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

COMPETENCY BASED CURRICULUM

TEXTILE MECHATRONICS

(Duration: Two Years)

Revised in July 2022

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

SECTOR – CAPITAL GOODS AND MANUFACTURING

Directorate General of Training

TEXTILE MECHATRONICS

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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1. COURSE INFORMATION

During the two-year duration of Textile Mechatronics trade a candidate is trained on professional skill, professional knowledge, Engineering Drawing, Workshop Calculation & Science and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work, industrial visit and extra-curricular activities to build up confidence. The broad components covered under Professional Skill subject are as below:-

FIRST YEAR–In the first year, the trainees will select and perform electrical/ electronic measurement of single range meter & perform panel wiring and test functionality. They will learn to construct different electrical sub systems and measure parameters. The trainees will identify terminals, carryout maintenance of alternator, AC Motors, Transformer & Starters and test them. Plan and prepare earthing installation. They will plan and execute electrical illumination system and detect faults in rectifier and service of different domestic and industrial appliances, practice soldering & desoldering of various electronic components. They will test and verify the input/output characteristics of various analog & power electronic circuits and analyze the circuit functioning. Construct a programme and verify different digital logic circuits and timer circuits using 555 IC's, simple programme on microprocessor and PLC.

The trainees will perform basic workshop operation of different manufacturing sections, methods and identify different components. They will be able to check different electrical wiring & winding methods of different electrical sub system. They will identify different Hydraulic & pneumatic applications in textile machines, different motors, sensors and transducers applications in textile.

SECOND YEAR–In this year, the trainees will identify different components of yarn preparatory machine for its maintenance; Check different components of knitting & weaving machine and carry out their maintenance. They will identify different components of Handloom & Power loom Turning for its maintenance. The trainees will be able to check different Pneumatic and Automation control In Textile Machines. They will be able to simulate electro-pneumatic systems involving pneumatic controls& apply Advanced Automation System in Textile industries.

The trainees will identify different HMI panels in textile industries & their applications; Check different flat /circular knitting machine and perform maintenance. They will check different production methods, machine maintenance & quality control concepts in Industry.

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.

Textile Mechatronics Trade under CTS is one of the popular courses delivered nationwide through network of ITIs. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Workshop Calculation science, Engineering Drawing and Employability Skills) imparts requisite core skills, knowledge and life skills. After passing out of the training Programme, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, 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 knowledge, core skills & employability skills while performing the job and repair & maintenance work.
- Check the job with circuit diagrams/components as per drawing for functioning, diagnose and rectify faults in the electronics components/module.
- Document the technical parameters in tabulation sheet related to the task undertaken.

2.2 PROGRESSION PATHWAYS:

- Can join industry as Textile Mechatronics Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- 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
5	Employability Skills	120	60
	Total	**1200**	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

4	On the Job Training (OJT)/ Group Project	150	150

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification, or, add on short term courses

2.4 ASSESSMENT & CERTIFICATION

The trainee will be tested for his 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 have 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.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 Controller of examinations, 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 percent for Trade Practical and Formative assessment is 60% & for all other subjects is 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 the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/ wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising 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 examining body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
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.
(b) Marks in the range of 75%-90% to be allotted during assessment	
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.
(c) Marks in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Textile Mechatronics; are generalized trade-technician workers. Textile Mechatronics technicians will usually assist design, development and engineering staff, as well as working closely with other trades persons to install, maintain, modify and repair Textile Mechatronics systems, equipment and component parts.

Textile Mechatronics may

- Fit and assemble parts and sub-assemblies made from electrical - electronic and computer components.
- Install, modify, repair and fault-find mechanical, hydraulic and pneumatic equipment and systems& sub systems.
- Set up, inspect, adjust& operate various textile machines and equipment and make repairs.
- Erect textile machinery and equipment on site.
- Examine detailed drawings or specifications to find out job, material and equipment requirements.
- Cut, thread, bend and install hydraulic and pneumatic components.
- Dismantle faulty tools and assemblies and repair or replace defective parts.
- Check accuracy and quality of finished parts, tools or sub-assemblies.

Textile Mechatronics technicians build automated systems for Textile industry. It involves mechanics, electrical-electronics, hydraulics, pneumatics and computer technology. The computer technology element covers information technology applications, programmable machine control systems and technology which enable communication between machines, equipment and people.

In addition, Textile Mechatronics have the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

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

May be designated as “Textile Mechatronics” according to nature of work done in Textile Industry.

Reference NCO-2015:

a) 7233.0101 - General Maintenance Fitter - Mechanical
b) 7412.0101 - Automation Specialist
c) 7412.0201 - Fitter-Electrical and Electronic Assembly
d) 7421.0300 - Electronics Mechanic
a) 7311.0400 – Mechanic Precision Instrument, Mechanical

Reference NOS: --TSC/N9420 TSC/N9421 TSC/N9422 TSC/N9423 TSC/N9424 TSC/N9425 TSC/N9426 TSC/N9427 TSC/N9428 TSC/N9429 TSC/N9430 TSC/N9431 TSC/N9432 TSC/N9401 TSC/N9402 TSC/N9433 TSC/N9434 TSC/N9435 TSC/N9436 TSC/N9437 TSC/N9438 TSC/N9439 TSC/N9440 TSC/N9441 TSC/N9401 TSC/N9402

