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

COMPETENCY BASED CURRICULUM

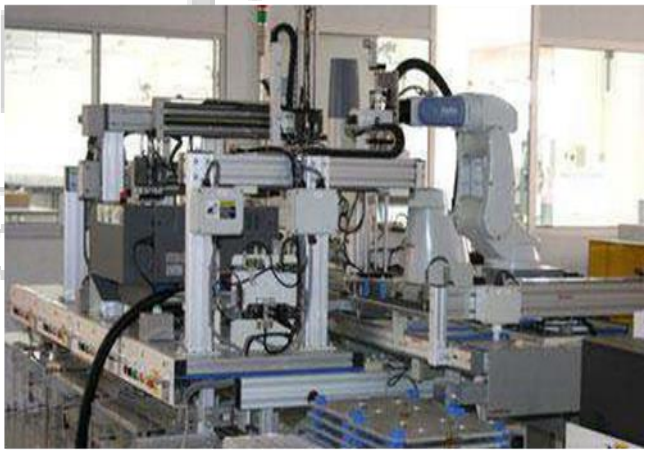
MECHATRONICSTECHNICIAN

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL- 4



SECTOR – MINING

Directorate General of Training

Skill India
कौशल भारत - कुशल भारत

MECHATRONICS TECHNICIAN

(Engineering Trade)

(Designed in 2022)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship

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1. COURSE INFORMATION

Flexi- MoU is one of the pioneer program under NCVT on the basis of the MoU in between DGT & Industry Training Partner (ITP) for propagating vocational training to allow industries to take advantage of various schemes for conducting training program in higher employment potential courses according to needs of industries. The concept of Flexi- MoU was introduced in June-July 2014. DGT and Industry Training Partner (ITP) shall decide to sign the memorandum of understanding to provide an opportunity to the youth to acquire skills related to Automobile and Manufacturing industry through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential & to contribute in the overall growth of automobile and manufacturing industry by creating a pool of skilled resources.

During the two-year duration, a candidate is trained on subjects Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. 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 task.

The content broadly covers skills in manufacturing process of automobiles components and automobiles in today's automobile industry. The year wise course coverage is categorized as below:

FIRST YEAR :– In the first year, the contents covered are safety aspects covers components like OSH&E, PPE, Fire extinguisher, First Aid and in addition 5S of Kaizen is being taught related to trade.

Basic electrical work such as working on basic electrical wiring (low voltage Control system power, Single phase, 3 phase power & earthing), electrical elements (Switch Gears, Motors, Drives and lighting and domestic circuits), use of measuring tools. And impart training on basic Electrical and Electronics sub-systems and its measuring techniques using appropriate Measuring instruments, operate and troubleshoot AC/DC equipment's. Acquire the skill of reading and analyzing Electrical and Electronics drawings. Construct, analyze and troubleshoot Electrical and Electronic circuits. Assemble and Disassemble Electrical and Electronic components by Soldering and de-soldering techniques. Carry out Industrial panel wiring. Understand and troubleshoot Protective devices in Electrical system And Basic mechanical elements and its working principles,automobile manufacturing process such as basic fitting operation (marking, filling, sawing, chiseling, drilling tapping & grinding), basic brazing/welding operation using arc welding (butt joint, lap joint, T-joint), Preventive maintenance of the equipment's including greasing, Filter cleaning, Belt checking, Oil top-up, Chain tightening etc. This year also covers practical training starting with practice with tools & measuring instruments viz. Vernier Caliper, micrometer, height gauge, dial gauge, slip gauge, feeler gauge, go-no go gauges etc. This is followed by on job training in practice at different shops as Press shop, Weld Shop, Paint Shop,Assembly shop etc.

