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

COMPETENCY BASED CURRICULUM

Nuclear Power Plant Technician

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 4

SECTOR – POWER

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

Kolkata-700091

Nuclear Power Plant Technician

(Engineering Trade)

(Designed in August 2025)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL: 4

Developed By

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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1. COURSE INFORMATION

During the two years duration a candidate is imparted training on subjects Professional Skill, Professional Knowledge and Employability Skills related to job role. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing practical task.

The course broadly covers all aspect of Skills required to work in the field of Mechatronics.

FIRST YEAR: In the first year, the trainee develops foundational skills in basic fitting operations such as marking, hacksawing, chiseling, filing, drilling, tapping, and grinding, achieving dimensional accuracy of ±0.25 mm while adhering to safety procedures. The trainee learns to join metal components through riveting and to perform machining operations including drilling, reaming, tapping, and dieing, checking accuracy with instruments such as vernier calipers, screw gauges, and micrometers. Competence is built in assembling components with various fits—sliding, angular, step, 'T', square, and profile—within tolerances of ±0.04 mm and angular tolerance of 30 minutes, ensuring interchangeability and proper functionality. The trainee gains experience in dismantling, replacing, and assembling pneumatic and hydraulic components such as compressors, pressure gauges, FRLs, valves, and actuators. Skills are developed in mating and finishing operations, including dovetail, radius, and combined fittings, as well as scraping, lapping, and honing to achieve ±0.02 mm tolerance and ±10 minutes angular tolerance, using fastening components like dowel pins, screws, bolts, keys, and cotters. The trainee dismantles and reassembles pipes, valves, and fittings, performing leakage tests through cutting, threading, flaring, bending, and joining. Preventive maintenance and basic repair practices are introduced.

Welding and cutting skills include setting up SMAW and oxy-acetylene equipment to perform fillet (T, lap, corner) and butt (square, V) joints in flat, horizontal, and vertical positions, and oxy-acetylene cutting in straight, bevel, and circular shapes. The trainee also sets up GMAW and GTAW equipment to perform welds and joints on mild steel sheets and plates using various techniques and positions. Supporting competencies include interpreting engineering drawings, applying mathematical concepts to practical tasks, and understanding basic scientific principles relevant to the trade.

SECOND YEAR: In the second year, the trainee develops competencies in maintaining and servicing a range of electrical sub-systems, including AC/DC motors, DC machines, motor

starters, universal motors, induction motors, AC drives, servo drives, and transformers, and measuring their operating parameters to assess performance. The trainee services and tests electronic sub-systems such as diodes, rectifier circuits, voltage regulators, transistor-based power devices, op-amp circuits, LED circuits, and SCR applications. Skills are honed in panel wiring and re-wiring using appropriate cables, connectors, and protective devices, followed by systematic functionality checks. The trainee troubleshoots and repairs electrical and electronic systems and devices, including fuses, MCBs, power circuits, control panels, circuit breakers, stabilizers, and AC/DC drives. Competence is developed in the maintenance and calibration of sensors, including proximity, inductive, capacitive, magnetic, photoelectric, and ultrasonic types. The trainee works with digital logic circuits such as logic gates, half and full adders, binary counters, and up-down counters, focusing on inspection, fault-finding, and functional verification.

Also introduces atomic structure, nuclear forces, and the principles of radioactivity, with emphasis on radiation safety procedures and understanding biological and environmental impacts. The trainee gains familiarity with the structure and function of nuclear power plants and the basic operations and controls of nuclear reactors. Supporting competencies include interpreting and applying engineering drawings, using mathematical concepts in practical applications, and applying basic scientific principles relevant to the field.

2. TRAINING SYSTEM

2.1 GENERAL

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

Nuclear Power Plant Technician trade under CTS is one of the newly designed courses delivered nationwide through network of NSTIs/ ITIs. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) impart professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skills, knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Candidates broadly 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.
- 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 PROGRESSION PATHWAYS:

- Can join industry as Nuclear Power Plant Technician and will progress further as Senior Technician, Supervisor and can rise to the level of Manager.
- Can become Entrepreneur in the related field.
- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.

- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE:

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

S No.	Course Element	Notional Training Hours	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	840	840
2	Professional Knowledge (Trade Theory)	240	300
3	Employability Skills	120	60
Total		**1200**	**1200**
On the Job Training (OJT)/ Group Project *		150	150
Optional Courses**		240	240
Grand Total		**1590**	**1590**

** The trainee has to undergo 150 hours of mandatory OJT (On the Job Training) at nearby industry or wherever industry not available then group project has to be done with the supervision of the trade instructor for every year.*

*** Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for obtaining 10th/ 12th class certificate from NIOS along with ITI certification, or, short term courses for extra skills/knowledge.*

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his/ her skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The **Continuous Assessment (Internal)** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning

outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.cstaricalcutta.gov.in or www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percentage for Trade Practical and Formative assessment are 60% & for all other subjects are 33%.

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising some of 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

- Computer based multiple choice question examination
- Practical Examination

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

Marks Allotted during Assessment	Performance Level	Evidence
Marks between 60% to 75%	For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
Marks above 75% to 90%	For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
Marks Above 90%	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	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job.

	of craftsmanship.	• A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Maintenance Fitter-Mechanical Maintenance Fitter-Mechanical dismantles, removes and replaces faulty equipment at component or unit level on a variety of different types of mechanical assemblies and sub-assemblies and diagnosing, locating faults, overhauling, fitting and adjusting mechanical systems and equipment.

Welder, Gas; fuses metal parts together using rod and oxygen acetylene flame. Examines parts to be welded, cleans portion to be joined, holds them together by some suitable device and if necessary, makes narrow groove to direct flow of molten metal to strengthen joint. Selects correct type and size of rod, nozzle etc. and tests, torch. Wears dark glasses and other protective devices while. Releases and regulates valves of oxygen and acetylene cylinders to control their flow into torch. Ignites torch and regulates flame gradually. Guides flame along joint and heat it to melting point, simultaneously melting rod and spreading molten metal along joint shape, size etc. and rectifies defects if any.

Electrician General; installs, maintains and repairs electrical machinery equipment and fittings in factories, workshops powerhouse, business and residential premises etc. Studies drawings and other specifications to determine electrical circuit, installation details etc. Positions and installs electrical motors, transformers, switchgears. Switch boards and other electrical equipment, fittings and lighting fixtures. Makes connections and solders terminals. Tests electrical installations and equipment and locates faults using megger, test lamps etc. Repairs or replaces defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. May do armature winding, draw wires and cables and do simple cable jointing. May operate, attend and maintain electrical motors, pumps etc.

Engineers and Related Technologists, other Architects, Engineers and Related Technologists, Other include all other engineers and technologists, such as those engaged in proper utilisation of machine and manpower, safety devices and other industrial problems, research work in laboratories and application of results thereof to manufacture and solve practical problems, not elsewhere classified.

Reference NCO-2015:

1. 7233.0101- Maintenance Fitter-Mechanical
2. 7212.0100– Welder, Gas
3. 7411.0100 – Electrician General
4. 2149.0100 - Engineers and Related Technologists, other

Reference NOS:

I.	CSC/N9506	II.	CSC/N9593	III.	CSC/N9512
IV.	AAS/N9407	V.	CSC/N94808	VI.	CSC/N9483
VII.	CSC/N9501	VIII.	CSC/N9685	IX.	CSC/N9539
X.	CSC/N9537	XI.	CSC/N9537	XII.	CSC/N9547
XIII.	CSC/N9548	XIV.	CSC/N0305	XV.	PSS/N6002
XVI.	PSS/N9407	XVII.	CSC/N9463	XVIII.	ELE/N9408
XIX.	SSC/N9416	XX.	CSC/N9701	XXI.	CSC/N9702
XXII.	CSC/N9703	XXIII.	CSC/N9704	XXIV.	CSC/N9401
XXV.	CSC/N9402				

4. GENERAL INFORMATION

Name of the Trade	**Nuclear Power Plant Technician**
Trade Code	DGT/2049
NCO – 2015	7233.0101, 7212.0100, 7411.0100, 2149.0100
NOS Covered	CSC/N9506, CSC/N9593, CSC/N9512, AAS/N9407, CSC/N94808, CSC/N9483, CSC/N9501, CSC/N9685, CSC/N9539, CSC/N9537, CSC/N9537, CSC/N9547, CSC/N9548, CSC/N0305, PSS/N6002, PSS/N9407, CSC/N9463, ELE/N9408, SSC/N9416, CSC/N9701, CSC/N9702, CSC/N9703, CSC/N9704, CSC/N9401, CSC/N9402
NSQF Level	Level: 4
Duration of the Trade	Two Years
Entry Qualification	Passed 10th class examination with Science and Mathematics or with vocational subject in same sector or its equivalent.
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, LC, DW, AA, LV, DEAF
Unit Strength (No. Of Student)	24 (There is no separate provision of supernumerary seats)
Space Norms	192 Sq. m.
Power Norms	8 KW
Instructors Qualification for	
1. Nuclear Power Plant Technician Trade	B.Voc/Degree in Mechatronics / Mechanical/ Instrumentation / Electrical Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience** in the mechanical field . OR 03 years Diploma in Mechanical/ Electrical/ Instrumentation/ Mechatronics Engineering from AICTE recognized board of technical education with **two years' of teaching or industry experience** in the mechanical field. OR NTC/NAC passed in the Trade of "Nuclear Power Plant Technician" **three years' of teaching or industry experience** in the mechanical field.

	<u>Essential Qualification</u>: Relevant Regular / RPL variants of National Craft Instructor Certificate (NCIC) under DGT. **<u>NOTE:-</u>*Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education with **two years' of teaching or industry experience.** **OR** NTC/ NAC in any one of the engineering trades with **three years' of teaching or industry experience.** **<u>Essential Qualification:</u>** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with **one-year of teaching or industry experience.** **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education with **two years' of teaching or industry experience.** **OR** NTC/ NAC in any one of the engineering/ Draughtsman group of trades with **one-year of teaching or industry experience.** **<u>Essential Qualification:</u>** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in any one of the engineering trades or RoDA.
4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with t**wo years' of teaching or industry experience with short term** ToT Course in Employability Skills conducted by DGT institutions.