4. GENERAL INFORMATION

Name of the Trade	**Textile Mechatronics**
Trade Code	DGT/1103
NCO - 2015	7233.0101, 7412.0101, 7412.0201, 7421.0300, 7311.0400
NSQF Level	Level -4
NOS Covered	TSC/N9420 TSC/N9421 TSC/N9422 TSC/N9423 TSC/N9424 TSC/N9425 TSC/N9426 TSC/N9427 TSC/N9428 TSC/N9429 TSC/N9430 TSC/N9431 TSC/N9432 TSC/N9401 TSC/N9402 TSC/N9433 TSC/N9434 TSC/N9435 TSC/N9436 TSC/N9437 TSC/N9438 TSC/N9439 TSC/N9440 TSC/N9441 TSC/N9401 TSC/N9402
Duration of Craftsmen Training	Two Years (2400 hours + 300 hours OJT/Group Project)
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	240 Sq. m
Power Norms	9 KW
Instructors Qualification for	
1. Textile Mechatronics Trade	B.Voc/Degree in Textile Mechatronics from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Textile Mechatronics from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC passed in "Textile Mechatronics" Trade with three years experience in the relevant field. **Essential Qualification:** Relevant Regular / RPL variants of National Craft Instructor Certificate

	(NCIC) under DGT. ***NOTE: Out of two Instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.***
2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE / recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade **OR** Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.

4. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills. (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.
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:

1. Perform electrical/electronic measurement by selecting single range meter & perform panel wiring using cable, connectors, protective devices and test functionality following safety precautions.(Nos:TSC/N9420)
2. Test & service different cells and construct different electrical sub system and measure parameters and install various control wiring system. .(Nos:TSC/N9421)
3. Construct, verify characteristics of electrical and magnetic circuits and measure power and energy with load. .(Nos:TSC/N9422)
4. Execute testing, identify terminal and maintenance of alternator, AC Motors, Transformer and Starters. .(Nos:TSC/N9423)
5. Plan and prepare earthing insulation. .(Nos:TSC/N9424)
6. Plan and execute electrical illumination system and detect faults in rectifier and service of different domestic and industrial appliances. .(Nos:TSC/N9425)
7. Plan and execute soldering and desoldering of various electronic and industrial appliances. .(Nos:TSC/N9426)
8. Construct, test and verify the input/output characteristics of various analog and power electronic circuits and analyze the circuit functioning. .(Nos:TSC/N9427)
9. Construct a programme and verify different digital logic circuits and timer circuits using 555 ICs, simple programme on microprocessor and PLC. .(Nos:TSC/N9428)
10. Perform basic workshop operation of different manufacturing sections, methods and identify different components. .(Nos:TSC/N9429)
11. Check different electrical wiring & winding methods of different electrical sub system. .(Nos:TSC/N9430)
12. Identify different Hydraulic & pneumatic applications in textile machines. Nos:TSC/N9431)
13. Identify different motors, sensors and transducers applications in textile. Nos:TSC/N9432)
14. Read and apply engineering drawing for different application in the field of work. Nos:TSC/N9401)

15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. Nos:TSC/N9402)

SECOND YEAR:

16. Identify different components of yarn preparatory machine for its maintenance. (Nos:TSC/N9433)
17. Check different components of knitting & weaving machine for its maintenance. (Nos:TSC/N9434)
18. Identify different components of Handloom & Power loom Turning for its maintenance. (Nos:TSC/N9435)
19. Check different Pneumatic Automation & control In Textile Machines. (Nos:TSC/N9436)
20. Simulate electro-pneumatic systems involving pneumatic controls. (Nos:TSC/N9437)
21. Apply Advanced Automation System in Textile industries. (Nos:TSC/N9438)
22. Identify different HMI panels in textile industries& their applications. (Nos:TSC/N9439)
23. Check different flat /circular knitting machine for maintenance. (Nos:TSC/N9440)
24. Check different production methods, machine maintenance& quality control concepts in Industry. (Nos:TSC/N9441)
25. Read and apply engineering drawing for different application in the field of work. (Nos:TSC/N9401)
26. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Nos:TSC/N9402)

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Perform electrical/electronic measurement by selecting single range meter & perform panel wiring using cable, connectors, protective devices and test functionality following safety precautions. TSC/N9420	Connect Voltmeter, Ammeter in a simple low voltage DC circuit.
	Measure the current & voltage.
	Perform skinning the cables and different joint practice-in single & multi strand cables.
	Verify the characteristics of series and parallel circuit
	Measure power and energy.
2. Test & service different cells and construct different electrical sub system and measure parameters and install various control wiring system. TSC/N9421	Check current charging of secondary cells.
	Trace magnetic field,prepare solenoid and vary its strength.
	Identify terminal connections, Build up the voltage.
	Start, run & maintain different motors.
	Wire up one lamp and one socket independently to prepare a test board.
3. Construct, verify characteristics of electrical and magnetic circuits and measure power and energy with load. TSC/N9422	Measure the current, voltage, P.F. Frequency, power of a simple A.C circuits.
	Verify the characteristics of RLC series and parallel circuit.
	Verify characteristics of star delta connections.
	Measure the power and energy of three phase load.
4. Execute testing, identify terminal and maintenance of alternator, AC Motors, Transformer and Starters. TSC/N9423	Identify the terminals of Alternator & build up the voltage.
	Start, run and reverse different types of single phase motor.
	Start, Run and reverse different types of three phase motor with different types of starters.
	Identify the terminals of transformer.
	Measure the primary & secondary voltage and respective currents.
5. Plan and prepare earthing insulation. TSC/N9424	Identify lead terminals of megger.
	Measure the resistance of cable.
	Check short circuit with megger.