SECOND YEAR –In this year, the trainee also gets knowledge of different sensors viz., inductive, capacitive, magnetic etc. and carries out related practical on the same. The student Understand the

principles of hydraulics, the basic functions of hydraulic systems, the functions of valves (flow control, pressure control, directional control). Attain the skill of reading and analyzing Hydraulic and Pneumatic drawings. Recognize circuit symbols and diagrams, construct basic hydraulic circuits as per drawings, understand and follow safe practice. Acquire the knowledge on the functions of power packs, pumps, filters, and reservoirs. And Mechanical elements (Bearing and bushes, ball screw & LM guide and nut bolts)

Understand the units and measurement scales associated with compressed air system. Understand the functioning of standard pneumatic cylinders and valves, read pneumatic circuit diagrams and understand Pneumatic symbols. Construct simple pneumatic controls as per drawing. Read, understand, analyze Electro-Pneumatic circuit diagrams, understand fundamental terminology and symbols of Electro-Pneumatic control, understand the function and operation of a range of proximity sensors. Fault diagnostics procedure and Troubleshooting of Hydraulics and Pneumatics sub- systems. Executes programming on PLC.

The Trainee will be able to develop, test and troubleshoot circuits using Electrical, Electronics, and Hydraulic and Pneumatic systems. Able to fabricate and repairing of electrical and mechanical equipment's, involving Fitting, Drilling, Turning, Milling, Grinding, Electrical wiring, programming, Hydraulic circuit assembly, Pneumatic circuit assembly, Drives, system assembly and Interfacing, functional testing, trouble shooting and repair. Safety and Quality measures in each stage.

2. TRAINING SYSTEM

2.1 GENERAL

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

The best outcome from the ITP shall conduct courses pan-India locations leveraging the facilities and services available at ITIs, regional training centers, training centers of training partners, vendors and dealers associated with Industry Training Partner (ITP). Theywill ensure that not less than 50% of trainees are placed with Industry Training Partner (ITP) or its business partners for not less than Two years duration. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs.Industry Training Partner (ITP) will strictly follow the policy guidelines for Flexi - MoU as in place from time to time. No deviation for the same would be permitted.Every Alternate Month Admission and Exam for trades run under Flexi MoU at training locations of Industry Training Partner (ITP).Theory content to be 30% and practical content to be 70%.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan work, 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.
- Check the survey drawing and data and rectify errors.
- Document the technical parameters related to the task undertaken. Process data recorded during field measurements and make relevant conclusions.

2.2 PROGRESSION PATHWAYS

- 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 Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

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)	1680	1680
2	Professional Knowledge (Trade Theory)	180	180
3	Workshop Calculation Science& Engineering Drawing	150	150
5	Employability Skills	120	60
	Total Hours	**4200**	

2.4 ASSESSMENT & CERTIFICATION

I. Conducting training of selected candidates is the sole responsibility ofIndustrial Training Partner (ITP).

II. Assessment will be jointly done by ITP and DGT. Practical and formative assessment shall be conducted by ITP, and Computer Based theoretical exams shall be conducted by DGT.

III. ITP must refer to the latest examination reform guidelines issued by DGT dated 4thOctober 2018 any changes or revisions to the same shall be applicable to Flexi-MoU scheme.

IV. Maximum attempts for clearing the exam and obtaining NTC shall be in line with CTS.

V. For practical examination and formative assessment, ITP has been given flexibility to design the questions, assess the candidates and upload their marks in the scheme portal.

VI. ITP shall develop a comprehensive Question Bank (in English and Hindi) of minimum 1000 questions, grouped by chapters and difficulty level. The same shall be vetted by NIMI experts and then be handed over to DGT for conducting theory exams. DGT may add some questions to the same before conducting actual exams.

VII. Theoretical exams shall be conducted by DGT in Computer Based Test format. Upon completion of course and payment of requisite examination fee by ITP, admit cards shall be generated by scheme portal.

VIII. DGT shall arrange for conduct of computer based theory exam at designated examination centres & certify the successful trainees with e-NTC under flexi-MoU scheme with mention of ITP name in the Certificate.

IX. Students, who have successfully appeared in the final exam after completion of course, are eligible to register as apprentices.

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first year itself.

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

The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory 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 the following:

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

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

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate 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) Weightage 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% accuracyachieved 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) Weightage 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% accuracyachieved 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

Mechatronics Trainees are specialized trade-technician workers. Mechatronics Trainees will usually assist to maintain machine basic condition as per its design, working application, development and engineering, as well as working closely with other trades persons to install, maintain, modify and repair plant Electro-mechanical & control systems, equipment and component parts.