	(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR** Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills conducted by DGT institutions.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES

FIRST YEAR:

Sl. No.	NOS CODE	Learning Outcome	Duration		
			Practical	Theory	Total
First Year					
1.	CSC/N9506	Perform different types of basic fitting operations and check for dimensional accuracy by following safety precautions. *[Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]*	100	20	120
2.	CSC/N9593	Join metal components by riveting by observing standard procedure.	25	5	30
3.	CSC/N9512	Make components by different operations and check accuracy using appropriate measuring instruments. *[Different Operations - Drilling, Reaming, Tapping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*	60	15	75
4.	AAS/N9407	Make different fit of components as per required tolerance by observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]*	60	15	75
5.	CSC/N9488	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	50	10	60
6.	CSC/N9483	Make & assemble components by mating surfaces, finishing operations. *[Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and*	125	25	150

		Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]			
7.	CSC/N9501	Dismantle and assemble pipes, valves & fittings and test for leakages. *[Range of skills – Cutting, Threading, Flaring, Bending and Joining]*	10	5	15
8.	CSC/N9685	Plan & perform basic day to day preventive maintenance and repair.	60	15	75
9.	CSC/N9539, CSC/N9537	Set the SMAW machine and Oxy-acetylene gas welding plant & perform different type of joints on MS in different positions observing standard procedure. [different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position – flat, horizontal & vertical]	130	20	150
10.	CSC/N9537	Set up oxy- acetylene cutting plant and perform different cutting operations on MS plate. [Different cutting operation – Straight, Bevel, circular]	20	10	30
11.	CSC/N9547	Setup GMAW plant and practice straight line beads on MS sheet/ plate by using different mode of metal transfer & perform different types of fillet joints (Tee, Lap and outside corner) and butt joint (square & single V) in flat, horizontal and vertical position.	100	20	120
12.	CSC/N9548	Setup GTAW plant and practice fusion runs without filler rod and deposit straight bead with filler rod on MS sheet in flat position & perform different types of joints (square butt, lap, outside corner and tee) on MS sheet in flat/ down hand position.	100	20	120
13.	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		30	30
14.	CSC/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.		30	30
		Employability Skills		**120**	**120**
		Total	**840**	**360**	**1200**

Second Year					
15.	CSC/N0305	Construct different electrical sub-systems and measure parameters. [Different electrical sub-systems: - AC/DC Motors, DC machine, DC motors, DC motor starter, Universal motor, Induction motor, AC drive, Servo drive, transformer.]	95	25	120
16.	PSS/N6002	Construct and test different electronics sub systems. *[Different sub system: - Diodes, rectifier circuit, voltage regulator, transistor power electronic devices, op-amp circuit, LED circuit, SCR etc.]*	95	25	120
17.	PSS/N9407	Perform panel wiring using cables, connectors, protective devices and test functionality.	50	10	60
18.	CSC/N9463	Troubleshoot and repair different Electrical, Electronic systems/ devices. *[Different Electrical, Electronic systems/ devices:- Fuse, MCB, Power circuit, Control panel, Circuit Breaker, Stabilizer, AC/DC drives.]*	75	30	105
19.	ELE/N9408	Demonstrate functions of different sensors. *[Different sensors: Proximity Sensors, inductive sensor, capacitive sensor, magnetic sensor, Photoelectric Sensors, ultrasonic sensors etc.]*	60	15	75
20.	SSC/N9416	Construct and verify different Digital Logic Circuits. (Different DLC: - Logic Gates, half & full adder, binary & counter, up-down counter).	45	15	60
21.	CSC/N9701	Interpret atomic structure, nuclear forces, and basic principles of radioactivity.	105	30	135
22.	CSC/N9702	Apply standard safety procedures and understand the biological and environmental impact of radiation.	105	30	135
23.	CSC/N9703	Demonstrate the structure and function of nuclear power plant.	105	30	135
24.	CSC/N9704	Demonstrate basic operations and controls of nuclear reactor.	105	30	135
25.	CSC/N9401	Read and apply engineering drawing for different application in the field of work.		30	30
26.	CSC/N9402	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic		30	30

		science in the field of study.			
Employability Skills				**60**	**60**
Total			**840**	**360**	**1200**
Grand Total			**1680**	**720**	**2400**

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Perform different types of basic fitting operations and check for dimensional accuracy by following safety precautions. Basic fitting operation – marking, Hacksawing, Chiselling, Filing, Drilling, Taping and Grinding etc.	• Plan & Identify tools, instruments and equipment for marking and make this available for use in a timely manner. • Select raw material and visually inspect for defects. • Mark as per specification applying desired mathematical calculation and observing standard procedure. • Measure all dimensions in accordance with standard specifications and tolerances. • Identify Hand Tools for different fitting operations and make these available for use in a timely manner. • Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding. • Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job. • Observe safety procedure during above operation as per standard norms and company guidelines. • Check for dimensional accuracy as per standard procedure. • Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
2. Join metal components by riveting observing standard procedure.	• Identify Tools and equipment for riveting and make these available for use in a timely manner. • Prepare the job for lap and butt joint. • Identify different type of rivets and use as per requirement. • Identify tools for drilling and use these tools. • Mark according to drawing. • Drill through holes on the job.

	• Rivet to prepare a job as per given drawing / sample following standard practices. • Observe safety procedure during riveting as per standard norms and company guidelines.
3. Make components by different operations and check accuracy using appropriate measuring instruments. *[Different Operations - Drilling, Reaming, Tapping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*	• Ascertain and select tools and materials for the job and make this available for use in a timely manner. • Plan work in compliance with standard safety norms. • Produce component by observing standard procedure. • Check the dimensions of the produced components to ensure dimensions are within prescribed limit. • Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
4. Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]*	• Recognize general concept of Limits, Fits and tolerance necessary for fitting applications and functional application of these parameters. • Ascertain and select tools and materials for the job and make this available for use in a timely manner. • Set up workplace/ assembly location with due consideration to operational stipulation • Plan work in compliance with standard safety norms and collecting desired information. • Demonstrate possible solutions and agree tasks within the team. • Make components according to the specification for different fit using a range of practical skills and ensuring interchangeability of different parts. • Assemble components applying a range of skills to ensure proper fit. • Check functionality of components.
5. Identify, dismantle, replace and assemble different pneumatics and	• Select and ascertain tools for the job and make this available for use in a timely manner. • Identify different pneumatics and hydraulics

hydraulics components. [Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]	components. • Plan to dismantle and replace pneumatics & hydraulics circuit as per drawing and collecting necessary information. • Perform dismantling and replacing of different components with accuracy applying range of skills and standard operating procedure. • Assemble different components. • Check functionality of the components.
6. Make & assemble components by mating surfaces, finishing operations. *[Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]*	• Ascertain and select tools and materials for the job and make this available for use in a timely manner. • Plan work in compliance with standard and collecting necessary information. • Set up workplace/ assembly location with due consideration to operational stipulation • Demonstrate possible solutions and agree tasks within the team. • Produce different components with appropriate accuracy by observing standard procedure& method as per specification using appropriate tools & machines. • Perform scraping and lapping of components to obtain required surface finish of different mating surface. • Comply with safety rules when performing the above operations. • Check tolerance and accuracy of components as defined with appropriate instruments observing standard procedure. • Assemble different components using different fastening components, tools and check the functionality.
7. Dismantle and assemble pipes, valves & fittings and test for leakages. *[Range of skills – Cutting, Threading, Flaring, Bending and*	• Ascertain and select tools and materials for the job and make this available for use in a timely manner. • Plan to Dismantle and assemble valves and pipe fittings. • Dismantle valves and fittings in pipes applying range of

Joining]	skills and check for defect as per standard procedure. • Demonstrate possible solutions in case of defect and agree tasks within the team for repair or replacement. • Assemble valves and various pipe fittings using range of skills and observing standard procedure. • Test for leakage and appropriate functioning of valves. • Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
8. Plan & perform basic day to day preventive maintenance and repair	• Ascertain preventive maintenance/repair procedure as per manual of machine and select appropriate tools & equipment for undertaking job. • Interpret construction, alignment and assembly of different parts of machine. • Plan to carry out the preventive maintenance/repair task with appropriate accuracy of simple machine by collecting necessary information. • Demonstrate possible solutions and agree tasks within the team. • Perform preventive maintenance/dismantle, repair parts and assemble sub-assemblies of simple machine as per layout plan and standard procedure. • Put the machine in operation complying Standard operating procedure. • Check for proper functioning of repaired machine and other parameters of simple machine as per manual after erection. • Dispose unsalvageable materials as per standard procedures.
9. Set the SMAW machine and Oxy-acetylene gas welding plant & perform different type of joints on MS in different positions	• Plan and select the type & size of electrode, current. • Prepare edge as per requirement • Prepare, set SMAW machine and tack the pieces as per drawing. • Set up the tacked pieces in specific position.

observing standard procedure. [different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position – flat, horizontal & vertical]	• Deposit the weld maintaining appropriate arc length, electrode angle, speed, weaving technique and safety aspects. • Clean the welded joint thoroughly. • Carry out visual inspection for appropriate weld joint & check by gauges. • Plan and select the nozzle size, working pressure, type of flame, filler rod as per requirement. • Prepare, set and tack the pieces as per drawing. • Set up the tacked joint in specific position. • Deposit the weld following proper technique and safety aspect. • Carry out visual inspection to ascertain quality weld joint.
10. Set up oxy- acetylene cutting plant and perform different cutting operations on MS plate. [Different cutting operation – Straight, Bevel, circular]	• Plan and mark on MS plate surface for straight/bevel/circular cutting. • Select the nozzle size and working pressure of gases as per requirement. • Set the marked plate properly on cutting table. • Set the cutting plant & perform the cutting operation maintaining proper techniques and all safety aspects. • Clean the cutting burrs and inspect the cut surface for soundness of cutting.
11. Setup GMAW plant and practice straight line beads on MS sheet/ plate by using different mode of metal transfer & perform different types of fillet joints (Tee, Lap and outside corner) and butt joint (square & single V) in flat, horizontal and vertical position.	• Select size of electrode wire, voltage, gas flow rate, wire feed rate as per requirement. • Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints. • Set up the tacked joint in specific position. • Deposit the weld adapting proper technique and safety aspects. • Carry out visual inspection to ensure quality of welded joint. • Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).

12. Setup GTAW plant and practice fusion runs without filler rod and deposit straight bead with filler rod on MS sheet in flat position & perform different types of joints (square butt, lap, outside corner and tee) on MS sheet in flat/ down hand position	• Select power source as per material, size and type of Tungsten electrode, current, gas nozzle size, gas flow rate and filler rod size as per requirement. • Prepare, set (machine & Job) and tack the pieces as per drawing and type of joints. • Set up the tacked joint in specific position. • Deposit the weld by adapting proper technique and safety aspects. • Carry out visual inspection to ensure quality of welded joint. • Inspect the weld using Dye-penetration Test (DPT)/Magnetic particle Test (MPT).
13. Read and apply engineering drawing for different application in the field of work.	• Read & interpret the information on drawings and apply in executing practical work. • Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. • Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
14. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	• Solve different mathematical problems • Explain concept of basic science related to the field of study
SECOND YEAR	
15. Construct different electrical sub-systems and measure parameters. [Different electrical sub-systems: - AC/DC Motors, DC machine, DC motors, DC motor starter,	• Plan and identify tools, instruments and equipment for the work and make it available timely. • Set up workplace/ assembly location with due consideration to operational stipulation. • Plan work in compliance with standard safety norms and collecting desired information. • Demonstrate possible solutions and agree tasks within the team.