	Measure the insulation value with megger.
6. Plan and execute electrical illumination system and detect faults in rectifier and service of different domestic and industrial appliances. TSC/N9425	Connect and test F.T, M.V / S.V lamps & energy efficient lamps.
	Apply Norms for illumination in textile mills
	Carry out fault finding, rectification and servicing of different types of domestic and Industrial appliances
7. Plan and execute soldering and desoldering of various electronic and industrial appliances. TSC/N9426	Perform Soldering & De-soldering.
	Identifying simple meters & the multimeter.
	Verify Ohm's law
	Identify and test the given components.
	Identify the color code of Resistors.
	Identify VI characteristics of diode Half wave & Full wave rectifier.
8. Construct, test and verify the input/output characteristics of various analog and power electronic circuits and analyze the circuit functioning. TSC/N9427	Check Voltage regulator circuit-Input-Output characteristic of Transistors at common base- common collector- common emitter modes.
	Construct Transistors & Amplifiers.
	Identify VI characteristics of SCR-speed control of D.C motor using SCR.
	Check FET amplifier Ckts.
	Identify UJT relaxation oscillator.
9. Construct a programme and verify different digital logic circuits and timer circuits using 555 ICs, simple programme on microprocessor and PLC. TSC/N9428	Identify different logic gates.
	Test gates using ICs & Construct Timer circuits using 555 ICs.
	Perform simple programming through microprocessor kit
	Identify commonly used Transducers.
	Demonstrate various controlling units.
	Compare PLC with conventional machine control.
	Identify different functions of keys on programme-Development Terminal (PDT).
10. Perform basic workshop operation of different	Identify mechanical, electrical & electronics components of the machine, setting &maintenance.

manufacturing sections, methods and identify different components. TSC/N9429	rotating machinery division, electric motor assembly section
	Identify basic workshop operation of rotating machinery division, electric motor assembly section, heavy engineering division, machine shop and tool room section.
	Identify various methods for transporting materials and machines of various sizes.
11. Check different electrical wiring & winding methods of different electrical sub system. TSC/N9430	Check wiring methods and perform an experiment to control one lam by one single way switch and 3 pin wall socket with switch control.
	Check advanced wiring of a switch control board and panel
	Identify the winding and test an AC relay coil.
	Test a single phase transformer.
	Connect the end connections of a 3- phase induction motor.
12. Identify different Hydraulic & pneumatic applications in textile machines. TSC/N9431	Identify different feedback elements and control elements
	Determine settings, speeds, production, efficiency and machinery particulars for carding.
13. Identify different motors, sensors and transducers applications in textile. TSC/N9432	Determine settings, speeds, production, efficiency and machinery particulars for draw frame.
	Determine settings, speeds, production, efficiency and machinery particulars for speed frame.
	Determine settings, speeds, production, efficiency and machinery particulars for spinning & winding.
14. Read and apply engineering drawing for different application in the field of work. TSC/N9401	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.
15. Demonstrate basic mathematical concept and principles to perform practical	Solve different mathematical problems

operations. Understand and explain basic science in the field of study. TSC/N9402	Explain concept of basic science related to the field of study
SECOND YEAR	
16. Identify different components of yarn preparatory machine for its maintenance. TSC/N9433	Determine settings, speeds, production, efficiency and machinery particulars for yarn preparatory machine.
	Identify mechanical, electrical &electronics components of the machine, setting & maintenance.
17. Check different components of knitting & weaving machine for its maintenance. TSC/N9434	Determine settings, speeds, production, efficiency and machinery particulars for knitting & weaving machine.
	Identification of mechanical, electrical & electronics components of the machine, setting &maintenance.
18. Identify different components of Handloom & Power loom Turning for its maintenance. TSC/N9435	Identify Handloom & Power loom Turning setting, production & running.
	Check mechanical, electrical & electronics components of the machine, setting & maintenance.
19. Check different Pneumatic Automation & control In Textile Machines. TSC/N9436	Identify different constructional features of pneumatic components using cut-section models and demonstration KIT.
	Simulate circuits using Festo trainer kit.
	Simulate multiple actuator systems.
20. Simulate electro-pneumatic systems involving pneumatic controls. TSC/N9437	Simulate electro-pneumatic systems.
	Simulate electro-pneumatic systems employing proximity switches, optical sensors and capacitive sensors.
	Identify Simple circuits using hydraulic elements.
21. Apply Advanced Automation System in Textile industries. TSC/N9438	Identify different PLC blocks.
	Carry out simple experiment on PLC.
	Check PLC based electronic controls.
22. Identify different HMI panels in textile industries & their applications. TSC/N9439	Identify role of HMI panels in textile industries.
	Perform calculation, setting of modern spinning & weaving machines.
	Identify mechanical, electrical &electronics components of the

	machine, setting & maintenance.
23. Check different flat /circular knitting machine for maintenance. TSC/N9440	Calculate speed production and identify different mechanisms of flat / circular machines.
	Identify mechanical, electrical &electronics components of the machine, setting & maintenance.
24. Check different production methods, machine maintenance & quality control concepts in Industry. TSC/N9441	Check Industrial safety & Health hazard.
	Check different Industrial production, machine maintenance &Quality concept viz. ISO9001-2000, SA8000, ISO14001-2004, 5S system, OHSAS18001-1999.
25. Read and apply engineering drawing for different application in the field of work. TSC/N9401	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. TSC/N9402	Solve different mathematical problems
	Explain concept of basic science related to the field of study

