taken when removing and applying load on turbo-alternators, stopping a turbine, sequence of operations, stopping the condensing plant and other auxiliaries. Study of feed water and steam: cycle. Turning gear.

16. Turbine troubles and remedies - study of abnormalities during operation and remedial measures. Troubles, such as loss of vacuum, air leakage, low oil pressure, hot bearings, etc. vibration - their causes and remedies.

17. Instrumentation and control - necessity of different instruments for measuring and recording temperature, pressure, flow etc. Co-relation of different date as recorded by various instruments. Study of these in relation to load. Turbine supervisory instrumentation.

18. Importance of maintenance of daily log sheets and records, delay register, defect register.

19. Operation of steam pressure reducing station and H. P., L. P. by pass station.

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

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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 electrical and apply in day to day	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.
	2.2 Measure dimensions as per drawing

work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Centre of gravity, Power transmission, Pressure]*	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, Method of representation, Symbol, scales, Different Projections, Assembly drawing, 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 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 & 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	Professional Knowledge
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. Safety regarding working with different types of steam and its First-Aid.	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 e.g.; 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. Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2.	Identification of tools & equipments as per desired specifications for marking & sawing(Hand tools , Fitting tools & Measuring tools) Selection of material as per application	Hand tools and its importance, steel rule, Try square, chisel, surface gauge and care & maintenance, Hacksaw frame, blades. Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and

	Visual inspection of raw material for rusting, scaling, corrosion etc. Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule. Marking out lines, gripping suitably in vice jaws, hack sawing to given dimensions, sawing different types of metals of different sections.	its types. Related safety. Marking block, Steel rule, and calipers-different types and uses. Combination set-its components and uses. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses.
3.	Understand and usage of different measuring instruments e.g. bore gauge, dial indicator, edge finder. Checking and setting of Venire calipers, venire height gauge &venire bevel protractor. Filing flat, square, steps and contour surfaces to an accuracy of 0.4 mm	Linear measurements & its units Classification, construction, materials and functional detail of following basic measuring and marking tools : - • Steel Rule • Calipers(Inside & outside), • Divider, Trammel • Try Square • Marking Punch Measuring Instruments. Venire calipers, venire height gauge &venire bevel protractor - principle, construction, calculation of least count and its use and care.
4.	Chipping practice on flat surface, slots & oil grooves, and chamfer at different angle on MS plate. Scraping practice on curved surfaces. Preparation of flat surfaces and scraping practice on flat surface taking impression on face high spots using prussian blue sharpening by diamond dresser & wheel and lapping stone.	Precision Measuring Instruments: Concept of precision & accuracy Micrometer (outside, inside and depth) –use & care, calculation of least count. **Limits, fits and tolerances:** Different system of limit and tolerances - Newall, BIS, British, DIN, ISO. Details of BIS system. Interchangeability and standardization. Use of templates, jigs and fixtures, gauges for manufacturing of interchangeable parts. **Scrapers**: Introduction, its types, material and use.
5.	Hand grinding of different types of tools, e.g. chisel, drill, etc. Reaming with hand reamers.	Joining & Fastening **Devices** Permanent, semi-permanent & temporary

	Threading by hand using taps and dies. Cold riveting of two components with different types of rivets. Pipe cutting, pipe threading, pipe fitting etc. Punching of holes with hollow punches on leather gaskets and other packing materials.	fastening devices. Different types of fasteners and their functions like bolts, nuts, washers, rivets, studs,pins cotter, keys, machine screws, Philip screws etc. Rivets and riveting - types, sizes, riveting tools, etc. Pipes and pipe fitting - tools, fixtures, threads etc. Screws and screwing - different type of threads function etc. Taper and tapering - devices with the use of tapers.
6.	**Skills involving in repairing on machine e1ements:** Removing of broken studs from machine parts. Removal and mounting of pulleys, gears in the shaft. Replacement of /repairing of bolts. Removal and mounting of antifriction bearings. Practice of scraping on machine slides, machine beds, plain bearings etc. Checking and repairing of broken and worn-out gears, shafts, pulleys, clutches, flanges, etc.	**Boiler Plant Operation** Boiler light-up and shutdown procedure, boiler emergency and normal operations, boiler protections. **General Terms of Boilers** Familiarization with different types of boiler and its mounting and accessories. Familiarization with Indian Boiler Act, Boiler Protects, Hydraulic test, different boiler losses.