Universal motor, Induction motor, AC drive, Servo drive, transformer.]	• Troubleshoot & test different electrical sub system.
16. Construct and test different electronics sub systems. *[Different sub system: - Diodes, rectifier circuit, voltage regulator, transistor power electronic devices, op-amp circuit, LED circuit, SCR etc.]*	• Plan and identify tools, instruments and equipment for the work and make it available timely. • Set up workplace/ assembly location with due consideration to operational stipulation. • Plan work in compliance with standard safety norms and collecting desired information. • Demonstrate possible solutions and agree tasks within the team. • Construct different electronics subsystem test electronics devices and subsystems.
17. Perform panel wiring using cables, connectors, protective devices and test functionality.	• Plan and estimate material requirement for panel wiring. • Identify tools equipment for the work and make it available timely. • Set up workplace/ assembly location with due consideration to operational stipulation. • Plan work in compliance with standard safety norms and collecting desired information. • Perform panel wirings.
18. Troubleshoot and repair different Electrical, Electronic systems/ devices. *[Different Electrical, Electronic systems/ devices:- Fuse, MCB, Power circuit, Control panel, Circuit Breaker, Stabilizer, AC/DC drives.]*	• Plan and identify tools, instruments and equipment for the work and make it available timely. • Plan work in compliance with standard safety norms and collecting desired information. • Demonstrate possible solutions and agree tasks within the team. • Trouble shoot and repair electrical & electronics system/ devices observing safety procedure. • Check the functionality of the system.
19. Demonstrate functions of different sensors. *[Different sensors:*	• Demonstrate the Behaviour of Proximity Sensors and ultra sonic sensors and logic operation of sensors. • Limits and level control using sensors. • Interfacing of sensors with electrical actuators.

Proximity Sensors, inductive sensor, capacitive sensor, magnetic sensor, Photoelectric Sensors, ultrasonic sensors etc.]	
20. Construct and verify different Digital Logic Circuits. (Different DLC: - Logic Gates, half & full adder, binary & counter, up-down counter).	• Plan and identify tools, instruments and equipment for the work and make it available timely. • Construct and verify digital logic circuits.
21. Interpret atomic structure, nuclear forces, and basic principles of radioactivity.	• Demonstrate radioactive half-life period using coin toss/statistics. • Compare energy released in chemical vs nuclear reactions (model-based). • Use cloud chamber to visualize particle tracks. • Demonstrate nuclear fission using animation and energy calculation. • Demonstrate Scintillation detector and ionization chamber.
22. Apply standard safety procedures and understand the biological and environmental impact of radiation.	• Demonstrate time, distance, and shielding principles. • Measure background radiation levels using handheld detectors. • Safe handling procedure for mock radioactive materials. • Decontamination procedure for radioactive contamination (personnel and area).
23. Demonstrate the structure and function of nuclear power plant.	• Assess model of a nuclear power plant layout. • Simulate energy flow from nuclear reactor to turbine (using software or kits). • Demonstrate heat exchange process using boiling water setup. • Execute turbine functioning through lab model.

24. Demonstrate basic operations and controls of nuclear reactor.	• Prepare a model to demonstrate working principle of reactor. • Carryout control rod insertion and reactivity change by simulation. • Demonstrate reactor light-up/shutdown sequence via simulation. • Simulate neutron moderation and multiplication.
25. Read and apply engineering drawing for different application in the field of work.	• Read & interpret the information on drawings and apply in executing practical work. • Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. • Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
26. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	• Solve different mathematical problems • Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS FOR NUCLEAR POWER PLANT TECHNICIAN TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 100 Hrs.; Professional Knowledge 20 Hrs.	1. Perform different types of basic fitting operations and check for dimensional accuracy by following safety precautions. *[Basic fitting operation – marking, Hacksawing, Chiseling, Filing, Drilling, Taping and Grinding etc.*	1. Development of Safety attitude and use of Personal Protective Equipment (PPE). 2. Safety signs for Danger, Warning, caution & personal safety message. 3. Preventive measures for electrical accidents & steps to be taken in such accidents. 4. Practice and understand precautions to be followed while working in fitting jobs. 5. Safe use of tools and equipment used in the trade.	Importance of trade training, List of tools & Machinery used in the trade. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Importance of safety and general precautions observed in the in the industry/shop floor. **Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations &regulations as applicable. Basic understanding on Hot work, confined space work and material handling equipment.
		6. Selection of material as per application and Visual inspection of raw materials for standard colour code of the material. 7. Sawing different types of metals of different sections.	Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, prick punch their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table. Measuring standards (English, Metric Units), angular measurements.

			Basic knowledge of materials and their handling process.
		8. Marking practice with dividers, odd leg calipers and steel rule (circles, arcs, parallel lines). 9. Filing Channel, Parallel. 10. Filing- Flat and square (Rough finish), 11. Filing practice, surface filing. Marking of straight and parallel lines with odd leg calipers and steel rule.	Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements. Basic knowledge of surface roughness
		12. Marking off straight lines filing, filing square & check using try-square and arcs using scribing block and dividers.	Marking off and layout tools, dividers, scribing block, - description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares. Uses, care & maintenance of cold chisels- materials, types, cutting angles.
		13. Marking according to simple blueprints for locating position of holes, scribing lines on chalked surfaces with marking	Marking media, marking blue, Prussian blue, red lead, chalk and their special application, description. Use, care and maintenance of

		tools. 14. Finding centre of a round bar with the help of 'V' block and marking block. 15. Joining straight line to an arc.	scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance.
		16. Filing flat, square, and parallel to an accuracy of 0.5mm. 17. Chip curve along a line-mark out, keyways at various angles & cut keyways.	Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity. Ultimate tensile strength 0.2% proof stress, yield strength, Stress and Strain.
		18. Saw along a straight line, curved line, on different sections of metal. 19. Straight saw on thick section of M.S. angle and M.S. pipes.	Power Saw, used for metal cutting.
		20. File steps and finish with 2nd cut, smooth file to accuracy of ± 0.25 mm. 21. File and saw on M.S. Square and M.S. pipe.	Vernier caliper, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper. Vernier height gauge: material construction, parts, graduations (English & Metric) use, care and maintenance. Profile gauges.
		22. File radius along a marked line (Convex & concave) & match.	Micrometer- outside and inside – principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer.
		23. Mark off and drill through	Drilling processes: common type

		holes. 24. De-burring and chamfering of holes 25. Drill and tap on M.S. flat.	(bench type, pillar type, radial type), drilling machine. Determination of tap drill size.
Professional Skill 25 Hrs.; Professional Knowledge 05 Hrs.	2. Join metal components by riveting by observing standard procedure.	26. Make riveted lap and butt joint. 27. Drill for riveting. 28. Riveting with as many types of rivet as available, use of counter sunk head rivets.	Various rivets shape and form of heads, importance of correct head size. Riveting tools, dolly snaps description and uses. Method of riveting, The spacing of rivets. Flash riveting, use of correct tools, compare cold riveting.
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	3. Make components by different operations and check accuracy using appropriate measuring instruments. *[Different Operations - Drilling, Reaming, Tapping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]*	29. Mark off and drill through holes. 30. Drill on M.S. flat. 31. Sharpening of Drills & Chisel. 32. Practice use of angular measuring instrument.	Drill, types and its nomenclature Cutting speed feed. R.P.M. for different materials. Drill holding devices.
		33. Counter sink, counter bore and ream split fit (three-piece fitting). 34. Drill through hole and blind holes. 35. Form internal threads with taps to standard size (through holes and blind holes). 36. Prepare studs and bolt.	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer and its nomenclature Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses.
		37. Form external threads with dies to standard size. 38. Prepare nuts and match with bolts.	Tap wrench: material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies & dies stock and its nomenclature. types, Method of using dies.

		39. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree). 40. Make simple open and sliding fits.	Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers.
		41. Enlarge hole and increase internal dia. 42. File cylindrical surfaces. 43. Make open fitting of curved profiles. 44. Practice angle grinder (portable)	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use.
		45. Correction of drill location by binding previously drilled hole. 46. Make inside square fit.	Gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge-types (feeler, screw, pitch, radius, wire gauge).
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	4. Make different fit of components as per required tolerance by observing principle of interchangeability and check for functionality. *[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit and Profile fit; Required tolerance: ±0.04 mm, angular tolerance: 30 min.]*	47. Make sliding 'T' fit.	Interchangeability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system.
		48. File fit- combined, open angular and sliding sides. 49. File internal angles with 30 minutes accuracy for open angular fit.	Method of expressing tolerance as per BIS Fits: Definition, types, description of each with sketch. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.
		50. Make sliding fit with angles other than 90°	Pig Iron: types of pig Iron, properties and uses.

			Cast Iron: types, properties and uses Wrought iron: - properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses.
		51. Scrap on flat surface, curved surface, parallel surface and test. 52. Make & assemble, sliding flats, plain surface. 53. Check for blue match of bearing surface- both flat and curved surface by Whitworth method.	Simple scraper- flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate.
		54. File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. 55. Locate & make accurate hole for stud fit. 56. Fasten mechanical components / sub-assemblies together using screws, bolts and collars using hand tools.	Vernier micrometer, material, parts, graduation, use, care and maintenance of measuring instruments. Screw thread micrometer: Construction, graduation and use.
		57. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)	Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators- measurement of cylinder bores.

Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	5. Identify, dismantle, replace and assemble different pneumatics and hydraulics components. *[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]*	58. Identify pneumatic components: Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. 59. Identify the parts of a pneumatic cylinder. 60. Dismantle and assemble a pneumatic cylinder. 61. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder. 62. Identify hydraulic component: Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators and hoses. 63. Inspect fluid levels, service reservoirs, clean/replace filters, hose for twist, kinks, and minimum bend radius, tube fittings. 64. Identify internal parts of hydraulic cylinders, pumps/motors	Fluid power, Pneumatics, Hydraulics, and their comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law. Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics. Introduction to hydraulic circuits. Pneumatic actuators: - Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. - Symbols of hydraulic components, Hydraulic oils – function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hydraulic reservoir & accessories, Pumps, - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses.
Professional Skill 125 Hrs.; Professional Knowledge	6. Make & assemble components by mating surfaces, finishing operations. *[Different Mating Surfaces – Dovetail fitting,*	65. Make 'H' fitting. 66. Power tools: Practice operation of power tool for fastening. 67. Tightening of bolt/ screw with specified torque.	Screws: material, designation, specifications, Property classes (e.g., 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its constructional features, uses & maintenance.

25 Hrs.	*Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools- hand operated & power tools, Required tolerance - ±0.02mm, angular tolerance ± 10 min.]*	68. Assembly sliding for using keys, dowel pin and screw, ± 0.02 mm accuracy on plain surface and testing of sliding fitting job. 69. File & fit angular mating surface within an accuracy of ± 0.02 mm & 10 minutes angular fitting.	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers.
		70. Make Dovetailed fitting and radius fitting.	Special files: types (pillar, warding, needle files) description & their uses. Templates and Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance.
		71. File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy and check with Vernier-callipers, micrometres etc.	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance.
		72. Perform drilling using 'V' block and a clamp. 73. Make male and female fitting parts, drill and ream holes not less than 12.7 mm.	Application of slip gauges for measuring, Sine Bar-Principle, application & specification.
		74. Lap flat surfaces using lapping plate.	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish.