7. TRADE SYLLABUS

SYLLABUS FOR TEXTILE MECHATRONICS TRADE			
FIRST YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 84Hrs; Professional Knowledge 17 Hrs	Perform electrical/electronic measurement by selecting single range meter & perform panel wiring using cable, connectors, protective devices and test functionality following safety precautions. (Map Nos:TSC/N9420)	1. Demonstrate artificial respiration and common defect practices for workshop. (21 hrs.)	Industrial safety precautions-safety devices, safety signs. First aid- fire extinguishers. (04 hrs.)
		2. Connect voltmeter, ammeter in a simple low voltage dc circuit. (13 hrs.) 3. Measure the current & voltage. (08 hrs.) 4. Skin the cables and perform different joint practice-in single & multi strand cables. (21 hrs.) 5. Verify the characteristics of series and parallel circuit. (13 hrs.) 6. Measure power and energy. (08 hrs.)	Fundamentals of electrical terms and definitions with their units-symbols -effects of electricity, conductor-insulator-semi conductor-type of cables. Work power and energy (p.e and k.e) ohm's law series and parallel circuit with simple problems. (13 hrs.)
Professional Skill 105Hrs; Professional Knowledge 20 Hrs	Test & service different cells and construct different electrical sub system and measure parameters and install various control wiring system. (Map Nos:TSC/N9421)	7. Grouping of cells for required voltage. (16 hrs.) 8. Current charging of secondary cells. (11 hrs.) 9. Tracing of magnetic field preparation of solenoid and vary its strength. (21 hrs.) 10. Identification of terminal connections, Build up the voltage. (21 hrs.) 11. Starting, running & maintenance of different	Primary cells-types of cells defects-applications secondary cells. Types of cells types of charging, care and maintenance. Applications-Electromagnetic induction Faraday's Law-Lenz's Law. D.C generator- Construction-Working principle-Types of generator and applications. Different types of motors, AC/ D.C motor-Construction-Working

		motors. (25 hrs.) 12. One lamp controlled by one way / two way switch, to wire up for one lamp and one socket independently, to prepare a test board. (11 hrs.)	principle-Types application necessity of starter-Types. Different types of Pump motors. Wiring-Types of wiring-Application of different types of wiring-Wiring accessories- Materials-Ear thing. (20 hrs.)
Professional Skill 42 Hrs; Professional Knowledge 08 Hrs	Construct, verify characteristics of electrical and magnetic circuits and measure power and energy with load. (Map Nos:TSC/N9422)	13. Measure the current voltage P.F. Frequency, power of a simple A.C circuits. (6 hrs.) 14. Verify the characteristics of RLC series and parallel circuit. (16 hrs.) 15. Verify characteristics of star delta connections. (15 hrs.) 16. Measure the power and energy of three phase load. (05 hrs.)	Fundamental terms in A.C circuits - types of A.C circuits-P. F-advantages of good P.F disadvantages of poor P.F-improvement of P.F Poly phase star and delta connections-line voltage-phase voltage-line current-phase current. (08 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 16Hrs	Execute testing, identify terminal and maintenance of alternator, AC Motors, Transformer and Starters. (Map Nos:TSC/N9423)	17. Identify the terminals of Alternator & buildup the voltage. (17 hrs.) 18. Start, run and reverse different types of single phase motor. (17 hrs.) 19. Start, Run and reverse different types of three phase motor with different types of starters. (21 hrs.) 20. Identify the terminals of transformer. (17 hrs.) 21. Measure the primary & secondary voltage and respective currents. (12 hrs.)	Alternators-Construction-working principle -voltage regulations-phase sequence A.C motor-Single phase motor working principle-types. Three phase motor working principle -types starter and their types. Transformer-principle-types & their application. (16 hrs.)
Professional Skill 21Hrs; Professional Knowledge	Plan and prepare earthing insulation. (Map Nos:TSC/N9424)	22. Demonstrate type of meters-measure the insulation value with megger. (21 hrs.)	Instruments-V.M, A.M, W.M, E.M-types-connections. Megger and application. (04 hrs.)

04 Hrs			
Professional Skill 42Hrs; Professional Knowledge 08 Hrs	Plan and execute electrical illumination system and detect faults in rectifier and service of different domestic and industrial appliances. (Map Nos:TSC/N9425)	23. Connect and test F.T, M.V / S.V lamps & energy efficient lamps. (08 hrs.) 24. Application of Norms for illumination in textile mills. (13 hrs.) 25. Fault finding, rectification and servicing of different types of domestic and Industrial appliances. (21 hrs.)	Illumination -incandescent lamp-fluorescent lamp-M. V lamp-connections-applications care and maintenance. Working and maintenance of domestic and Industrial appliances- heaters/ Furnaces/ Pump set. (08 hrs.)
Professional Skill 42 Hrs; Professional Knowledge 08 Hrs	Plan and execute soldering and desoldering of various electronic and industrial appliances. (Map Nos:TSC/N9426)	ELECTRONICS: 26. Soldering & De-soldering practice identifying simple meters-Study the multimeter. (13 hrs.) 27. Verify Ohm's law. (5 hrs.) 28. Identification and testing the given components. (08 hrs.) 29. Identify the color code of Resistors. (08 hrs.) 30. Identify VI characteristics of diode Half wave & Full wave rectifier. (08 hrs.)	Conductor, insulator,, Semiconductor, types of solder, Types of fluxes methods of soldering Resistors, Capacitors, inductors etc. Types specification and their applications. Study of solid state device such as diodes, transistors SCR and Ics. Semiconductor theory P-type and N-Type Semiconductors. Diode-Constructions working rectifiers, filters. (08 hrs.)
Professional Skill 21 Hrs; Professional Knowledge 04 Hrs	Construct, test and verify the input/output characteristics of various analog and power electronic circuits and analyze the circuit functioning. (Map Nos:TSC/N9427)	31. Voltage regulator circuit-Input-Output characteristic of Transistors at common base- common collector-common emitter modes. (3 hrs.) 32. Study of Integrated (IC) circuit. (3 hrs.) 33. Construction of Transistors & Amplifiers. (5 hrs.) 34. VI characteristics of SCR-speed control of D.C motor using SCR. (4 hrs.)	Transistors-construction working amplifier circuits SCR, FET, UJT, DIAC & TRAIC constructions working applications circuits. Study of Integrated (IC). (04 hrs.)