7-8	Diagnosis of faults in machines. Identify various types of boiler and its mounting and accessories by using charts, posters and models.	**Steam Turbines** Fundamental principles of turbine-impu1se and reaction, condensing and non-condensing turbines, turbine compounding. Nomenclature and parts of a turbine, simples features & construction and functions of nozzles, blades, rotors, discs, cylinders, Steam Chest, diaphragm, gland, couplings, bearings, thrust block, thrust balancing. Concept of turbine critical speed. **Turbine Plant Auxi1iaries** Condenser, its classification, function and its construction. Circulating water pumps, Condensate & feed water system extraction pumps, drain cooler, feed heaters, steam traps de-aerator. Air evacuation system, turbine gland sealing system, Air compressors – it working, types and Air drivers. **Gas Turbine Power Plant** Introduction, advantages and limitations of gas turbine power plant, cycles for gas turbine - open & close cycle gas turbine power plants. Methods used for improving of gas turbine power plant, fuel system of gas turbine plant, combustion chamber, essential auxiliaries of gas turbine power plant, governing system of gas turbine plant, starting and stopping procedures.

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9-10	Identify various pressure, temperature, flows, current and voltage measuring instruments and its use. Filling log sheets & record keeping. Identify and use of various types of valves like gate valve, globe valve, flap valve, butter fly valve, needle valve, disk valve, hydraulic valves, pneumatic valves, motor operated valves, non return valves, cocks etc. Identify and understanding operation of different types of pumps like centrifugal pumps - single stage & multistage, gear pumps, screw pumps, reciprocating pumps, etc. Priming the pumps, starting, stopping isolating them .	**Diesel Engine Power Plant** Working of diesel engine, advantages and disadvantages of diesel engine power plant, essential components of diesel engine power plant. Air intake system, fuel supply system, Cooling system, Exhaust system, lubricating system, starting and stopping operation, governing system. **Nuclear Power PI ant: Fundamentals, basic elements of power plant, reactors.** **Hyde1 Power Plant** Water turbine working principles, basic elements of hydro power plant, classification, its auxiliaries, speed controls of water turbines, operation of hydro power station.
11.	Identification of various types of centrifugal pumps, their parts. Overhauling of pump. Priming of pump, Fitting gland packing. Starting and stopping of pumps. Trouble shooting in pump operation.	Centrifugal Pump, Fan, Blower and Compressor: - Function of pump. Types and working principle of centrifugal pump. Constructional detail of pump Starting and stopping Pump performance and characteristics. Capitation & aeration. Preventive & schedule maintenance of pumps. Gland packing changing procedure. Concept of Mechanical seal Trouble shooting in pump. Air compressors - cooling system, inter & after coolers, storage devices, Air dryers, compressor on load - off load regulation etc.
12.	Identification of various types of fans, Blowers, their parts. Dismantling, cleaning and assembly of parts. Identification of various types of compressors, their parts. Starting and stopping of compressors Cleaning and changing of filters Preventive & schedule maintenance of Blower &	Fan & Blowers: Types and working principle Constructional detail of Fans & Blowers. Starting and stopping of Fans and Blowers Different parts of Fans & Blowers Concept of surge. Preventive & scheduled maintenance. Compressors: Compression theory, Types of compressors Constructional detail of compressors, working mechanism Different

	Compressor	parts and their function. Loading unloading system Concept of air dryer. Preventive & schedule maintenance.
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.

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BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills	Professional Knowledge
1-2	**General Maintenance:** 1. Standard pipe thread, join pipes and make pipe assemb1y. 2. Scrap angular matching and sliding surfaces& originate flat surface without master. 3. Assemble components accurately using dowel pins and screw. 4. Lap and finish flat surfaces. 5. Make oil grooves on bearing with chisel. 6. Assemble parts by riveting, screwing, pinning, so as to make complete unit according to drawing. 7. Dismantle or remove worn out broken or defective parts using hand tools and replace them by repaired or new one test completed article to ensure correct performance. 8. Fit parts together in set order using nuts, bolts, screws and pins etc. with necessary wrenches, spanners and other special tools. 9. Mechanical handling of machines for transportation purpose involving the use of screw jacks, pulley blocks, cranes, hoists &slings, roller, bars and wire ropes etc. 10. Alignment of brackets and shafts. 11. Remove and fit antifriction bearings. 12. Maintenance of pneumatic tools & hydraulic driven machines. 13. Recondition thread by tap. 14. Use of precision measuring instruments. 15. Reaming holes for proper assembly.	Repair of machines including preventive maintenance: Importance of maintenance work, Different types of maintenance. Methods of maintenance and overhauling of machines and tools. Basic concepts on preventive maintenance.