Mechatronics Trainees:

- Fit and assemble parts and sub-assemblies made from mechanical and electrical - electronic and computer components.
- Manufacture, install, modify, repair and fault-find hydraulic and pneumatic equipment and systems.
- Inspect machinery and make repairs.
- Erect machinery and equipment on site.
- Cut, thread, bend and install hydraulic and pneumatic pipes and lines
- Dismantle faulty items and assemblies and repair or replace defective parts
- Set up and operate hand and machine tools and equipment.
- Check accuracy and quality of finished parts, tools or sub-assemblies.

Mechatronics Trainees repair & maintain manufacturing plant systems for industry which involves mechanics, conveyors, hydraulics, pneumatics, control systems and computers. The computer technology element covers programmable logic control systems (PLC), and technology which enable communication between machines, equipment and people. In addition Maintenance Person has 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.

Reference NCO-2015:

- 7233.0100 - Fitter, General
- 7233.0101 - General Maintenance Fitter-Mechanical
- 7412.0101 - Automation Specialist
- 7412.0201 - Fitter-Electrical and Electronic Assembly
- 7411.0100 - Electrician, General
- 7421.0300 - Electronics Mechanic

4. GENERAL INFORMATION

Name of the Trade	**Mechatronics Technician**
Course Code	DGT/7027
NCO - 2015	7233.0100, 7233.0101, 7412.0101, 7412.0201, 7411.0100, 7421.0300
NSQF Level	Level –4
Duration of Craftsmen Training	Two Years
Entry Qualification	Pass in 10th Examination or its Equivalent
Minimum Age	18 years as on first day of academic session
Unit Strength (No. Of Student)	20
Space Norms	164 Sq. m.
Power Norms	17 KW
Instructors Qualification for	
1. Mechatronics Technician Trade	Degree in Mechanical or Electrical or Electronics and Communication or instrumentation or Automobile Engineering from recognized Engineering College /university with one-year experience in the relevant field. **OR** Diploma in Mechanical or Electrical or Electronics and Communication or instrumentation or Automobile Engineering or Mechatronics from recognized board of technical education with two years' experience in the relevant field. **OR** NTC/NAC in the Trade of "Mechatronics" With 3 years' post-qualification experience in the relevant field. **Essential Qualification:** Craft Instructor Certificate in relevant trade under NCVT. 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 Degree in Engineering with one-year experience. OR Diploma in Engineering with two years' experience. **Essential Qualification:** Craft Instructor Certificate in RoD& A course under NCVT.
3. Engineering Drawing	Degree in Engineering with one year experience. OR Diploma in Engineering with two years' experience. OR NTC / NAC in the Draughtsman (Mechanical) with three years' experience.

	Essential Qualification: Craft Instructor Certificate in RoD& A course under NCVT.
4. Employability Skill	MBA or BBA with two years experience or Graduate in Sociology/ Social Welfare/ Economics with Two years experience or Graduate/ Diploma with Two years experience and trained in Employability Skills from DGT institutes. AND Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above. OR Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes.
List of Tools and Equipment	As per Annexure – I

5. NSQF LEVEL COMPLIANCE

NSQF level for **Mechatronics Technician**trade CTS (Flexi MoU):**Level-4.**

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

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

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

a. Process
b. Professional Knowledge
c. Professional Skill
d. Core Skill
e. Responsibility

The broad learning outcome of **Mechatronics Technician**trade under CTS (Flexi MoU) mostly matches with the Level descriptor at Level- 4.

The NSQF Level-4 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skills	Core Skills	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice.	Factual knowledge of field of knowledge or study.	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, usingappropriate rule andtool, using qualityconcepts.	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and naturalenvironment.	Responsibility for own work and learning.