		75. Lapping holes and cylindrical surfaces.	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
		76. Dovetail and Dowel pin assembly. 77. Scrape cylindrical bore.	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart.
		78. Scrapping cylindrical bore and to make a fit. 79. Scrapping cylindrical taper bore and check taper angle with sine bar.	Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).
		80. Hand reams and fit taper pin. 81. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.	Reaming operation procedure and reamer size drill calculation etc.
Professional Skill 10 Hrs.; Professional Knowledge 05 Hrs.	7. Dismantle and assemble pipes, valves & fittings and test for leakages. *[Range of skills – Cutting, Threading, Flaring, Bending and Joining]*	82. Dismantling & assembling – globe valves, sluice valves, stop cocks, seat valves and non-return valve.	Details nomenclature of different valves and stop cocks.
		83. Visual inspection for visual defects e.g. dents, surface finish. 84. Fit & assemble pipes, valves and test for leakage & functionality of valves.	Inspection & Quality control -Basic Statistical Process Control (SPC) -Visual Inspection.
Professional Skill 60 Hrs.; Professional Knowledge 15 Hrs.	8. Plan & perform basic day to day preventive maintenance and repair.	85. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed 86. Perform routine check of machine and do replenish as per requirement	Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.

		87. Simple repair of machinery: - Making of packing gaskets. 88. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. 89. Dismantling, assembling of different types of bearing and check for functionality.	Method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Washers-Types and calculation of washer sizes. The making of joints and fitting packing.
Professional Skill 130 Hrs. Professional Knowledge 20 Hrs.	9. Set the SMAW machine and Oxy-acetylene gas welding plant & perform different type of joints on MS in different positions observing standard procedure. *[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position – flat, horizontal & vertical]*	90. Demonstrate Machineries used in the trade. 91. Identify safety equipment and their use etc. 92. Perform hacksawing, filing square as per the given dimensions. 93. Mark out on MS plate and punching. 94. Perform straight line beads on 10 mm thick M.S. plate in flat position. 95. Perform weaved bead on 10mm thick MS plate in flat position. 96. Set up oxy-acetylene equipment, igniting and setting of flame. 97. Perform fusion run without filler rod on 2mm thick MS sheet in flat position. (OAW) 98. Make square butt joint on 2 mm thick M.S. sheet in flat Position. (1G) (OAW) 99. Make fillet “T” joint on 10 mm thick M.S. Plate in flat position. (1F) (SMAW)	• Introduction to welding and its history. • Importance of welding in Industry. • Classification of welding processes and their applications. • Introduction of SMAW and OAW Equipment, tools and accessories. • Terms and definitions of SMAW and OAW. • Safety precautions in Shielded Metal Arc Welding & Oxy-Acetylene gas welding and cutting. • Oxy-acetylene gas welding: its principle, advantages and disadvantages. • System of oxy-acetylene gas welding: HP & LP. • Oxygen gas & its properties. • Acetylene gas & its properties • Oxygen cylinder and its features. • DA cylinder and its features.

		100. Open outside corner joint on 2 mm thick MS sheet in flat Position (1F) (OAW) 101. Make Fillet lap joint on 10 mm thick M.S. plate in flat position. (1F) (SMAW) 102. Make Fillet "T" joint on 2 mm thick MS sheet in flat position. (1F) (OAW) 103. Open outside corner joint on 8 or 10 mm thick MS plate in flat position. (1F) (SMAW) 104. Make Fillet Lap joint on 2 mm thick MS sheet in flat position. (1F) (OAW) 105. Make Single "V" Butt joint on 10 mm thick MS plate in flat position (1G). (SMAW) 106. Make Square Butt joint on 2 mm thick M.S. sheet. in Horizontal position. (2G) (OAW) 107. Make Fillet "T" joint on 8 or 10 mm thick M.S. plate in Horizontal position. (2F) (SMAW) 108. Make Fillet Lap joint on 10 mm thick M.S. plate in horizontal position. (2F) (SMAW) 109. Perform Fusion run with filler rod in vertical position on 2mm thick M.S sheet. (OAW) 110. Make Open square butt joint on 5 mm thick M.S. sheet in horizontal position (2G). (SMAW) 111. Make Single 'V' Butt joint on 10 or 12 mm thick	• Gas Welding Regulator: functions, types, and working principle of single and double stage gas regulators. • Basic types of welding joint and their applications. • Surface Cleaning operations before welding. • Basic electricity applicable to arc welding and related terms & definitions. • Heat and temperature and its terms related to welding. • Arc welding power sources: Transformer, Welding Generator, Rectifier and Inverter type machines. • Advantages and disadvantages of A.C. and D.C. machines. • Arc length – importance – types – effects of arc length. • Polarity: Importance – types and applications. • Weld quality inspection. • Visual inspection after defects • Weldability of metals, importance of pre-heating, post heating and maintenance of inter-pass temperature. • Weldability of low, medium and high carbon steel and alloy steels. • Explain different types of recognized welding position (1G, 2G, 3G, 4G, 5G and 6G).

		M.S. plate in horizontal position (2G). (SMAW) 112. Perform straight line beads practice on 8 or 10 mm thick M.S. Plate in Vertical (up) position. 113. Make Fillet "T" joint on 10 mm thick M.S. plate in vertical position. (3F) 114. Perform Dye Penetrant (DP) Test exercise	• Explain edge preparation used in arc and gas welding. • Welding positions as per EN, ISO & ASME: flat, horizontal, vertical and overhead position. • Weld slope and rotation. • Welding symbols as per ISO & AWS. • Appearance of good and defective weld. • Weld gauges & their uses. • Gas welding blow pipe: functions, types, construction and working principle of HP & LP blow pipe. Difference between them. • Oxy-acetylene welding flame: features, types and uses. • Brief description of acetylene gas generation by water to carbide & carbide to water type generator. • Gas welding techniques: Rightward and Leftward welding technique. • Arc blow – causes, effects and methods of controlling arc blow. • Distortion in arc & gas welding: causes and types. • Arc welding defects: external and internal, causes and remedies of each defect. • Arc welding defects: external and internal, causes and remedies of each defect.

			• Gas welding filler rods, specifications and sizes. • Gas welding fluxes – types and functions. • Gas welding defects, causes and remedies • Electrode: types, functions of flux, coating factor, size & specifications of electrode. • Effects of moisturized electrode. • Coding of MMAW electrode by different standard (IS & AWS). Storage and baking of electrodes.
Professional Skill 20 Hrs.; Professional Knowledge 10 Hrs.	10. Set up oxy-acetylene cutting plant and perform different cutting operations on MS plate. *[Different cutting operation – Straight, Bevel, circular]*	115. Set up oxy-acetylene gas cutting plant 116. Make straight cuts (freehand) 117. Mark and straight line cut of MS plate 10 mm thick by gas cutting process (accuracy within ± 2mm).	• Common gases used for gas cutting. • Oxy-Acetylene Cutting process: its principle, equipment, parameters and application. • Faults in oxy-acetylene gas cutting and methods for their remedies.
Professional Skill 100 Hrs. Professional Knowledge 20 Hrs.	11. Setup GMAW plant and practice straight line beads on MS sheet/ plate by using different mode of metal transfer & perform different types of fillet joints (Tee, Lap and outside	118. Demonstrate GMAW plant, safety equipment and their use. 119. Set GMAW machine & accessories and striking an arc. 120. Perform depositing straight line beads on M.S Plate using different metal transfer technique. 121. Make Fillet weld – "T" joint on 10mm thick M.S plate in flat position by Dip/ Spray transfer. (1F)	Introduction to GMAW process: Its principle, advantages, disadvantages & applications, specific safety operation

	corner) and butt joint (square & single V) in flat, horizontal and vertical position.	122. Make Fillet weld – Lap joint on 3mm thick M.S. sheet in flat position by Dip transfer. (1F) 123. Make Fillet weld – "T" joint on 3mm thick M.S. sheet in flat position by Dip transfer. (1F) 124. Make Fillet weld – outside corner joint on 3mm thick M.S. sheet in flat position by Dip transfer. (1F)	• Explain the various names of the process (MIG/ MAG/ CO_2). Advantages of GMAW over SMAW, limitations and applications
		125. Make Butt weld – Square butt joint on 3 mm thick M.S sheet in flat position by Dip transfer. (1G) 126. Make Butt weld – Single "V" butt joint on 8 or 10 mm thick M.S plate by Dip/ Spray transfer in flat position. (1G)	Details about the equipment and accessories used in GMAW: power source, wire feed system, shielding gas and choices of as per application, welding guns or torch.
		127. Make Fillet weld – "T" joint on 8 or 10 mm thick M.S plate in Horizontal position. (2F)	Constant voltage power source used in GMAW.
		128. Make Fillet weld – "T" joint on 8 or 10 mm thick M.S plate in vertical position. (3F) 129. Make Fillet weld – corner joint on 8 or 10 mm thick M.S plate in vertical position. (3F) 130. Make Fillet weld – Lap joint on 3mm thick M.S. sheet in vertical position by Dip transfer. (3F) 131. Make Fillet weld – corner joint on 3mm thick M.S. sheet in vertical position by Dip transfer. (3F) 132. Make Tee Joint on MS	Wire feed system, welding torch/gun – types – care and maintenance.