3-4	**Basic skills involved in breakdown maintenance, preventive maintenance and overhauling of machine:** 1. Diagnosis of faults in machines. 2. Breakdown maintenance of general machine tools (lathe, drilling machine, etc.) 3. Practice in carrying out preventive maintenance work (the jobs involve inspection and lubrication of the machine as per instructions). Painting and use of surface protective coatings under preventive maintenance programme. 4. Overhauling of Bench Drilling Machine, Pedestal Grinding Machine, coolant pump, and machine accessories e.g. chucks vice, steadies, tai1 stock, etc.	**Power Transmission and Driver :** 1. Common methods of power transmission and drives. 2. Belts and belting - types, sizes and use of belts, fasteners, belt speeds, parallel and crossed belt drives. 3. Types and uses of keys and keyways - 4. Tooth gears and gearing - types and uses of gears, conversion of rotary motion into reciprocating motion, pinning and racks, etc. 5. Chain and sprockets - types and uses, solid, flexible, friction, universal etc. 6. Coupling and sprockets - types and uses, solid, flexible, friction, universal etc. 7. Mechanical, hydraulic and pneumatic drives - basic principles and uses. 8. Prime movers, line shafts and drive system, individual drive system, reciprocating drive, reverse drive, eccentric drive, crank drive, cam drive, rotary to linear drive and vice versa. 9. Systems of speed, variation using stepped pulleys, gear box, disc-contact, etc.
5.	Making of different types of keys, keyways on pulleys, gears, etc. by hand. Practice on exercise involving making of simple machine parts which have certain functional relationship to other parts. Make oil grooves on bearing with chisel.	Friction and Lubrication: Friction - its effect, methods of reducing friction, use of bearings. Coolants - different types and uses, cooling system. Lubrication and Lubricants - methods of lubrication, need and use, qualities of good lubricants, viscosity, techniques of selection, type of lubrication oil and greases - their rating, commercial names and uses.

6.	**Hydraulic &pneumatic** circuit reading practice & constructing hydraulic circuits for single & double acting cylinders, meter in, meter out circuit, pressure control circuits &regenerating circuit.	Basic principle of Hydraulic& pneumatic system. Advantages & limitation. Constructional & functional details of Hydraulic & pneumatic cylinder, motor, control valves and FRL unit.
7.	Fit parts together in set order using nuts, bolts, screws and pins etc. with necessary wrenches, spanners and other special tools. Mounting and dismounting of pulleys and gears on shaft.	**Bearings:** Different types, their application and dimensional relationship with shafts, methods of clamping and fitting lubrication of bearings, methods of mounting and dismounting, care maintenance, inspection of bearings. Basic working principal of water flow meter, steam flow meter, CO_2, indicator and reactors, Electro static pacificator, smoke density meter, types of draughts.
8.	a) Use of basic hand tools for electrical work. b) Making of points in single and multi-strand cables and wires. c) Wiring and use of electrical accessories, such as switches, plugs, cut-outs, fuese, regulators, fluorescent lights, etc. indoor and outdoor wiring. d) Making simple electrical circuits on wooden boards.	**Basic Electricity: -** Fundamental of electricity Definition and properties of conductors, insulators and semi-conductors. Voltage grading of different types of Insulators, Temp. Familiarization with the units and its measuring instruments - Volts, Amp., Ohm's, watt., B.O.T., H.P. etc. Capacitor, resistance, reluctance, Colour code of resistance. Types of wires & cables standard wire gauge Specification of wires & Cables-insulation & voltage grades -Low , medium & high voltage Precautions in using various types of cables / Ferrules Ohm's Law, Flemings rules. Simple electrical circuits and problems (series and parallel)
9.	a) Use of primary and secondary batteries. b) Use of electrical measuring instruments. c) Verification of Ohm's Law. d) Dismantling, cleaning and assembling of	Different types of Batteries. Types of Voltage (A.C. and D.C.) Principal of Motor and generator (A.C. and D.C.)

	A.C. and D.C. motors upto one H. P., detection of failures of these motors and remedy thereof.	
10.	Identification by Flow chart of a thermal power plant.	**Coal Pulverisers** Types of pulverizes, -working principles. Importance of fineness of pulverized fuel and methods of controlling it, Coal feeders emergency operation during fire. **Ash Handling System** Handling bottom ash and fly ash in boilers. Description and use of cyclone type of mechanical dust collectors, Principle and function of electrostatic precipitator. **Water Treatment Plant** Impurities in water and their harmful effects. Priming, foaming, scale formation and corrosion, softening and de-mineraling plant, boiler internal chemical treatment of feed water. Familiarization with TDS & PH value of water & their effects.
11-12	Detect faults, Inspect, align and test machine for accurate functioning.	Familiarization of air-pre- heaters, Seal setting of air-pre -heaters, Inspection of Tabular air-heater, S C A P H cleaning, Knowledge of International Boiler Regulation. Pu1verisers and Feeders, Fans: Fan lubrication system, Ash & Dust Collect ion System of dust collection ash handling system, Ash disposal line. Air Compressors: Trouble shooting, Pump Maintenance: Steam Turbine Generator Overhauling: Maintenance of Heat Exchangers Ejector maintenance. Cooling Tower: Components, Specific problems, Major modifications, I D fan gear box overhauling. Types of faults, Types of joints, gland packing & gaskets.
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.*