		35. Checking of FET amplifier Ckts. (3 hrs.) 36. Identification of UJT relaxation oscillator. (3 hrs.)	
Professional Skill 21 Hrs; Professional Knowledge 04 Hrs	Construct a Programme and verify different digital logic circuits and timer circuits using 555 ICs, simple Programme on microprocessor and PLC. (Map Nos:TSC/N9428)	37. Study of different logic gates. (3 hrs.) 38. Testing of gates using ICs-Constructions of Timer circuits using 555 ICs. (3 hrs.) 39. Simple programming through microprocessor kit. (3 hrs.) 40. Study of commonly used Transducers. (3 hrs.) 41. Demonstration of various controlling units. (3 hrs.) 42. Comparisons of PLC with conventional machine control. (3 hrs.) 43. Functions of keys on Programme- Development Terminal (PDT). (3 hrs.)	Introduction to logic gates. Explanation of basic logic gates, OR, AND, NOT, NOR AND , EX - OR etc. Truth table using diodes, transistors, resistors. Logic gates using etc. Flip-Flops-Counters, Timer circuits. Microprocessor -working principle & block diagram. Transducers-thermocouples, thermostats, LDRs, LVDTs, strain gauges, magnetic pickup photo diodes, photo transistor. Over current relays, D.C Motor controllers photo electrical relays. Concept of PLC Block diagram comparison of PLC with conventional terminal / relay. Function of various programmes development terminal (PDT). (04 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 17 Hrs	Perform basic workshop operation of different manufacturing sections, methods and identify different components. (Map Nos:TSC/N9429)	44. Elementary training in Basic Manufacturing Methods (welding & press shop). (11 hrs.) 45. Identification of mechanical, electrical & electronics components of the machine, setting &maintenance. (16 hrs.) 46. Elementary training in rotating machinery division, electric motor assembly section. (17 hrs.)	Introduction - Objectives of blow room- identification of components of the machine, & and its functions Objectives of carding- Working mechanism of carding- Identification and importance of components in carding. Objectives and working of lap formers &Comber- identification of machine components and its functions. Objectives and working Draw

		47. Elementary training in heavy engineering division, machine shop and tool room section. (21 hrs.) 48. Elementary training in assembly section. (11 hrs.) 49. Study of various methods for transporting materials and machines of various sizes. (08 hrs.)	frame-identification of machine components and its functions. Objectives and working Speed Frame-Simplex- spinning-working Mechanism. Auto cone Winding- Sequence of Process- Mechanism of Cone/cheese -winding-Working principle and operation. (17 hrs.)
Professional Skill 105Hrs; Professional Knowledge 21 Hrs	Check different electrical wiring & winding methods of different electrical sub system. (Map Nos:TSC/N9430)	50. Study of wiring methods and perform an experiment to control one lam by one single way switch and 3 pin wall socket with switch control. (17 hrs.) 51. Advanced wiring of a switch control board and panel. (21 hrs.) 52. Demonstration of the winding and testing of an AC relay coil. (25 hrs.) 53. Demonstration the winding and testing of a single-phase transformer. (21 hrs.) 54. Experiment to connect the end connections of a 3-phase induction motor. (21 hrs.)	Application of Mechatronics in Blow room & Carding. Electrical and electronics involved in Blow room - regulation of cotton flow-detection of foreign particles Coiler-stop motion units- Electric motors-working- principle of operation-introduction to electric drives-drives involved in textile machines and their importance Can changer mechanism, principle of auto leveler, importance and its functions, control systems involved in Auto leveler, production & monitoring system APPLICATION OF MECHATRONICS IN COMBER, DRAW FRAME, LAP FROMERS AND SPEED FRAME: Working principle of Comber-starting mechanism-Electronics involved in Doffing operation-Draw frames Working principle of Speed frames-controls system in speed frame machines-Cone drum mechanism. (21 hrs.)
Professional	Identify different Hydraulic &	55. Study of feedback elements and control elements. (21	Introductions to Hydraulics-application of hydraulics