		Pipe 60 mm OD x 3 mm WT (1G position: Arc constant and pipe rolling).	
Professional Skill 100 Hrs. Professional Knowledge 20 Hrs.	12. Setup GTAW plant and practice fusion runs without filler rod and deposit straight bead with filler rod on MS sheet in flat position & perform different types of joints (square butt, lap, outside corner and tee) on MS sheet in flat/ down hand position.	133. Demonstrate GTAW plant, setting up of GTAW machine and accessories. Safety equipment in GTAW and their use. 134. Perform striking an arc and fusion run practice on MS sheet (2 mm) without filler rod in Flat position.	Introduction to GTAW process: Its principle, advantages, disadvantages & applications.
		135. Perform depositing straight line bead on MS sheet (2 mm) with filler rod in Flat position. 136. Make Butt weld – square butt joint on MS sheet (2 mm) in Flat position.	Advantages of GTAW over Oxy-acetylene gas welding process.
		137. Make Fillet weld – Lap joint on MS sheet (2 mm) in Flat position.	Details about the equipment and accessories used in GTAW: Power Source (AC & DC), High Frequency Unit, DC Suppressor, shielding gas supply, welding torch.
		138. Make Fillet weld – outside corner joint on MS sheet (2 mm) in DHP. 139. Make Fillet weld – T joint on MS sheet (2 mm) in Flat position.	Selection of AC & DC welding power source for GTAW.
		140. Make Fillet weld – Lap joint on MS sheet (2 mm) in Horizontal position (HP).	Necessity of H.F. unit in GTAW.
		141. Make Fillet weld – T joint on MS sheet (2 mm) in Horizontal position (HP).	
		142. Make Fillet weld – square butt joint on MS sheet (2 mm) in Horizontal position (HP).	• Importance of DC Suppressor in GTAW. • Inspection of welding: Necessity, methods of

		143. Make Fillet weld – Lap joint on MS sheet (2 mm) in VP. 144. Make Fillet weld – T joint on MS sheet (2 mm) in Vertical position (VP). 145. Make Butt weld – square butt joint on MS sheet (2 mm) in Vertical position (VP). 146. Make Butt Joint on MS Pipe 60 mm OD x 3 mm WT (1G position: Pipe rolling).	inspection before – during – after welding. • Classification of destructive and NDT methods. • Knowledge of common DT & NDT. Cost economy and estimation.
Engineering Drawing			
Professional Knowledge ED- 30 Hrs.	13. Read and apply engineering drawing for different application in the field of work.	**<u>Engineering Drawing:</u>** Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the freehand sketches. • Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering–Single Stroke. Dimensioning • Types of arrow head • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation– • Different symbols used in the related trades. Concept and reading of Drawing in • Concept of axes plane and quadrant • Concept of Orthographic and Isometric projections • Method of first angle and third angle projections (definition and difference) Reading of Job drawing of related trades.	
Workshop Calculation & Science			
Professional	14. Demonstrate	**Unit, Fractions**	

Knowledge WCS- 30 Hrs.	basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	• Classification of unit system • Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units • Measurement units and conversion • Factors, HCF, LCM and problems • Fractions - Addition, subtraction, multiplication & division • Decimal fractions - Addition, subtraction, multilipication & division • Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** • Square and square root • Simple problems using calculator • Applications of pythagoras theorem and related problems • Ratio and proportion • Ratio and proportion - Direct and indirect proportions • Percentage • Precentage - Changing percentage to decimal and fraction **Material Science** • Types metals, types of ferrous and non ferrous metals • Introduction of iron and cast iron **Mass, Weight, Volume and Density** • Specific gravity **Speed and Velocity, Work, Power and Energy** • Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation • Speed and velocity - Related problems on speed & velocity • Work, power, energy, HP, IHP, BHP and efficiency **Heat & Temperature and Pressure** • Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals • Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature **Basic Electricity** • Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC,DC their comparison, voltage, resistance and their units • Conductor, insulator, types of connections - series and parallel • Ohm's law, relation between V.I.R & related problems • Electrical power, energy and their units, calculation with assignments • Magnetic induction, self and mutual inductance and EMF generation

		• Electrical power, HP, energy and units of electrical energy **Trigonometry** • Measurement of angles • Trigonometrical ratios

SYLLABUS FOR NUCLEAR POWER PLANT TECHNICIAN TRADE			
SECOND YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 95 Hrs; Professional Knowledge 25 Hrs	15. Construct different electrical sub-systems and measure parameters. [Different electrical sub-systems: - AC/DC Motors, DC machine, DC motors, DC motor starter, Universal motor, Induction motor, AC drive, Servo drive, transformer.]	147. Check/Test the line, neutral and earth wires before connecting cable in to plugs. 148. Test short circuit and open circuit. 149. Find out relationship among V, I, R. 150. Demonstrate the given Electrical circuit/board and identify different types of plugs, sockets, switches, fuses and fuse holder. 151. Construct and test by connecting DC sources in series and parallel. 152. Measure the voltage and current in AC/DC Circuits using ammeter, voltmeter, and multi meter. 153. Construct series and parallel combination of DC sources and verify voltage & current. 154. Test the operation of a Relay. 155. Demonstration of faraday's law. 156. Measure input and output voltages in stabilizers, power supply unit in the control panel. 157. Application of test lamp and multi meter for identifying single and three phase supply. 158. Construct and perform	**Basic Electrical Engineering** Concept of current, voltage, resistance, electric charge, current density and Power and energy. Ohms law and Kirchhoff's Laws. Primary and secondary cells & Battery. Types of secondary cells & battery. Measurement of voltage and current in Networks. AC parameters for sine and Square wave forms. **Electromagnetic theory: -** Flux, Flux density, magnetic effect, magnetic field, electromagnetic force, concepts of coil (electromagnetic). Solenoids and relays. Faraday's laws of electromagnetic induction. **Instrument used for Measuring electrical parameters: -** Measurements of electrical quantities using voltmeter , Ammeter, Multimeter, Megger. Power supply units and Stabilizers. Electromagnetic induction, Motor and Generator effect. Types of AC and DC Motors, Construction and its working principles, Speed control of AC/DC Motors. Principle and Operation of servo motor, Stepper motor and its applications. Concepts of AC/DC Drives.

		forward and Reverse operation of DC Motors. 159. Construct and perform speed control of DC Motors. 160. Connect, start, run single-phase AC motor (inductive-start and capacitive-start) and reverse the direction. 161. Control the speed of AC motor. 162. Start and Run 3-phase AC motor using star-delta starter and reverse the direction. 163. Check the Motor speed and its line current using Tacho Generator and Clamp-on meter. 164. Configure AC drive for controlling induction motor. 165. Configure DC drive for controlling DC motor. 166. Construct a simple circuit to test position and velocity using Servo Drive. 167. Practice on encoder to perform positional accuracy. 168. Practice on linear scale to perform positional accuracy. 169. Verify the terminals of 3-phase transformer HT and LT side. 170. Measure Voltage and current of 1-Φ, 3-Φ Auto transformer. 171. Measure phase sequence and power factor using phase sequence meter, power factor meter.	Principle and operation of single phase, Three phase transformer and Auto transformer. Winding details of three phase transformer. Tacho Generator. Instrument transformers (CT and PT), clamp meter, Phase sequence meter, Power factor meter. Concepts of open loop and closed loop systems, feedback devices used in Mechatronics, Principle and Operation of tacho-generator, Encoder, and linear scale. Concept of Power transformer and associated safety precautions

		172. Measure the current of a given load using Tong-Tester.	
Professional Skill 95 Hrs; Professional Knowledge 25 Hrs	16. Construct and test different electronics sub systems. *[Different sub system: - Diodes, rectifier circuit, voltage regulator, transistor power electronic devices, op-amp circuit, LED circuit, SCR etc.]*	173. Demonstrate commercially available electronic components & their nomenclature. 174. Test the Electronic components using component tester and Multi meter and Test ICs using IC Tester. 175. Construct Diode circuit and draw V-I characteristics. 176. Construct a Transistor Switch. 177. Construct Zener regulator. 178. Construct transistor voltage regulator circuit. 179. Construct comparator and Instrumentation Amplifier using Op-Amp. 180. Construct and Verify Photo LED circuit. 181. Construct and verify the operation of LDR and Photo diode. 182. Construct isolation circuit using opto-isolator. 183. Testing of SCR, DIAC, TRIAC, IGBT and UJT using Multi-meter and component tester. 184. Construct a phase control rectifier circuits using SCRs. 185. Practice Soldering and De-soldering on the PCBs for a given circuits.	**Electronic components:** Basic Electronic components (active and passive) and its symbols. Reading of electronic circuit drawing. Types of Resistors, capacitors, inductor and its identification. Working and operation of Diodes. Rectifier circuits. Zener voltage Regulator. Transistors and its applications. DC Regulated power supplies. Introduction to Op-Amp, characteristics, Configuration and its applications. Introduction to Opto-electronics, LED, LDR, Photo diode, opto-coupler. **Study of Power Electronic Devices:** Power diodes, power transistors, SCR, DIAC, TRIAC, UJT IGBT, phase control rectifiers, Converters. **Soldering Techniques: -**. Describe Soldering and De-soldering process, Do and Don’ts of soldering. Concepts of SMD.
Professional Skill 50 Hrs; Professional	17. Perform panel wiring using cables, connectors,	186. Estimate the materials for a given panel board connection plan. 187. Perform Termination of	**Electrical cables connectors & switchgears:** Colour code of cables, cable joints (straight joints and T-

Knowledge 10 Hrs	protective devices and test functionality.	wires, cables and electronic components. 188. Perform Skinning, dressing, and joining for different types of cables. 189. Perform Crimping practice on RJ45, BNC, Audio, D-shell and Edge connectors. 190. Measure Insulation Resistance by using Megger. 191. Perform wiring in PVC conduit for power sockets. 192. Construct staircase wiring to control a lamp. 193. Perform wiring to install buzzer, buttons, and protection alarm. 194. Prepare panel mains board with switch and distribution fuse box. 195. Perform Wiring of power and control circuits in the panel board. 196. Measure earth resistance using earth tester. 197. Test the switches, pushbuttons, limit switches, Foot pedal switch, Micro switches for its operation 198. Practice on working of protective elements such as MCB, OLR, ELCBs and fuses in power circuits.	Joints), wiring layout diagrams, Types of cables and its specifications: **PVC- XLPE cable** PVC cable, XLPE cable, UTP cable, STP cable, PVC cable (heavy duty), Aerial bunch cable Power cable, co-axial cables, Fiber optical cables. Types of connectors and its specifications: Power connectors, Flat cables, RJ45 Connector, BNC, TNC, Audio Video, D-Shell and Edge connector. Cable termination methods, cable layout diagrams, electrical control panel wiring and electrical bus systems. Purpose of using protective devices, Fuses, Contactor ,Relays, Timers, Circuit Breakers e.g. ACB, VCB, OCB, MCBs, ELCBs etc. DOL , Star – Delta Starters, Push buttons, Limit switches, Micro switches, Float switches, Solenoids, Float switch, OLRs, Photo electric relay, Importance of earthing,
Professional Skill 75 Hrs; Professional Knowledge 30 Hrs	18. Troubleshoot and repair different Electrical, Electronic systems/ devices. *[Different Electrical, Electronic systems/*	199. Replacement of fuses, Locating OLR and its resetting practice. 200. Locating faults in power circuit such as fuse blown, MCB Tripped, control fuse blown etc. 201. Perform general checking of loose contacts in the	Introduction to maintenance, Importance of maintenance and types. Guidelines for trouble shooting of electrical, electronic systems. Types of earthing techniques. Importance on electrical safety, safety marking and symbols, Risk management, Electric

	devices:- Fuse, MCB, Power circuit, Control panel, Circuit Breaker, Stabilizer, AC/DC drives.]	control panel wirings. 202. Troubleshoot and Service a circuit breaker. 203. Service and troubleshoot the DC motor starter. 204. Maintain, Service, and troubleshoot DC Machine. 205. Identify controls, trace the circuit and test the function of stabilizer. Troubleshoot the AC/DC Drives and check the feedback sensors. 206. Demonstrate action in case of electric shock. 207. Demonstrate use of fire extinguisher in case of electrical fire.	hazards, Prevention of accidents and Personal safety aspects. Environment safety and safety precautions while handling electrical equipment. Classification of fires, Different type of firefighting equipment. **Types of Maintenance** • Preventive maintenance • Corrective maintenance **Electrical Safety** • Action in case of electric shock • Electrician First aid kit • Electrical fire & its prevention
Professional Skill 60 Hrs; Professional Knowledge 15 Hrs	19. Demonstrate functions of different sensors. *[Different sensors: Proximity Sensors, inductive sensor, capacitive sensor, magnetic sensor, Photoelectric Sensors, ultrasonic sensors etc.]*	208. Test the resistance, Proximity Sensors, inductive sensor, capacitive sensor, magnetic sensor in an application circuit. 209. Test the Reflex Photoelectric Sensors in an application circuit. 210. Test the ultrasonic sensor in an application circuit. 211. Test the reed switch and limit switch in an application circuit. 212. Test the Temperature Sensors in an application circuit. 213. Test the Level Control in an application circuit. 214. Interface Sensors and Electrical Actuators. 215. Interface Sensors and Pneumatic Actuators.	Introduction to Sensors & transducers Sensors - Classifications & Operation Proximity Sensor - Classifications & Operation Sensors for Temperature measurements Sensors for Distance and Displacement Sensor characteristics and interface technique.
Professional Skill 45 Hrs;	20. Construct and verify different Digital Logic	216. Verify the truth table of AND, OR, NOT, NAND, NOR, XOR gates.	**Number System:** Binary, Decimal, Octal, Hexa Decimal Number systems and its