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9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

BLOCK I

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
		30		**20**
1	**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.		**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	
2	**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		**Material Science** : properties - Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	
3	**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.		**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
4	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - Isometric view		**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	
5	**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		**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	
6	**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		**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.	

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B. Block- II

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	30	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	20
2	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.		**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.	
3	Free hand Sketches for simple pipe line with general fittings.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboids, cylinder and Sphere. Surface area of solids -cube, cuboids, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	
4	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.		**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.	

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5	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		**Simple machines Transmission of power:** -Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	
6	Free hand sketch of trade related components / parts /cutting tool indicating angles.		**Trigonometry:** 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.	
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.**			

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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	Basic of computer Networks (using real life examples), Definitions of

and Internet	Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, 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, Vibroacoustic 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-JOB TRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR TRADE:

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. Introduction to elementary knowledge of feed water system and boiler feed pump, draught system of boilers, fuel system, steam network and turbine and visit at site.
4. Study of different parts & fittings of a boiler such as steam and water drums, stoker gauge, water tubes and flow tubes, high and low water level alarm, gauge glasses, soot blowers, safety valves etc. Forced draught, induced draught, balanced draught and secondary draught fans, Air pre-heater, chimney, water walls, water wall tubes, boiler bank tubes, primary and secondary super heaters, Attemperator, down comer and riser tubes, de-aerator, LP and HP dosing pumps, DM water plant and water chemistry, coal mills and coal handling plats, cooling towers & economizer, boiler controls, etc.
5. Measurement of temperature, pressure, vacuum, draught, flow using appropriate instruments for different system.
6. Uses, methods of jointing, checking of joints for leakage and remedy thereof.
7. Study of different parts of turbine; study the features of construction of blades, nozzles, governor parts, condensers, ejectors, etc. Study of different types of pumps, compressors and their parts. Different types of valves.
8. Boiler & their Auxiliaries:

a) Working and management of steam boilers; economizers and air heater.
b) Correct use of various types of cocks, mounting and fittings used in boilers.
c) Functions of feed pumps.
d) Operation of fans, blowers, feed pumps including starting and stopping.
e) Operation of fuel preparation equipment, fuel feeding indicators and recorders orsat apparatus, smoke density drive and draft regulation of proper combustion.
f) Operation of ash discharge disposal system in boiler.
g) Water level control in boiler operation, blow-down of boiler.
h) Control of steam pressure and steam flow.
i) Operation of super heater and control of super heated steam temperature.
j) Starting and commissioning of boilers, banking and shutting down.
k) Periodical cleaning and inspection of boilers.
l) Preparation of boiler for testing, inspection, hydraulic, and steam test.

m) Draining of steam lines - the danger of water logging and precautions to be observed in starting of steam lines.
n) Testing the correctness of water gauges - replacement of gauge glass.
o) Detection of false water level and knowledge of alarm device.
p) Use of safety valve, easing operation, use of blow down cock or valve, and adjustment of high steams and low water safety alarm.
q) Checking and renewal of gland packings and mechanical seals of pumps, valve chest and working knowledge of feed pumps and/or injectors.
r) Use of thermometers and pressure gauges, vacuum gauges steam and water flow meters, pyrometers, fuel meters, CO2 indicators and recorders, orsat apparatus, smoke-density meter.
s) Boiler safety precautions.

9. CONTROL ROOM & ELECTRICAL SYSTEMS:

a) Starting of power plant equipment, such as fans, pumps, compressors, etc. Control room operations, such as operation of switch gear, control of turbo alternator load, excitation etc.
b) Building up of voltage and synchronizing, alternator with operation of field rheostat, voltage regulator, governor control, synchroscope etc.
c) Alternator cooling system air cooling, hot air stator water cooling and cold air temperature, air cooler, hydrogen cooling system (if available) normal pressures and temperature control and changing of hydrogen cylinders, method of regenerating hydrogen drier (if available) , safety precautions, (if hydrogen cooling exists).
d) Study of methods of boiler control and turbine control. Method of loading an alternator, meger power factor control of machines running in parallel.
e) Use of emergency lighting, fire protection, handling of power failure and breakdown.