Skill 105Hrs; Professional Knowledge 21 Hrs	pneumatic applications in textile machines. (Map Nos:TSC/N9431)	hrs.) 56. Determination of settings, speeds, production, efficiency and machinery particulars for carding. (84 hrs.)	Hydraulics-application. Fluid couplings-Drive tech- Waste Evacuation system. Spinning-working principle of pneumatic speed variator-doffing sequence-electronics in doffing sequence. (21 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 16 Hrs	Identify different motors, sensors and transducers applications in textile. (Map Nos:TSC/N9432)	57. Determination of settings, speeds, production, efficiency and machinery particulars for draw frame. (33 hrs.) 58. Determination of settings, speeds, production, efficiency and machinery particulars for speed frame. (34 hrs.) 59. Determination of settings, speeds, production, efficiency and machinery particulars for spinning & winding. (17 hrs.)	Importance of overhead cleaners and their operation-drives, motors sensors and transducers operations in overhead cleaners Importance of OE Spinning-electronic controls- drives, motors and mechanism in OE Spinning Principle of Winding-electronic controls in Auto corner - Principle of conveyor operation. (16 hrs.)
Engineering Drawing (40 Hrs.)			
Professional Knowledge ED- 40 Hrs	Read and apply engineering drawing for different application in the field of work. (Map Nos:TSC/N9401)	**<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 free hand 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 arrowhead	

		• 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 (36 Hours)		
Professional Knowledge WCS- 36 Hrs	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (MapNos:TSC/N9402)	**WORKSHOP CALCULATION & SCIENCE** **Unit, Fractions** ▪ 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, multiplication & 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 ▪ Percentage - 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
Project work / Industrial visit		

SYLLABUS FOR TEXTILE MECHATRONICS TRADE			
SECOND YEAR			
Duration	**Reference Learning outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 42Hrs; Professional Knowledge 12 Hrs	Identify different components of yarn preparatory machine for its maintenance. (MapNos:TSC/N9433)	60. Determination of settings, speeds, production, efficiency and machinery particulars for yarn preparatory machine. (21 hrs.) 61. Identification of mechanical, electrical &electronics components of the machine, setting & maintenance. (21 hrs.)	Principles of yarn preparatory m/c. (12 hrs.)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Check different components of knitting & weaving machine for its maintenance. (MapNos:TSC/N9434)	62. Determination of settings, speeds, production, efficiency and machinery particulars for knitting & weaving machine. (21 hrs.) 63. Identification of mechanical, electrical &electronics components of the machine, setting &maintenance. (21 hrs.)	Principles of knitting & weaving machine.(12 hrs.)
Professional Skill 42 Hrs; Professional Knowledge 12 Hrs	Identify different components of Handloom & Power loom Turning for its maintenance. (MapNos:TSC/N9435)	64. Handloom & Power loom Turning & setting & production & running. (21 hrs.) 65. Identification of mechanical, electrical &electronics components of the machine, setting & maintenance. (21 hrs.)	Working principles of different types of looms.(12 hrs.)
Professional Skill 105Hrs;	Check different Pneumatic	66. Study of constructional features of pneumatic	PNEUMATIC AUTOMATION IN TEXTILE MACHINES: Introduction

Professional Knowledge 31 Hrs	Automation & control In Textile Machines. (MapNos:TSC/N9436)	components, using cut-section models and demonstration KIT. (38 hrs.) 67. Simulation of circuits using Festo trainer kit. (42 hrs.) 68. Simulation of multiple actuator systems. (25 hrs.)	to pneumatics-application of pneumatics in blow room Pneumatic controls in carding machine-components involved and their control systems Pneumatic controls comber M/C components and its functions and identification of basic components. (31 hrs.)
Professional Skill 147Hrs; Professional Knowledge 43 Hrs	Simulate electro-pneumatic systems involving pneumatic controls. (MapNos:TSC/N9437)	69. Simulation of electro-pneumatic systems. (42 hrs.) 70. Simulation of electro-pneumatic systems employing proximity switches, optical sensors and capacitive sensors. (63 hrs.) 71. Simple circuits using hydraulic elements. (42 hrs.)	Pneumatic controls silver lap and ribbon lap former-components involved and their control systems. Pneumatic controls drawing machines and ring frames components involved and their basic operations. Pneumatic controls winding machines-components involved and their control systems. (43 hrs.)
Professional Skill 84 Hrs; Professional Knowledge 24 Hrs	Apply Advanced Automation System in Textile industries. (MapNos:TSC/N9438)	72. Identification of PLC blocks. (25 hrs.) 73. Simple experiment on PLC. (34 hrs.) 74. PLC based electronic controls. (25 hrs.)	INTRODUCTION TO ADVANCED AUTOMATION SYSTEM: Introduction to PLC and their programming methods-block diagram of PLC-working of PLC-Input and output units. Role of PLCs in textile industries-programming examples-logic gates. (24 hrs.)
Professional Skill 147Hrs; Professional Knowledge 43 Hrs	Identify different HMI panels in textile industries & their applications. (MapNos:TSC/N9439)	75. Introduction to HMI (Human m/c Interface) Software. (33 hrs.) 76. Calculation, setting of modern spinning & weaving machines. (76 hrs.) 77. Identification of mechanical,	Role of HMI panels in textile industries-hand held operating system. Introduction to working of modern spinning & weaving machine. (43 hrs.)