Professional Knowledge 15 Hrs	Circuits. (Different DLC: - Logic Gates, half & full adder, binary & counter, up-down counter).	217. Construct and verify SR, JK, T and D Flip-Flops. 218. Construct and verify Binary counter, UP/DOWN counter circuits. 219. Construct and verify encoder and decoder circuits. 220. Construct Multiplexer and De multiplexer circuits.	Conversions. Binary Arithmetic and logical operations. **<u>Digital Logic:</u>** Boolean algebra. Logic gates: AND, OR, NOT, NAND, NOR, XOR. Encoder and Decoders. Concepts of Flip-Flop: SR, JK, T, D. Counters, Multiplexers and De-Multiplexers. Memories: Discs, RAM, ROM, Semiconductor memories.
Professional Skill 105 Hrs. Professional Knowledge 30 Hrs.	21. Interpret atomic structure, nuclear forces, and basic principles of radioactivity.	**Basics of Nuclear Physics** 221. Video demonstration/ Model of atomic models using kits (Bohr model). 222. Simulate nuclear decay chains using visual aids/software. 223. Demonstrate radioactive half-life period using coin toss/statistics. 224. Compare energy released in chemical vs nuclear reactions (model-based). 225. Use cloud chamber to visualize particle tracks. 226. Demonstrate nuclear fission using animation and energy calculation. Demonstrate Scintillation detector and ionization chamber. 227. Measure radiation using Geiger-Müller (GM) counter/simulation.	**Basics of Nuclear Physics** • Introduction to sources of energy. (Why nuclear power) • Facts about nuclear energy. • Atomic structure, nucleus, isotopes, and mass-energy equivalence. • Basics of nuclear reaction. • Radioactive and non-radioactive materials • Nuclear forces and binding energy. • Types of radioactive decay (alpha, beta, gamma). • Fission vs fusion. • Units of radioactivity and radiation • Introduction to nuclear reactions and decay chains.
Professional Skill 105 Hrs. Professional Knowledge	22. Apply standard safety procedures and understand the biological and environmental impact of	**Nuclear Radiation Safety** 228. Demonstrate time, distance, and shielding principles. 229. Measure background radiation levels using	**Nuclear Radiation Safety** • Types and sources of radiation exposure. • Nuclear safety culture. • Health effects: acute vs chronic.

30 Hrs.	radiation.	handheld detectors. 230. Safe handling procedure for mock radioactive materials. Decontamination procedure for radioactive contamination (personnel and area). 231. Use of personal protective equipment (PPE) and dosimeters. 232. Role-play of emergency response to contamination/ spillage. 233. Simulate radiation zone mapping. 234. Poster making on ALARA (As Low As Reasonably Achievable) principle.	• Brief of international & national safety standards (IAEA, AERB). • Radiation dose limits. • Radiation protection procedure. • Personal (Thermo Luminescent Dosimeter (TLD), Direct Reading Dosimeter (DRD)) and area radiation monitoring. • Waste disposal methods. ALARA principle and regulatory frameworks. Learning from case studies for past incident happened in world w.r.t. Nuclear events.
Professional Skill 105 Hrs. Professional Knowledge 30 Hrs.	23. Demonstrate the structure and function of nuclear power plant.	**Nuclear Power Plant** 235. Build model of a nuclear power plant layout. 236. Simulate energy flow from nuclear reactor to turbine (using software or kits). 237. Demonstrate heat exchange process using boiling water setup. 238. Observe turbine functioning through lab model. 239. Group activity: compare thermal, hydro, and nuclear plants. 240. Virtual visit/tour of a nuclear power plant. 241. Poster/chart creation on energy efficiency and reactor types.	**Nuclear Power Plant** • Overview of nuclear power process plant and Components. (reactor core, coolant, moderator, control rods, turbine, condenser). • Types of reactors: {Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR) Pressurised Heavy Water Reactor (PHWR) and Fast Breeder Reactor (FBR). • Energy conversion process: heat to electricity. • Nuclear fuel cycle: mining, enrichment, disposal. • Comparison of nuclear with other conventional energy sources.

Professional Skill 105 Hrs. Professional Knowledge 30 Hrs.	24. Demonstrate basic operations and controls of nuclear reactor.	**Operation of Nuclear Reactors** 242. Prepare a model to demonstrate working principle of reactor. 243. Control rod insertion and reactivity change by simulation. 244. Reactor light-up/shutdown sequence via simulation. 245. Simulate neutron moderation and multiplication. (Animation) 246. Demo on Mock emergency response (Role play).	**Operation of Nuclear Reactors** • Recap on reactor and types of reactors (PHWR, FBR, PWR) • Recap on chain reaction and criticality. • Role of moderators, coolants, control rods. • Feedback mechanisms (positive and negative). • Safety systems and interlocks. • Instrumentation and monitoring. • Emergency response • Operating procedures and maintenance basics
Engineering Drawing			
Professional Knowledge ED- 30 Hrs.	25. Read and apply engineering drawing for different application in the field of work.	• Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Double nut, Castle nut, Pin, etc. • Reading of foundation drawing • Reading of Rivets and rivetted joints, welded joints • Reading of drawing of pipes and pipe joints • Reading of Job Drawing, Sectional View & Assembly view	
Workshop Calculation & Science			
Professional Knowledge WCS- 30 Hrs.	26. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Algebra** • Algebra - Addition, subtraction, multiplication & division • Algebra - Theory of indices, algebraic formula, related problems **Estimation and Costing** • Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade • Estimation and costing - Problems on estimation and costing	

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs. for 1st year + 60 Hrs. for 2nd year)

Learning outcomes, assessment criteria, syllabus and Tool List of Employability Skills is provided separately in www.cstaricalcutta.gov.in / www.bharatskills.gov.in / www.dgt.gov.in.

ANNEXURE-I

FITTER			
LIST OF TOOLS AND EQUIPMENT (For batch of 24 candidates)			
S no.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)			
1.	Steel Rule with metric & British graduation	150 mm, Stainless steel	24+1 Nos.
2.	Try Square.	150 mm blade	24+1 Nos.
3.	Caliper inside spring type.	150 mm	24+1 Nos.
4.	Caliper hermaphrodite spring type	150 mm	24+1 Nos.
5.	Caliper outside spring type	150 mm	24+1 Nos.
6.	Divider spring type	150 mm	24+1 Nos.
7.	Scriber	150 mm	24+1 Nos.
8.	Centre Punch	10 mm and Length - 120 mm	24+1 Nos.
9.	Screw driver	150mm insulated flat type	24+1 Nos.
10.	Chisel cold flat	20 mm X 150 mm High carbon steel	24+1 Nos.
11.	Hammer ball peen with handle	450 grams (1 lb)	24+1 Nos.
12.	Hammer ball peen with handle.	220 grams (1/2 lb)	24+1 Nos.
13.	File flat - second cut	250 mm	24+1 Nos.
14.	File flat smooth	250 mm.	24+1 Nos.
15.	File half round second cut	150 mm.	24+1 Nos.
16.	Hacksaw frame fixed type	300 mm	24+1 Nos.
17.	Safety goggles.		24+1 Nos.
18.	Dot punch	100 mm	24+1 Nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
INSTRUMENTS			
19.	Steel Rule Graduated both in Metric and English Unit	300 mm Stainless steel	4 nos.
20.	Straight edge steel	300 mm or above	2 nos.
21.	Spirit Level metal Type - 2	300 mm Basic Length Accuracy 0.1mm/Meter	1 no.
22.	Stud Extractor EZY - out	Set of 8	2 sets

23.	Combination Set	300 mm	2 nos.
24.	Micrometer outside.	0 - 25 mm	2 nos.
25.	Micrometer outside.	25 - 50 mm	2 nos.
26.	Micrometer outside.	50 - 75 mm	2 nos.
27.	Micrometer inside with extension rods.	Accuracy 0.01 mm with extension rods up to 150 mm	1 no.
28.	Vernier caliper	150 mm	4 nos.
29.	Vernier height gauges	0 - 300 mm with least count = 0.02 mm	1 no.
30.	Vernier bevel protractor Blade with Acute Angle Attachment	300 mm	1 no.
31.	Screw pitch gauge Metric	0.25 to 6 mm	1 no.
32.	Wire gauge, metric standard.		1 no.
GENERAL SHOP OUTFIT			
33.	Surface plate C.I/Granite with Stand and Cover	600 x 600 mm	1 no.
34.	Marking table (Mild steel)	900X900X900 mm	1 no.
35.	Universal scribing block.	220 mm	2 nos.
36.	V-Block pair with clamps	150 x 100 x 100 mm	2 nos.
37.	Angle plate	150 X 150 X 250 mm	2 nos.
38.	Portable hand drill (Electric)	0 to 13 mm Capacity	1 no.
39.	Drill twist straight shank	3 mm to 12 mm by 0.5 mm H.S.S.	2 sets
40.	Drill twist Taper shank	8 mm to 20 mm by 0.5 mm H.S.S.	2 sets
41.	Taps and dies complete set-in box.	Whitworth	1 no.
42.	Taps and dies complete set	5, 6, 8, 10 & 12mm set of 5	2 Sets
43.	File knife edge smooth	150 mm	4 nos.
44.	File feather edge smooth	150 mm	4 nos.
45.	File triangular smooth	200 mm	12 nos.
46.	File round second cut	200 mm	12 nos.
47.	File square second cut	250 mm	12 nos.
48.	Feeler gauge	Gauge Feeler / Thickness - 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm - 13 leaves	1 set
49.	File triangular second cut.	200 mm	12 nos.
50.	File flat second cut safe edge.	300 mm	12 nos.
51.	File flat bastard	200 mm	12 nos.
52.	File flat bastard.	300 mm	12 nos.
53.	File Swiss type needle	Set of 12, Length = 150 mm	2 sets
54.	File half round second cut.	250 mm	12 nos.
55.	File half round bastard.	250 mm	12 nos.
56.	File round bastard.	250 mm	12 nos.