10. PERFORMANCE IMPROVEMENT IN OPERATION

Losses in boiler and turbine, Insulation of boiler, turbine and pipelines, Insulation in penthouse of boiler.

11. RELIABILTY OF BOILER OPERATION

Creep in boiler tube materials, boiler tube failures, Safety valve floating of boiler, Know-how of Remaining Life Assessment of boiler.

Block – II

1. Turbine and Auxiliaries:

a) Explanation on Turbine & construction of different parts, back-pressure turbine. PRDS operation, Advantage of back pressure turbine over pressure reducing station for process steam.
b) Study of steam cylinder, steam chest, diaphragms rotor blades, discs, glands, coupling, bearing etc.
c) Method of gland sealing - steam seals, water seals, clearances, sealing pressure regulators and controls.

d) Lubrication system - oil tank, oil strainers, centrifugal filters and oil coolers, cleaning of oil coolers and oil strainers, oil piping, method of jointing -oil pumps, jack-oil pump, gear pumps, reciprocating pumps and centrifugal pumps, main oil pumps and auxiliary oil pumps, methods of dismantling & assembling. Contamination control of lubricating oil.
e) Turbine bearings, bearing clearances and blue matching, monitoring of parameters of bearing.

2. Turbine auxiliaries such as condensers, ejectors, extraction pumps, C.W. pumps etc.
   a) Condensers - water flow, steam flow, constant water level control starting a condensing plant or stopping it. Care and precautions to prevent loss of vacuum, causes of loss of vacuum, remedies, air leakages, condenser cleaning methods.
   b) Pumps - centrifugal and reciprocating, starting a centrifugal pump. Different methods of priming, putting the pumps on load, starting a reciprocating pump, care and maintenance of running pumps.
   c) Air ejectors - different types, steam, hydraulic, starting ejectors, sequence of operation, stopping it, starting an ejector in conjunction with a condensing plant,
   d) Function and use of evaporators, drain collars and feed heaters, putting them into operation and taking them out of operation, maintenance of proper feed water temperature.
   e) Atmospheric relief valve and other safety devices.
   f) Compressors, operation, care and maintenance.
   g) Cooling water system.
   h) Reheat and regenerative system.

3. Study, operation and adjustment of turbine governor, different types, method of working of synchronizing governor, over speed governor, speed limit governor and emergency shut-off devices, Electro-hydraulic governor. The trainee must get a thorough practical idea of manual remote control of governors.

4. Turbine plant operation - starting an condensing plant, starting a steam turbine from cold condition, method of running up to speed necessity of slow and uniform heating, critical speed avoiding, vibration at critical speeds, care to be taken when removing and applying load on turbo-alternators, stopping a turbine, sequence of operations, stopping the condensing plant and other auxiliaries. Study of feed water and steam: cycle. Turning gear.

5. Turbine troubles and remedies - study of abnormalities during operation and remedial measures. Troubles, such as loss of vacuum, air leakage, low oil pressure, hot bearings, etc. vibration - their causes and remedies.

6. Instrumentation and control - necessity of different instruments for measuring and recording temperature, pressure, flow etc. Co-relation of different date as recorded by various instruments. Study of these in relation to load. Turbine supervisory instrumentation.

7. Importance of maintenance of daily log sheets and records, delay register, defect register.

8. Operation of steam pressure reducing station and H. P., L. P. by pass station.

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.

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INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR

A. LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)

Sl. No.	Item	Specification	Qty
1.	Scale BB 20		20 Nos.
2.	Inside Spring Caliper	150 mm	20 Nos.
3.	Outside Spring Caliper	150 mm	20 Nos.
4.	Spring Divider	150 mm	20 Nos.
5.	Engineers Square	150 mm.	20 Nos.
6.	Hacksaw Frame AB	250,300.	20 Nos.
7.	Engineer Ball Peen Hammer complete with handle.	250gm,	20 Nos.
8.	Engineer Ball Peen Hammer Complete with handle.	500gm	20 Nos.
9.	Flat Chisel	20x200 H	20 Nos.
10.	Cross cut Chisel	10x150	20 Nos.
11.	Half round Chisel	10x250	20 Nos.
12.	Diamond Point Chisel	9.5 mm.	20 Nos.
13.	Centre Punch 5		20 Nos.
14.	Prick Punch	150 mm.	20 Nos.
15.	Engineers File Flat Bastard 300mm		20 Nos.
16.	Engineers File Flat 2nd cut250 with two sq. edges		20 Nos.
17.	Engineers File Flat Bastard	350mm	20 Nos.
18.	Engineers File Flat smooth two safe edges.	200 mm.	20 Nos.
19.	Flat/Round Nose Plier	150mm	20 Nos.
20.	Combination Pliers	150mm	20 Nos.
21.	Engg. Half Round File 2nd cut 250 mm.		20 Nos.
22.	Engg. Three sq. File Smooth		20 Nos.
23.	Engg. Round File Smooth	200mm	20 Nos.
24.	Engg. Square File Smooth	200 mm.	20 Nos.
25.	Engg. Needle Set of 12		20 Nos.
26.	File Handle		20 Nos.
27.	Caliper Hermaphrodite	150mm	20 Nos.
28.	Scraper A	250 mm.	20 Nos.
29.	Scraper D	150mm	20 Nos.
30.	Scraper B	150mm	20 Nos.

31.	Spindle Blade Screw Driver		20 Nos.
32.	Keys Allen Hexagonal	2.5 to 12	20 Nos.
33.	Tap Wrench (adj.) and fixed		20 Nos.
34.	Die Ho 1der s		20 Nos.
35.	Card File		20 Nos.
36.	Scriber	300 mm.	20 Nos.
B. TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS			
37.	Master Bar 45 Degree scraping Bar 600 mm. width of bar 75 mm., thickness25 mm., all side an accuracy of 0.02 mm seasoned		2 No.
38.	Master F1 at-scraping test bar 600 mm, length *7 5x7 5* mm sq. in cross section all sizes scraped to an accuracy of 0.02 mm. per 300 mm. seasoned.		1 No.
39.	Hand tap M-6 to 12 each size set of 3 with tap wrench thread cutting die MM6 to HS.		1 each
40.	Spanner Socket	set of 8 with Ratchet 8, 12,20	1 each
41.	Hexagonal Key	1.5 to 12.	1 Set
42.	Hammer Soft	faced 30 mm dia. Plastic tipped	4 Nos.
43.	Pipe Wrench	450mm	2 Nos.
44.	Chain Pipe Wrench	650mm	1 No
45.	Flat Nose Plier AI	100mm	1 No.
46.	Spindle Blade Screw Driver	150 mm.	1 No.
47.	Scriber Block Universal	300 mm	4 Nos.
48.	Bench Vice	100mm jaw	8 Nos.
49.	Bench Vice	150mm jaw	8 Nos.
50.	Ring Spanner	set of 6 S.A.E.	1 No.
51.	Double Ended Open Spanner .	5.5 to 50 mm	1 Set
52.	Double Ended Off-set Ring spanner	5.5 to 50	1 Set
53.	Gear Puller capacity three leg type	150 mm.dia.	1 No
54.	'C' Spanner CxlO		1 Set
55.	Scale BB 80		8 Nos.
56.	Scale BB 20		1 No
57.	Metric Steel Tape measure		1 No
58.	Thread Pitch Gauge	0-25,6-00,150-60	1 No
59.	Thread Pitch Gauge metric screw threads		1 No
60.	2/3 Cells Torch		2 Nos.
61.	Grease Gum		1 No
62.	Level 1 P 300-0.05/metre		1 No
63.	Engineer Square	400mm blade	1 Set.
64.	Feeler Gauge	(0.03 to 1 mm).	1 No

65.	Magnetic Basic Off-on Type		1 No
66.	Detachable Spout Oil Can 250		1 No
67.	Single Ended Open Jaw adj. Wrench **A**-200		1 No
68.	Stationery Scissors	Type-II 65	1 No
69.	Gasket Hollow Punches 5,6,8,10,12, 19,25 mm. dia.		1 Each
70.	Bar Type Torque Wrench		1 No
71.	Hand operated Socket Wrench		1 Set
72.	Taps & Dies Complete Set.		1 No
73.	Cam Lock Type Screw Driver		1 No
74.	Dial Indicator Type Torque		1 No
75.	Propane Torch		1 No
76.	Ring Spanner SE of	8-25 mm.	1 Set
77.	Box Spanner SE Hexagonal		1 Set
78.	Heavy Duty Screw Driver		1 No.
79.	Spindle Blade Screw Driver (Engg.).	200 mm	1 No.
80.	Hammer Soft		1 No.
81.	Pipe Cutter	19 mm dia	1 No.
82.	Flaring Tool		1 No.
83.	Tube Expander up to	62 mm.	1 Set
84.	Cranked Double ended Ring Spanner		1 No
85.	Box Spanner DE	8 to 20	1 Set
86.	Gear Box Unit (For Trg.)		1 No
87.	Bearing Housing Unit (for trg.)		1 No
88.	Shafting Unit with Pulleys as available (for trg.)		1 No
89.	Horizontal Centrifugal Pumps (Gear and Spindle)		1 No
90.	Air Compressor		1 Se t .
91.	Key Alien Hex		
92.	Circlip P1iers(inside and outside)		1 Set .
93.	Right angle drill attachment 6 mm. capacity.		1 No .
94.	SRDG Ball Bearing		1 No.
95.	DRDG Ball Bearing		1 No.
96.	Self aligning Bali Bearing		1 No.
97.	SRAC Ball Bearing		1 No.
98.	Ball Bearing Thrust Type		1 No.
99.	Needle Bearing		1 No.
100.	Single Row Cylindrical Roller Bearing		1 No.
101.	Tapered Roller Bearing		1 No.
102.	Barrel Type Bearing		1 No.
103.	Plain Bush Bearing		1 No.
104.	Thin Walled Bearing		1 No.

STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR

105.	Thrust Roller Bearing		1 No.
106.	Se1f-alignment Roller Ball Bearings		1 No.
107.	Telescopic Gauges		1 No.
108.	Arbour Press Bench Type		1 No.
109.	Lubricant Tro11ey-2409x 1 200x1200 mm (8 mm chamber).		1 No.
110.	Compressor Sprayer Machine		1 No.
111.	Tap Extractor		1 No.
112.	Gear Pump		1 No.
113.	Vane Pump (fixed and variable delivery).		1 Each
114.	Piston Pump (radial and axial)		1 Each
115.	Re 1i ef Valve		1 No.
116.	Sequence Valve		1 No.
117.	Un-loading Valve		1 No.
118.	Pressure Reducing Valve		1 No.
119.	Check Valve		1 No.
120.	Directional Control Valve(rotary spool and sliding spool)		1 Each
121.	Flow Control Valve		1 No.
122.	Pressure Gauge		1 No.
123.	Reservoir		1 No.
124.	Linear Actuator (differential and non-differential)		1 Each
125.	Hydrometer		1 No.
126.	Accumulator (spring and gas)		1 Each
127.	Pneumatic too1s(portable nut runner, pneumatic chise1,pneumatic ram etc.) for demonstration purpose.		1 Each
128.	Pneumatic Valves and Actuators		1 Each
129.	Hydraulic and Pneumatic Board with necessary aggregates for different machine circuits.		1 Set
130.	Double Face Sledge Hammer 1600		1 No.
131.	Wooden Straight Edge 300,600,900,1200.		1No.
132.	Man-on-chise1		1Each
133.	Tasla		1 No.
134.	Pick Axes.		2 Nos.
135.	Bar Bending Tools and Cutting Tools		1 No.
136.	Spirit Leve1		1 No.
137.	Pocket Steel Tape 150 mm		1 No.
138.	Four Fold Foot Rule		1 No.
139.	Crow Bar		2 Nos.

140.	Plumb Bob		1 No
141.	Masons Tool for Plaster Work		1 No.
142.	Drill Chuck 13		1 No.
143.	Reduction Sleeve and Extension Sockets		1 Each
144.	Centre Drill A-4		1 Each
145.	Revolving Centers		1 No
146.	Knurling Too 1(straight, cross &diamond)		1 Set
147.	Lathe Carriers up to 75 mm		1 Set
148.	Centre Gauge		1 Set
149.	Oil Stone 10x100		1 No.
150.	Emery Cloth No.00, 0, & 1.		1 Pkt
151.	Engg. File 50 length		1 No.
152.	H.S.S Tool Bits 8 & 10sq.x75		16 Nos.
153.	Boring Tool Holder 10 mm sq9 Bit Size x Length 200 mm.		2 Nos.
154.	Cylindrical Milling Cutter		1 No.
155.	Side and Face Milling Cutter 150x10x271		1 No.
156.	Side and Face Cutter 100x6x27		1 No.
157.	Equal Angle Milling Cutter 45~ox27 mm bore 60x27 mm bore		1 Each
158.	Single Angle Milling Cutter 45~ox27 mm bore(LH) and (RH)		1 Each
159.	Single Angle Milling Cutter 60~ox27 mm bore(LH) and (RH)		1 Each
160.	Slot Milling Cutter with Parallel Shank		1 No.
161.	Slot Milling Cutter with Parallel Shank 10x27 mm.		1 No.
162.	Slitting Saw 3 mm Thick x 2 7 mm.		1 No.
163.	Slitting Saw 4 mm Thick x 27 mm.		1 No.
164.	Key Way Milling Cutter		1 Set
165.	T - Slot Mi 11ing Cutter		1 Set
166.	Convex Milling Cutter		1 Set
167.	Concave Milling Cutter		1 Set
168.	Single Corner Rounding Milling Cutter		1 Set
169.	Milling Cutter No.8,9,10, 12 , 16,20, D.P.No. 1 to 8		1 Set
170.	Rotary Gear Cutters for Spur and Helical Gear .		1 Set
171.	Fly Cutter Holder		1 No.
172.	Hexagonal Bolt and Nut M 60 x 150		1 Set
173.	Plain Washers		1 Set
174.	Plain Clamps		1 Set
175.	Engineers Parallel		1 Set
176.	Spanner D.E.G.P		1 Set