6. LEARNING OUTCOME

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

6.1 GENERIC LEARNING OUTCOME

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

6.2 SPECIFIC LEARNING OUTCOME

FIRST YEAR

1. Recognize & comply Health, Safety & Environment practices in a vehicle manufacturing plant& Industry Orientation.
2. Understand & explain maintenance, purpose & types of maintenance in general, requirement of maintenance in manufacturing industry.
3. Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy. [Basic fitting operation Filing, Marking, Hack sawing, Drilling, Taping, chipping and Grinding etc].
4. Plan and organize to prepare jobs for sheet metal brazing, electric resistance welding, and structure steel, plates, piping for welding work using power tools such as abrasive cutter and grinder. Perform perfect V joint for weld filling. Perform joining of metals by welding and brazing observing standard procedure.

5. Prepare electrical wire joints, carry out soldering and crimping.
6. Select and perform electrical/ electronic measurement of single range meters
7. Test different batteries used in electronic applications and record the data to estimate repair cost.
8. Plan and execute soldering & desoldering of various electrical components like Switches, PCB & Transformers for electronic circuits.
9. Test various electronic components using proper m e a s u r i n g instruments and compare the data usingstandard parameter.
10. Assemble simple electronic power supply circuit and test for functioning.
11. Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. [Different Fit –Open & Square Fit; Required tolerance: ±0.05 mm]
12. Construct, test and verify the input/ output characteristics of various analog circuits.
13. Assemble, test and troubleshoot various digital circuits.
14. Construct different electrical control circuits and test for their proper functioning with due care and safety.

SECOND YEAR

15. Assemble accessories and carry out wiring of control cabinets and equipment.
16. Execute the operation of different process sensors, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments
17. Trouble shoots and repairs different Electrical, Electronic systems devices. [Different Electrical, Electronic systems/ devices: - Fuse, MCB, Power circuit, Control panel, Circuit Breaker, AC/DC drives, SMPS, Relay etc.].
18. Perform speed control of AC motors by using solid state devices/ AC drives
19. Recognize various types of conveyor systems, their components, their utility, common defects occurs in different types of conveyors in industry and perform overhauling and repairing of each type of conveyors ..
20. Demonstrate function of different types of measuring, monitoring & control system devices / instruments, i.e. sensors, solenoid, relays, switches, fuses etc.
21. Demonstrate functioning of different mechanical elements in plant and perform connections, removal, re-fitting, servicing of fasteners, fittings, hoses, valves, bearings, ball screw, LM guides & rails, spindles, belts, chains & sprockets, drive belts, pulleys, couplings, gears, pumps, pressure gauges and gauge indicators.
22. Explain Power pack & power locks - Types of Power pack & power locks, Uses of different types of Power pack & power locks, common defects & Maintenance activities in Power pack & Power locks.
23. Identify & explain the Seals & O- Rings - Types of Seals & O-Rings, Uses of different types of Seals & O-Rings, common maintenance activities in Seals & O-Rings.
24. Explain Maintenance planning basic and prepare Maintenance -Schedules for mechanical, electrical and control system maintenance under supervisor's guidance.
25. Prepare & update Maintenance documents - Charts, reports and register.
26. Explain concepts of all Mechanical systems, components, and functions in plant viz Hydraulic system, Lubrication system, Coolant system, Pneumatic system. Perform preventive maintenance of mechanical systems.
27. Explain Basic Pneumatic system and elements. Capable to designing of pneumatic circuit. Construct simple pneumatic circuit and check functionality.

28. Explain Basic Hydraulic system and elements. Capable to designing of pneumatic circuit. Demonstrate installation of accessories in hydraulic system and trouble shoot and defects.
29. Plan and organize the work and carryout service and maintenance activities in various mechanical assemblies (Ball screws and LM guides) using standard procedure and proper tools, tackles and consumables.
30. Plan & Organize work to Install hydraulic pump, motors and carryout maintenance of these components.
31. Construct different hydraulic system and operate to achieve desired functions. [Different hydraulic system: - Clamp control, injection control, reciprocating screw, oil filtration, hydraulic press control, accumulator control].