57.	File hand second cut.	150 mm	12 nos.
58.	File card.	3"x5" size, brass or steel wire	12 nos.
59.	Oil Can	250 ml	2 nos.
60.	Pliers combination insulated	150 mm	2 nos.
61.	Wooden handle forged Soldering Iron copper bit.	230V, 250 W, 350 gm	2 nos.
62.	Blow Lamp	0.5 litre	2 nos.
63.	Spanner- Double Ended	6x7, 8x9, 10x11, 12x13, 14x15, 16x17, 18x19, 20x22	1 set each
64.	Spanner adjustable	150 mm	2 nos.
65.	Interchangeable ratchet socket set	12 mm driver, sized10-32 mm set of 18 socket & attachments.	1 set
66.	Double Ended tubular Box spanner set with Tommy bar.	A/F 6-25 mm set of 10 Tommy Bar Dia. 6, 8, 10, 12, 14, 16	1 set
67.	Glass magnifying	75 mm	2 nos.
68.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	2 nos.
69.	Clamp "C"	100 mm	2 nos.
70.	Clamp "C"	200 mm	2 nos.
71.	Hand Reamer set (Taper pin straight flute)	Nominal Dia. 6, 8, 10, 12, 16mm	1 set
72.	Machine Reamer parallel (Helical flute)	12 - 16mm set of 5.	1 no.
73.	Scraper flat	150 mm	12 nos.
74.	Scraper triangular	150 mm	12 nos.
75.	Scraper half round	150 mm	12 nos.
76.	Chisel cold crosscut& diamond point.	9 mm X 150 mm	10 each
77.	Chisel cold flat	9 mm X 100 mm	12 nos.
78.	Chisel cold round nose	9 mm X 100 mm	12 nos.
79.	Drill chuck with key	12 mm.	1 no.
80.	Pipe wrench	400 mm	1 no.
81.	Pipe vice	100 mm	1 no.
82.	Adjustable pipe die set BSP	cover pipe size 1" or 3/4"	1 Set
83.	Wheel dresser (One for 4 units) Star/Dresser with Holder	Length 150 mm, diamond point	1 no.
84.	Machine vice - Swivel Base	100 mm	1 no.
85.	Machine vice - Swivel Base	125 mm	1 no.
86.	Sleeve drill Morse	No. 0 - 1, 1 - 2, 2 - 3, 3 - 4, 4 - 5	1 Set
87.	Vice bench	150 mm	20 nos.
88.	Bench working.	2400 x 1200 x 900 mm	4 nos.
89.	Fire extinguisher (For 4 Units)	CO2 type, 3 kg capacity	As

			required
90.	Fire buckets.		As required
91.	Machine vice.	100mm	2 nos.
92.	Wing compass.	254 mm or 300 mm	2 nos.
93.	Hand hammer with handle.	1000 gm	1 nos.
94.	Power tools for fastening	Capacity 10-18mm	1 No.
95.	Different Profile gauges (Plate type) - For demonstration	Metric standard	4 nos.
96.	Knurling tool (Diamond, straight & Diagonal)		1 each
97.	Indexable boring bar with inserts	1" shank	4 nos.
98.	Temperature gauge	Range 0 - 150°C	1 each
99.	Dowel pin (straight)	Dia. -1” Length -4" (Mat: Stainless Steel)	1 each
100.	Standard Tap screws	M3, M4, M5, M6, M8, M10, M12, M14, M16	1 each
101.	Lapping plate	Dia. -6"	2 each
102.	Medium carbon Heat treated alloy steel Metric Studs and bolts along with nuts (for display) of standard length (May be manufactured in-house)	M6, M8, M10, M12, M14, M16 (Standard)	2 each
103.	Caps screws	M6, M8, M10, M12	2 each
104.	Drill gauges	Letter drill gauge (A to Z), Number drill gauge (1 to 60), Metric drill gauge (1.5mm to 12.5mm, 30 holes)	2 nos.
105.	Cast Iron Globe Valve (Flanged type)	150NB, Class# 150 Flange: ANSI125-B16.1	2 nos.
106.	C.I. Sluice / Gate valve (flanged type)	150NB, Class# 150 Flange: ANSI125-B16.1	2 nos.
107.	Stop cock	25NB (2-way, Threaded end)	2 nos.
108.	M.S. Pipe	150NB, Sch.40, ERW, IS:1239	as required
109.	G.I. Pipe	25mm, Sch.40, ERW	as required
110.	Slip-on Forged steel Flange	150NB, ANSI-B16.5, Class#150	4 nos.
111.	Bolt & Nut with washer (May be manufactured in-house)	M20x2.5x90Long (part thread - Hex. Head)	20 nos.
112.	Pipe threading die with handle	Ratchet type Die head of 1/2”, 3/4" and 1"	2 nos.
113.	Jigs & Fixture (sample)-For demonstration (May be		1 no.

	manufactured in-house)		
114.	Steel keys (May be manufactured in-house)	to fit with key slot of shaft & pulley	2 nos.
115.	Damaged old spur gear	to fit 50mm dia. Shaft	2 nos.
116.	V-belt and Flat belt	to fit on pulley	1 each
117.	Packing gasket	PTFE gasket roll small size	As required
118.	Washer, clutch, keys, jib, cotter &circlip	minimum 25mm size, carbon steel material	2 each
119.	Hollow punch	Straight Shank Hollow Punch Sets 5-12mm	1 set
120.	Drill Drift (May be manufactured in-house)	200mm hardened and black finish	2 nos.
121.	Bearing different types	each type of diameter 25mm (min.)	1 each
122.	Bearing extractor	Universal gear puller 2 or 3 jaws adjustable	1 no.
123.	Pulley extractor	- do -	1 no.
GENERAL SHOP OUTFIT			
124.	Carbide Wear Block.	1 mm - 2 mm	2 each
125.	Stilson wrenches	250 mm	2 nos.
126.	Pipe cutter wheel type.	6 mm to 25 mm	1 no.
127.	Pipe bender machine spool type with stand manually operated.	up to 25 mm cold bending	1 no.
128.	Adjustable pipe chain tonge to take pipes	up to 300 mm	1 no.
129.	Adjustable spanner.	380 mm long	1 no.
E. GENERAL MACHINERY INSTALLATION			
130.	Pillar Type Drilling machine	Sensitive 0-20 mm cap. with swivel table motorized with chuck & key.	1 no.
131.	Drilling machine bench	Sensitive 0-12 mm cap motorized with chuck and key.	2 nos.
132.	D.E. pedestal Grinding machine with wheels rough and smooth	2 H.P.-3 Phase-415V, 1500 rpm,250 dia. wheel	1 no.

WELDER			
LIST OF TOOLS AND EQUIPMENT (For batch of 20 Candidates)			
S No.	**Name of the Tools& Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-15 is required additionally)			
1.	Helmet fiber		24+1 Nos.
2.	Hand shield fiber		24+1 Nos.
3.	Chipping hammer	with metal handle 250 Grams	24+1 Nos.
4.	Chisel cold	flat 19 mm x 150 mm	24+1 Nos.
5.	Centre punch	9 mm x 127 mm	24+1 Nos.
6.	Dividers	200 mm	24+1 Nos.
7.	Stainless steel rule	300mm	24+1 Nos.
8.	Scriber	150 mm double point	24+1 Nos.
9.	Flat Tongs	350mm long	24+1 Nos.
10.	Hack saw frame	fixed 300 mm	24+1 Nos.
11.	File half round	bastard 300 mm	24+1 Nos.
12.	File flat	350 mm bastard	24+1 Nos.
13.	Hammer ball pane	1 kg with handle	24+1 Nos.
14.	Tip Cleaner		24+1 Nos.
15.	Try square	6”	24+1 Nos.
16.	Vernier caliper	Digital upto 300 mm	2 nos.
17.	Micrometer	Digital upto 0-25 mm	2 nos.
18.	Thermal gun/ temperature measuring gun		2 nos.
B. INSTRUMENTS AND GENERAL SHOP OUTFIT - For 2 (1+1) units no additional items are required			
TOOLS & EQUIPMENT			
19.	Wire cutter	For MIG welding	6 nos.
20.	Spindle key	For welding plant	8 Nos. (2 for each type of gas)
21.	Screw Driver	300mm blade and 250 mm blade	1 each
22.	Number punch	6 mm	2 set
23.	Letter punch	6 mm	2 set
24.	Magnifying glass	100 mm dia.	2 Nos.
25.	Universal/ Cambridge Weld measuring gauge		2 Nos.

26.	Spanner D.E.	6 mm to 32mm	2 sets
27.	C-Clamps	10 cm and 15 cm	2 each
28.	Hammer sledge	double faced 4 kg	2 No.
29.	S.S tape	5 meters flexible in case	5 No.
30.	H.P. torch	with 5 nozzles	2 sets
31.	Oxygen Gas Pressure regulator	double stage	2 Nos.
32.	Acetylene Gas Pressure regulator	double stage	2 Nos.
33.	Pre-heater	For GMAW	2 Nos.
34.	CO_2 Gas pressure regulator	with flow meter	2 set
35.	Argon Gas pressure regulator	with flow meter	2 set
36.	Metal rack	182 cm x 152 cm x 45 cm	1 No.
37.	First Aid box		1 No.
38.	Steel lockers	with 8 Pigeon holes	3 Nos.
39.	Steel almirah / cupboard		4 Nos.
40.	Black board and easel with stand		1 No.
41.	Flash back arrester (torch mounted)		4 pairs
42.	Flash back arrester (cylinder mounted)		4 pairs
43.	Multiangle magnetic clamp set	Metal base (18x10x10 cm)	one
GENERAL SHOP OUTFIT			
44.	AC welding Transformer	with all accessories (400A, OCV 60–100 V, 60% duty cycle)	4 sets
45.	Transformer (or) Inverter based machine (IGBT)	with all accessories (300A, OCV 60 – 100 V, 60% duty cycle)	2 sets
46.	DC rectifiers set with all accessories	(400 A. OCV 60 – 100 V, 60% duty cycle)	2 sets
47.	GMAW machine	400A capacity with air cooled torch, Regulator, Gas pre-heater, Gas hose and Standard accessories	2 sets
48.	AC/DC GTAW machine	with water cooled torch 300 A, Argon regulator, Gas hose, water circulating system and standard accessories.	2 sets
49.	Auto Darkening Helmet		5Nos.
50.	Pedestal grinder fitted with coarse and medium grain size grinding wheels	300 mm dia.	2 No.