177.	Hexagon Socket Screw Keys		1 Set
178.	Engineers File		1 No.
179.	Single Ended Open Jaw adjustable Wrench A150		1 No.
180.	Table Chuck 3 Jaw with tightening arrangement and graduated in degrees.		1 No.
181.	Machine Vice 200 mm Swivel Base		1 No.
182.	Machine Vice Swivel Base 160		1 No.
183.	Tool Holder L.H,R.H & Straight		1 No.
PRECISION INSTRUMENT			
184.	Venire height Gauge	500 mm.	1 No.
185.	Mechanical Bevel Protractor A 150		1 No.
186.	Venire Caliper A 200		1 No.
187.	Venire Caliper A 300		1 No.
188.	External Micrometer Gr.1		1 No.
189.	External Micrometer Gr.I I		1 No.
190.	External Micrometer Gr.I I I		1 No.
191.	External Micrometer Gr.IV .		1 No.
192.	External Micrometer Gr.V		1 No.
193.	Combination Set with 300 mm Scale,		1 No.
194.	Centre Head sq. head & Protractor head.		1 No.
195.	Telescopic Gauge 12 mm to 150 mm Set.		1 Set
196.	Venire Depth Gauge 200 with fine adjustment.		1 No.
197.	Sine Bar 200 mm.		1 No.
198.	Sine gauge (in sets)		1 Set
199.	Engineers Square 450 B		1 No.
200.	V - Block, Grade A & B		1 Each.
201.	V - Block 50/5 -40 A		1 No
202.	Precision Angle Plate 250x150		1 No.
203.	Precision Angle Plate 19195x75		1 No.
204.	Micrometer Internal		1 No.
205.	Micrometer External		1 No.
206.	Venire Gear Tooth Caliper		1 No.
207.	Bevel Gauge 200		1 No.
208.	Dial Gauge Type 1 Gr. A (complete with clamping devices and stand).		2 Nos.
209.	Feeler Gauge (0.03 to 1)		1 No.
210.	Radius Gauge		1 No.
211.	Radius Gauge		1 No.
212.	Thread Pitch Gauge 0.25 to 6.15 degree x60 degree		1 No.
213.	Thread Gauge 55 deg.x47 1/2 degree		1 No.

214.	Thread Gauge 60 degree		1 No.
215.	Plug Gauge Plain(designation of tape as per tab 1e 1)		1 No.
216.	Ring Gauge Morse Taper No.1,2,3,4.		1 Set.
217.	Ring Gauge 5 to 25 by 2.5 mm.		1 No.
218.	Wire Gauge		1 No.
219.	Bore Dial Gauge(01 mm dial)		1 No.
220.	Indicator with Magnetic Base		1 No.
221.	Dial Gauge Tupe1, Gr. A complete with clamping devices		1 No.
222.	Straight Edge 485mm to 1445mm		1 Set
223.	Hand Tachometer for checking the R.P.M. 0-10,000		1 No.
224.	Mandrels		1 Set

The specifications of the items in the above list have been given in Metric Units. The items which are available in the market nearest of the specification as mentioned above, if not available as prescribed should be procured Measuring instruments such as steel rule which are graduated both English and Metric Units may be procured, if available.

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.

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INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: STEAM TURBINE-CUM-AUXILIARY PLANT OPERATOR

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+1 set
2.	Set square celluloid 45º (250 X 1.5 mm)		20+1 set
3.	Set square celluloid 30º-60º (250 X 1.5 mm)		20+1 set
4.	Mini drafter		20+1 set
5.	Drawing board (700mm x500 mm) IS: 1444		20+1 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		20
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.		

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ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

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

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
	Maximum Marks (Total 100 Marks)		**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														

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