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERAL LEARNING OUTCOMES		
LEARNING OUTCOMES		**ASSESSMENT CRITERIA**
1. Identify &comply with general safe working practices, environment regulation and housekeeping & Industry orientation.	1.1	Follow and maintain procedures to achieve safe working environment inlinewithoccupational health andsafetyregulations andrequirements
	1.2	Recognizeandreportallunsafe situations/conditionsaccordingto workplace policy.
	1.3	Identify and take necessaryprecautions onfire and safetyhazardsander portaccordingtoworkplacepolicyand procedures.
	1.4	Identifydifferentfireextinguisherandusethesameas perrequirement.
	1.5	Identify& observe safetyalarms accurately & Evacuation procedures according to workplace policy.
	1.6	Identify andobserve workplacepolicies andprocedures in regardtoillnessoraccident.
	1.7	Reportsupervisor/competentauthorityintheeventof accident orsicknessofanystaffandrecordaccident detailscorrectly according to workplaceaccident/injury procedures.
	1.8	Identifybasicfirstaidandusethemunderdifferent circumstances.
	1.9	IdentifyPersonalProductiveEquipment(PPE)anduse thesameasperrelatedworkingenvironment.
	1.10	Identify environmental pollution and contribute to avoidanceof same.
	1.11	Takeopportunitiestouseenergyandmaterials inan environmentallyfriendlymanner.
	1.12	Identify, handleand store/ dispose of dangerous/unsalvageable goodsandsubstances accordingto workplace policyand dispose waste as per proceduresfollowing safety regulationsandrequirements.
	1.13	Recognizedifferentcomponentsof5Sandapplythe samein theworkingenvironment.
2. Explain&performdifferent mathematiccalculation&science inthefieldofstudy includingbasicelectrical/ Mechanical.*[Different mathematical calculation&science– Arthematics, graph,Statistics,Algebra, Geometry & Mensuration, Trigonometry, Work,Power & Energy,Heat&Temperatur*	2.1	Solve the basic mathematical calculations related to statistics, Geometry & mensuration accurately
	2.2	Read & Interpret the given drawing and calculate the unknown terms
	2.3	Measuredimensionsasperdrawing & use of appropriate tools
	2.4	Ensure dimensional accuracy of parts/objects by using different instruments/gauges.
	2.5	Explainconceptofbasicsciencerelatedtothefieldsuch as Material science, Mass, weight, density, speed, velocity,heat&temperature, force,motion,pressure, heattreatment,centerofgravity,friction& solve the problems related to it .
	2.6	Explain basic Electricity, Insulation, earthing & electrical

e, Levers& Simple machine,Centreofgravity,Powertransmission,Pressure]		devices OR Explain the basic concepts of drilling, milling, grinding
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectionalviews, Estimation of material]*	3.1	Read & interpret the information on drawings and apply in executing practical work.
	3.2	Read & analyze the specification to ascertain the material requirement,tools,andmachining/assembly/ maintenance parameters & dimensions.
	3.3	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
	3.4	Practice & use ISOCPEUR (Engineering script) in day to day writing activities
	3.5	Analyze and draw the drawings from Isometric to orthographic projection & vice versa
	3.6	Practice & draw the free hand sketches related to their trade tools.
4. Select and ascertain measuring instrument and measure dimension of components and record data	4.1	Selectappropriatemeasuringinstrumentssuchas micrometers,Vernier calipers and height gauge(as per toollist).
	4.2	Ascertainthefunctionality&correctness oftheinstrument.
	4.3	Measure dimension of the components & record data to analyses with the given drawing/measurement.
5. Explainentrepreneurshipand manage/organizerelatedtaskindayto dayworkforpersonal&societal growth	5.1	Explain the need & scope of entrepreneurship.
	5.2	Explain role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financing support agencies to familiarize with the Policies/Programmes, procedure and the available scheme.
	5.3	Explain the concept of SWOT analysis & risk management
	5.4	Explain and understand the qualities of entrepreneurship
6. Explainthe concept inproductivity,qualitytools, andlabourwelfarelegislationandapply suchin daytodayworkto improveproductivity&quality.	6.1	Explain the concept of productivity, quality tools & its necessity and apply during execution of job
	6.2	Explain the concept how to enhance the productivity through working aids, automation etc. at workplace
	6.3	Explain the concept of comparative productivity in the development of countries
	6.4	Understand the basic conceptoflabourwelfare legislation and adhere to responsibilities andremainsensitive towards such laws.
	6.5	Knows benefits guaranteed under various acts.
7. Explain occupational health, energyconservation,globalwarmingandpollutionandcontributeindaytodayworkbyoptimallyusingavailableresources	7.1	Explain the concept of occupational hygiene, first aid, accident preventions technique at workplace.
	7.2	Explain the concept of energy conservation, global warming, and pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.
	7.3	Dispose waste following standard procedure.