		electrical &electronics components of the machine, setting & maintenance. (38 hrs.)	
Professional Skill 105Hrs; Professional Knowledge 31 Hrs	Check different flat /circular knitting machine for maintenance. (MapNos:TSC/N9440)	78. Calculation of speed. Production and study of different mechanisms of flat / circular machines. (63 hrs.) 79. Identification of mechanical, electrical &electronics components of the machine, setting &maintenance. (42 hrs.)	Working of flat /circular knitting machine- control, Operations and their importance. (31 hrs.)
Professional Skill 126Hrs; Professional Knowledge 36 Hrs	Check different production methods, machine maintenance & quality control concepts in Industry. (MapNos:TSC/N9441)	80. Industrial safety & Health hazard. (16 hrs.) 81. Industrial Visit & Implant training in production & machine maintenance. (110 hrs.)	Quality concept, ISO9001-2000, SA8000, ISO14001-2004, 5S system, OHSAS18001-1999 Industrial Visit. (36 hrs.)
Engineering Drawing (40 Hrs.)			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work. (MapNos:TSC/N9401)	▪ 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 (16 Hours)			
Professional Knowledge WCS- 16 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (MapNos:TSC/N9402)	**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	

Project work

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

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

ANNEXURE-I

List of Tools and Equipment			
TEXTILE MECHATRONICS (For Batch of 24 candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit sl. 1-25 is required additionally)			
1.	Combination Pliers	200 mm insulated	24+1 Nos.
2.	Screw Driver	200 mm	24+1 Nos.
3.	Screw Driver	100 mm	24+1 Nos.
4.	Terminal Screw Driver		24+1 Nos.
5.	Hammer Ball Pein	0.25 kg	24+1 Nos.
6.	Try Square	200 mm	24+1 Nos.
7.	File round (half)	2" cut 250 mm	24+1 Nos.
8.	File round	150 mm	24+1 Nos.
9.	Plumb Both	115 gm.	24+1 Nos.
10.	Barwood Mallet	1 Kg. (75 mm X150 mm)	24+1 Nos.
11.	Knife		24+1 Nos.
12.	Wood rasp file	250 mm	24+1 Nos.
13.	Firmer chisel	12 mm	24+1 Nos.
14.	Firmer chisel	6 mm	24+1 Nos.
15.	Neon Tester		24+1 Nos.
16.	Tenon saw	250 mm	24+1 Nos.
17.	File flat	25 cm. 2nd cut	24+1 Nos.
18.	File flat	25 cm. Smooth	24+1 Nos.
19.	Steel Rule	300 mm to read Metric	24+1 Nos.
20.	Test lamp		24+1 Nos.
21.	Circlip Opener		24+1 Nos.
22.	Continuity Tester		24+1 Nos.
23.	Glouse		24+1 Nos.
24.	Insulating Tape		24+1 Nos.
25.	Electrical soldering Iron		24+1 Nos.
B. SHOP TOOLS, INSTRUMENTS – For 2 (1+1) units no additional items are required			
Lists of Tools:			
26.	Ammeter	1 MA to 500 MA	1 No.
27.	Ammeter	0 to lamp D.C	1 No.

28.	DC ammeter	(0-5) A	4 Nos.
29.	Ammeter	(0-50) mA	3 Nos.
30.	AC ammeter	(0-10)A	4 Nos.
31.	DC voltmeter	(0-250)V	4Nos.
32.	Mill voltmeter	100-0-100 m Volt	1 No.
33.	Digital voltmeter		3 Nos.
34.	AC Voltmeter	(0-300) V	2 Nos.
35.	AC voltmeter	(0-600) V	1 No.
36.	AC Voltmeter	M.I. 0-500V	1 No.
37.	KW meter	0 to 1 K.W. capacity 1:2	1 No.
38.	Single phase power factor meter		1 No.
39.	Frequency meter		1 No.
40.	AC Energy meter	single phase 5A 230V	1 No.
41.	Megger	500 volts	1 No.
42.	Fan	DC 220 Volt 1200 mm	1 No.
43.	Electric hot plate	150 Watt. 220V with temperature control	1 No.
44.	Electric kettle	1000 watts. 230 V	1 No.
45.	Immersion heater	750/1000/1500W-230V	1 No.
46.	Series type ohm meter	0-2000 approximate	1 No.
47.	Shunt type ohm meter	0-25 approximate	1 No.
48.	3-point DC starter1		1 No.
49.	4-point DC starters		1 No.
50.	Cut out, reverse current over load voltage relays		1 No.
51.	Starters	3-phase, 400V, 50 cycles, 2 to 5 H.P. AC motors	1 No.
52.	Auto transformer type starter		1 No.
53.	Star delta starter with manual, semi auto & Automatic		1 No.
54.	Direct on line starter		1 No.
55.	Multimeter		1 No.
56.	Motor generator set consisting of:	Motor shunt 5HP, 440 Volts with starting Compensator and switch directly coupled to generator A.C 3.5 KVA, 400/230 Volts, 3-phase, 4 wire, 0.3 PF 50 cycles with exciter and 1 switch Board mounted with regulator circuit breaker, ammeter, voltmeter frequency meter,	1 No.