51.	Bench grinder fitted with fine grain size silicon carbide green grinding wheel	150 mm dia.	2 nos.
52.	AG 4 Grinder		4 Nos.
53.	Suitable gas table	with fire bricks	2 Nos.
54.	Suitable Arc table	with positioner	6 Nos.
55.	Trolley for cylinder (H.P. Unit)		2 Nos.
56.	Hand shearing machine capacity	cut 6 mm sheets and flats	1 No.
57.	Power saw machine	18'' or blade size 450 mm	1 No.
58.	Portable drilling machine	(Cap. 6 mm)	1 No.
59.	Oven, electrode drying	0 to 350°C, 10 kg capacity, depth 450mm to 500 mm, intake capacity 10 kg	1 No.
60.	Work bench	340x120x75 cm with 4 bench vices of 150 mm jaw opening	4 sets
61.	Oxy Acetylene Gas cutting blow pipe		2 sets
62.	Oxygen, Acetylene Cylinders **		2 each
63.	CO_2 cylinder **		2 Nos.
64.	Argon gas cylinder **		2 Nos.
65.	Anvil 24 sq. inches working area with stand		1 No.
66.	Swage block 5048	Cast iron 16x16x16 inch	1 No.
67.	Magnetic particle testing Kit #		1 set
68.	Portable abrasive cut-off machine		1 No.
69.	Suitable Gas cutting table		1 No.
70.	Water cooled induction / Brazing machine	200-250 Amp., induction coil length 3 inch and 2.5 inch	1
71.	Swaging and flooring tool kit 45^0 tubing	1/8 to ¾ inch	
72.	Modern Welding Booth with welding positioner	With fume extractor and manipulator	04 nos.
73.	Master Welding Booth with welding positioner	With fume extractor and manipulator	01 no.
74.	Ultrasonic testing machine with accessories and different probes	Standard	01 sets
C. CONSUMABLE			
75.	Leather Hand Gloves	14"	20 pairs
76.	Masking tape	2.5"	5 nos.

77.	Cotton hand Gloves	8”	20 pairs
78.	Leather Apron leather		20 Nos.
79.	S.S Wire brush	5 rows and 3 rows	20 Nos. each
80.	Leather hand sleeves	16”	20 pairs
81.	Safety boots for welders	Size 7,8,9,10	20pairs
82.	Leg guards leather		20pairs
83.	Rubber hose clips	½"	20 Nos.
84.	Rubber hose oxygen	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
85.	Rubber hose acetylene	8 mm dia X 10 Mtr. long as per BIS	2 Nos.
86.	Arc cables multi cored copper	400/ 600 amp as per BIS	45 mts. each
87.	Arc single-coloured glasses	108 mm x 82 mm x 3 mm. DIN 11A &12 A	34 Nos.
88.	Arc plain glass	108 mm x 82 mm x 3 mm.	68 Nos.
89.	Gas Goggles	with Colour glass 3 or 4A DIN	34 Nos.
90.	Safety goggles plain		34 Nos.
91.	Spark lighter	CUP lighter for	6 Nos.
92.	AG 4 Grinding wheels		50 Nos.
93.	Earth clamp	600A	6 Nos.
94.	Electrode holder	600 amps	6 Nos.
95.	Die penetrant testing kit		1 set
96.	Anti spatter spray can	100 to 300 ml	5 Nos.
97.	GMAW Torch nozzle tip	Size 0.8, 1.0, 1.2 (in mm)	5 Nos. each
98.	TIG torch ceramic nozzle	Size 3,4,5,6,8	4 Nos. each
99.	Tungsten electrode	1.0, 1.6, 2.0 (in mm), length 150 mm	5 Nos. each
100.	AG4 cutting wheels		100 Nos.

Note:

1. *** Optionally Gas cylinders can also be hired as and when required.*
2. *# One machine per institute irrespective of number of units of trade is necessary.*
3. *Internet facility should be available in classroom*

ELECTRICIAN			
LIST OF TOOLS AND EQUIPMENT (For batch of 24 Candidates)			
Sl. No	**Name of the Tool & Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1	Screw driver electrician	150 mm	24+1 Nos.
2	Screw driver	Nos. 860, 862	24+1 Nos.
3	Long nose plier	150 mm	24+1 Nos.
4	Combination plier	150 mm	24+1 Nos.
5	Screw driver Philips	Nos. 860, 862	24+1 Nos.
6	Tweezers		24+1 Nos.
7	Knife	100 mm	24+1 Nos.
8	Wire Stripper		24+1 Nos.
9	Neon Tester		24+1 Nos.
10	Scissors	150 mm	24+1 Nos.
11	Soldering iron	25 watts	24+1 Nos.
12	Bread Board		24+1 Nos.
B: TOOLS AND EQUIPMENTS:			
13	Ammeter	0 – 500 mA	3 Nos.
14	Ammeter	0 – 1 Amp DC	3 Nos.
15	Voltmeter	0 – 300/600V AC	4 Nos.
16	PF Meter		2 Nos.
17	Phase Sequence Meter		2 Nos.
18	Digital multi-Meter		5 Nos.
19	Energy meter, Single / Three phase		2 Nos.
20	Clamp on meter	0 – 50 Amps	2 Nos.
21	Ammeter portable type	0 – 15 Amps AC	4 Nos.
22	Test lamp		3 Nos.
23	Line Tester		5 Nos.
24	Battery Tester		4 Nos.
25	Electrician Tool Kit		3 Nos.
26	Rechargeable Battery		5 Nos.
27	Pressure Transducers panel board to demonstrate pressure gauge, Load cell, Bourdon tube, Capacitive transducers.		5 Nos.
28	Flow Transducers panel board to demonstrate Flow nozzle, Vane Anemometer, Rota meter.		5 Nos.
29	Temperature Transducers panel board to demonstrate Bimetallic strip, RTD,		5 Nos.

	Thermocouple, Thermistor.		
30	Level Transducers panel board to demonstrate capacitive and float switch.		5 Nos.
31	Insulated Screw Diver	200 mm	5 Nos.
32	Insulated combination cutting plier	200 mm	5 Nos.
33	Small Screw Driver		5 Nos.
C. TOOLS & EQUIPMENT OF ELECTRICAL & SENSORS			
i) Electrical			
34	Variable Resistance Box	Upto 1 k	1 each
35	Solder Iron, Solder Lead, PCB Board (Groove Board), Solder Wick	25 w	1 set
ii) Sensors			
36	Power Supply	0-30V DC, 3A	1 No.
D. LAB OUTFIT			
46	Discrete component tester Trainer kit		2 Nos.
47	Analog circuit trainer kit		3 Nos.
48	Soldering and de soldering Station		5 Nos.
49	AC Squirrel cage Induction Motor	DOL Starter and star –Delta starter assembly	1 No.
50	Auto transformer	0 – 300 V, 8 Amp	2 Nos.
51	Digital and Analog IC Tester		1 each
52	Digital Tachometer		2 Nos.
53	Signal Generator		2 Nos.
54	DC Power supply unit	0 - 30 V , 2 Amps	4 Nos.
55	Digital Earth Tester		1 No.
56	Firefighting equipment		As required
57	Linear IC Trainer Kit		1 No.
58	AC / DC Motor speed control trainer kit		1 No. each
59	AC Drive/ VVF Drive		1 Nos.
60	DC Drive		1 No.
61	Personal Computers	CPU 64 Bit i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM: - 16 GB DDR-III or Higher,VRAM-4GB to 8GB, Wi-Fi Enabled.: Integrated Gigabit Ethernet, Graphic Card, with USB Mouse, USB Keyboard and Monitor (Min. 26 Inch.) Licensed Operating System and Antivirus	12 Nos.

		compatible with trade related software.	
62	Operating system (Windows latest version)		12 Users
63	UPS	5KVA	01 Nos
64	Portable Hard Disk	1 TB	1 No.
65	Megger	Test voltages 500v, 1000v, 2500v & 5000v DC	2 Nos.
66	Panel Wiring Work bench		3 Nos.
67	Protection Devices Trainer Board.		1 Nos.
68	Actuators Application Trainer (Servo, stepper motor, and Solenoid)		1 No.
69	Winding resistance meter	Test current 1A, 5A & 10A	1 No.

BASIC NUCLEAR PHYSICS			
LIST OF TOOLS AND EQUIPMENT (For batch of 24 Candidates)			
S no.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
1.	Atomic Structure Model Kit	Plastic models with nucleus, electrons, neutrons, protons	6 sets
2.	Geiger-Müller (GM) Counter (Educational)	Digital display, counts/minute, safe demo source (e.g., KCl or Thoriated lamp)	4 Nos.
	Thermo Luminescent Dosimeter (TLD)	For training purpose (under OJT)	
	Direct Reading Dosimeter (DRD)	For training purpose	
	Electronic Personnel Dosimeter (EPD)		
3.	Simulation Software for Nuclear fission Processes	Offline/online software: nuclear decay, reactor control, plant operations	12 user licenses
4.	Smart Interactive Flat Panel	HDMI/USB connectivity	1 Nos.
5.	Turbine Demonstration Model	Transparent casing, electric motor driven	2 Nos.
6.	Nuclear Power Plant 3D Working Model	Plastic/Acrylic working layout with labeled parts	2 Nos.
7.	Radiation Shielding Material Set	Lead, plastic, aluminum sheets, HDPE Blocks	4 sets
8.	PPE Kit coverall (lab coat, gloves, mask, goggles)	Cotton lab coat, nitrile gloves, N95 mask, anti-fog goggles, respirator	24 Nos.
9.	Test source box	Reference standard	01 no.
10.	First Aid Kit	ISI-certified with burn, radiation injury management materials	2 Nos.
11.	Charts and Posters	Decay chains, reactor types, safety symbols, ALARA posters	Set of 10
12.	Video Resources	Educational videos on nuclear topics	As required
13.	Fire Extinguisher (ABCD&E Type)	4.5 kg standard – ISI mark	2 Nos.
14.	Safety shoes		24 nos.

Note: -

1. *All the tools and equipment are to be procured as per BIS/ IS specification.*
2. *Internet facility is desired to be provided in the classroom.*

CLASSROOM FURNITURE FOR TRADE THEORY			
S No.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
1	Instructor's table and Chair (Steel)		1 set
2	Students chairs with writing pads		24 Nos.
3	White board	size 1200 mm X 900 mm	1 No.
4	Instructor's laptop with latest configuration pre-loaded with operating system and MS Office package.		1 No.
5	Desktop with latest configuration		1 No.
6	LCD projector with screen/ interactive board		1 No.
7	Process, Inspection & codes DVD/ CDs.		1 set each (optional)

Annexure – II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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Annexure – III

ABBREVIATIONS	
CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities


कौशलं बलम्