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8. Explain & perform basic computer skills and TPS in day to day work to improve the productivity & quality	8.1	Recognize the parts of computer & its functions and how to apply in day to day usage
	8.2	Explain about the operating systems & management of files in windows [new versions] – Excel, Word & Power point
	8.3	Create & format the word documents as per the requirements
	8.4	Create a worksheet, apply simple formulae & graphs
	8.5	Explain the concept of computer network in daily life [LAN,WAN]
	8.6	Explain the concept of TPS and apply in executing practical work/ workplace.
9. Planandorganizetheworkrelatedtotheoccupation.	9.1	Use documents, drawings and recognize hazards in thework site.
	9.2	Plan workplace/assembly location with dueconsideration to operational stipulation.
	9.3	Communicate effectively with others and plan projecttasks.
	9.4	Assign roles and responsibilities of the co-trainees forexecution of the task effectively and monitor the same.

SPECIFIC LEARNING OUTCOMES	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
FIRST YEAR	
10.Recognize & comply Health, Safety & Environment practices in a vehicle manufacturing plant& Industry Orientation	10.1 Practice and understand precautions to be followed while working in assembly line.
	10.2 Safe use of equipment generally used in assembly line with operating standard
	10.3 Understand class of fire and be able to operate fire extinguishers.
	10.4 Practical use and understanding of PPEs.
11.Understand &explainmaintenance, purpose&typesofmaintenance in general,requirement ofmaintenance inmanufacturingindustry.	11.1Define maintenance in general and explain Plant maintenanceanditsobjectives.
	11.2Explaintypesofmaintenanceandscheduleforeach typeof maintenance.
	11.3Describethejobdescriptionandresponsibilitiesofa Technician– PlantMaintenance.
	11.4Able toread and explaintechnicalspecification and materials andtools requirement tocarryout maintenance.
	11.5Explain broad maintenanceactivitiesin aplant.
12.Planandorganizetheworktomake jobas per specification applying different typesofbasicfitting operationandCheck for dimensional accuracy. [Basic fitting operation Filing,Marking, Hacksawing, Drilling, Taping, chippingandGrindingetc].	12.1 Plan and Identify tools, instruments and Equipment formarkingandmakethis availabletimely.
	12.2 Selectraw materialandvisual inspectionfordefects.
	12.3 Mark as per specification applying desired mathematical calculation and observing standard Procedure.
	12.4 Identify Hand Tools for different fitting Operations andmaketheseavailabletimely.
	12.5 Preparethejob for Hacksawing,chiseling,filing.
	12.6Performbasicfittingoperationsviz.,Hacksawing,Filing andChippingofclosetoleranceasperspecificationto makethejob.
	12.7 Observesafetyprocedureduringaboveoperations as perstandardnormsandguidelines.
	12.8 MeasureandCheckalldimensions oftheworkpieces as per standard procedure inaccordance with Specificationsandtolerances.
	12.9 Identify unused materials and components for storinginanappropriateenvironmentandprepare for disposal.
13.Planandorganizetoprepare jobsfor sheetmetalbrazing,electric resistancewelding,andstructure steel,plates,pipingfor weldingwork usingpowertoolssuch as abrasive cutterandgrinder.Performperfect Vjointforweldfilling. Perform joiningof metalsbyweldingand	13.1Planandselecttheir ghthandandpowertoolstocarry outjobpreparationforwelding/brazingconsideringall health & safetyaspects.
	13.2 Performfabricationandfitting/tachweldingofjobsforthdesiredweldpositionandjoint.
	13.3 Prepareedgesofmetalplatesandpipesandtachweld inthepositionasperdrawingusinghand&powertools safely.
	13.4 Use proper PPE for the work and performhousekeepingon completionof work.
	13.5Planandselectthetype&sizeofelectrode,weldingcurrent, nozzlesize, working pressuretypeofflame, fillerrodandfluxasperrequirement