		knife blade switch and fuses etc,., set complete with cast iron bed plate, fixing blots, foundation bolts & flexible coupling	
57.	Motor shunt DC,	220 volt, 2 to 3 H.P.	1 No.
58.	Motor AC Single phase,	230 volt, 1 H.P. repulsion type with starter and switch	1 No.
59.	Motor AC Single	phase 230 volt, 50 cycles series type with starter/switch H.P.	1 No.
60.	Current transformer		1 No.
61.	Potential transformer		1 No.
62.	Variable auto transformer	0-250 V 5 apms	1 No.
63.	Single phase resistive load	3 KW	1 No.
64.	Three phase resistive load	10 KW	1 No.
65.	Motor generator set consisting of:	Motor Induction squirrel cage, 7 HP 400 volts, 50 cycle 3-phase with star delta starter and switch directly coupled to DC shunt generator, 5 KW 400 volts, switch board mounted with regulator, air circuit breaker, ammeter, voltmeter knife blade switches and fuses, set complete with cast iron and plate, fixing blots. Foundation bolts and Flexible coupling.	1Complete set
66.	Motor of AC squirrel cage,	3-phase 400 volt, 50 cycles, 2 to 3 HP with star delta starter.	1 No.
67.	Motor AC phase-wound slip ring type	5 HP 400 volts, 3-phase, 50 cycles with starter and switch	1 No.
68.	Soldering Iron set with temp control		1 No.
69.	Soldering Iron		1 No.
70.	De-soldering pump		1 No.
71.	RPS		3 Nos.
72.	CRO		1 No.
73.	PLC trainer		1 No.
74.	AF Oscillator		1 No.
75.	Foam extinguisher		1 No.
76.	Dry extinguisher (powder)		1 No.
77.	Carbon dioxide Extinguisher		1 No.
78.	Sand bucket		1 No.

79.	Dry c ell		1 No.
80.	Lead Acid battery	12 V, 10 AH	1 No.
81.	Rheostat	50 ohms' /5A	4 Nos.
82.	Ceramic Resistor	10 ohms, 22 ohms, 68 ohms, 100 ohms, 47 ohms	3Sets.
83.	Load resistance		1 Set.
84.	Resistor	58 k ohms, 2 ohms, 100 ohms	1 Set.
85.	Rheostat	750 ohms, 1.2 ohms	1 Set.
86.	Capacitor	60 uF	1 Set.
87.	Inductor	95 Mh	1 Set.
88.	Wiring Tool kit		3 Nos.
89.	Sodium vapour lamp		2 Nos.
90.	Mercury lamp		2 Nos.
91.	Megger Earth electrode	25 million to 1550 ohms	1 No.
92.	Festo Trainer Kit		1 No.
C. GENERAL SHOP OUTFIT			
93.	Pliers side cutting	200 mm	12 Nos.
94.	Pliers Flat nose	150 mm	7 Nos.
95.	Pliers round nose		7 Nos.
96.	Pliers long nose		12 Nos.
97.	Screw driver heavy duty	250 mm	12 Nos.
98.	Screw driver Square blade	7 mm X 300 mm	12 Nos.
99.	Firmer Chisel	25 m	12 Nos.
100.	Firmer Chisel	10 mm	12 Nos.
101.	Marking Gauge		7 Nos.
102.	Combination bevel Protractor		3 Nos.
103.	Cold Chisel flat	25x200 mm	4 Nos.
104.	Cold Chisel flat	18 X200 mm	4 Nos.
105.	Hammer Ball Pein	0.5 kg.	7 Nos.
106.	Hammer Ball Pein	0.75 kg.	7 Nos.
107.	Hammer Ball Pein	1 kg.	7 Nos.
108.	Hammer Cross Pein	0.5 kg.	7 Nos.
109.	Wall jumper Octagonal	37 mmX450 mm, 37 mmX600mm	2 Nos. Each
110.	Centre Punch	100 mm	7 Nos.
111.	File flat	300 mm rough	7 Nos.
112.	File flat	300 mm 2nd. Cut	7 Nos.
113.	File flat	250 mm Bastard	7 Nos.
114.	File flat	250 mm smooth	7 Nos.
115.	File half round	300 mm 2 nd cut	7 Nos.
116.	File Triangular	150 mm 2nd cut	4 Nos.
117.	Spanner double ended	set of 6	7Sets
118.	Adjustable Spanner	350 mm	2 Sets

119.	Foot Print grip	250 mm	2 Set
120.	Allen keys	(Metric & Inches)	20 Sets
121.	Steel Rule	30 cm	7 Nos.
122.	Steel Measuring Tape	2 m	7 Nos.
123.	Steel Measuring Tape	20m	2 Nos.
124.	Hacksaw frame Adjustable	200 mm to 300mm	7 Nos.
125.	Spirit level	300 mm	3 Nos.
126.	Bench vice	150 mm	3 Nos.
127.	Bench vice	100 mm	2 Nos.
128.	Pipe Wrench	300 mm	12 Nos.
129.	Spanner	up to 32 mm	12 Nos.
130.	Vernier caliper		2 Nos.
131.	Ring spanner		3 Set
132.	grip Plier	12"	4 Nos.
133.	Inner caliper		7 Nos.
134.	Outer caliper		7 Nos.
135.	Box spanner		4 Set
136.	Torque spanner		3 Nos.
137.	File Swiss type needle set		5 Nos.
138.	Shore hardness tester for rubber		1 No.
139.	Needle file		3 Set
140.	Nylon hammer		7 Nos.
141.	Puller	2 arm, 3 arm	3 Each
142.	Copper tube cutter		3 Nos.
143.	Ratchet brace	6 mm capacity	7 Nos.
144.	Ratchet bit	4 mm and 6 mm	7 Nos.
145.	Vernier Caliper	200 mm (ordinary)	7 Nos.
146.	Snips		7 Nos.
147.	Conduit Pipe die set		7 Nos.
148.	Tong Tester		2 Nos.
149.	Ohm meter		2 Nos.
150.	Grimping tool	Manual	1 No.
151.	Blow Lamp		2 Nos.
152.	Multimeter		2 Nos.
153.	Ladle		7 Nos.
154.	Pipe Vice	18"	2 Nos.

Note: -

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

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