brazingobservingstandard procedure.	asperprocess requirement.
	13.6Cleantheweldedjointthoroughly.
	13.7 Prepare, set SMAW machine/Gas welding plant and tackthepiecesasperdrawing.
	13.8Set-upgasweldingunitinaccordancewithstandard procedure.
	13.9Carryoutbrazingworkusingweldrodandfluxwithutmost safety.
14. Prepare electrical wire joints, carry out soldering and crimping.	14.1 Observe safety precautions during joints & soldering.
	14.2 Identify types of wires, cables and verify their specifications
	14.3 Prepare electrical wire joints, carry out soldering and crimping.
	14.4 Prepare electrical wire joints, carry out soldering and crimping.
	14.5 Identify types of wires, cables and verify their specification
	14.6 Solder the finished copper conductor joints with precaution
15. Select and perform electrical/ electronic measurement of single range meters	15.1 Plan work in compliance with standard safety norms.
	15.2 Identify the type of electronic instruments.
	15.3 Determine the measurement errors while measuring resistance by voltage drop method
	15.4 Extend the range of MC voltmeter and ammeter.
	15.5 Measure the value of resistance, voltage and current using digital multi meter.
16. Test different batteries used in electronic applications and record the data to estimate repair cost.	16.1 Identify Tools and instruments for testing of batteries.
	16.2 Observe safety procedure during testing of batteries and work as per standard norms and company guidelines
	16.3 Identify the primary and secondary cells.
	16.4 Measure and test the voltages of the given cells/ battery using analog / digital multimeter.
	16.5 Charging and discharging the battery.
	16.6 Maintain and estimate the repair cost of secondary Battery
	16.7 Use a hydro meter to measure the specific gravity of the secondary battery.
17. Plan and execute soldering & de-soldering of various electrical components like Switches, PCB & Transformers for electronic circuits.	17.1 Plan work in compliance with standard safety norms.
	17.2 Identify different types of mains transformers and test.
	17.3 Identify the primary and secondary transformer windings and test the polarity.
	17.4 Measure the primary and secondary voltage of different transformers.
	17.5 Solder the given components
	17.6 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
18. Test various electronic components using proper measuring instruments and compare the data using standard parameter.	18.1 Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	18.2 Plan work in compliance with standard safety norms.
	18.3 Identify the different types of resistors.
	18.4 Measure the resistor values using colour code and verify the reading by measuring in multi meter.
	18.5 Identify the power rating using size.
	18.6 Measure the resistance, Voltage, Current through series and parallel connected networks using multi meter.
	18.7 Ascertain and select tools and materials for the job and make this

	available for use in.
19. Assemble simpleelectronic powersupplycircuitandtestf orfunctioning.	19.1 Practice soldering on components, lug and board with safety.
	19.2 Identify the passive /active components by visual appearance, Code number and test for their condition
	19.3 Identify the control and functional switches in CRO and measure the D.C. & A.C. voltage, frequency and time period.
	19.4 Construct and test a half & full wave rectifiers with and without filter circuits
	19.5 Construct and test a bridge rectifier with and without filter circuits.
	19.6 Construct and test a Zener based voltage regulator circuit
20. Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. [Different Fit –Open & Square Fit; Required tolerance: ±0.05 mm]	20.1 Recognize general concept of Limits, Fits and tolerances necessary for fitting applications and functional application of these parameters.
	20.2 Plan and Identify tools, instruments and equipment for work piece and make this available timely.
	20.3 Set up workplace/ assembly location with due consideration to operational stipulation.
	20.4 Plan work in compliance with standard safety norms and collecting desired information.
	20.5 Demonstrate possible solutions and agree tasks within the team.
	20.6 Make components according to the specification for different fits, practical skills including scraping and ensuring interchangeability of different parts.
	20.7 Measure the components using Vernier, Micrometer, Height gauge.
	20.8 Assemble components applying a range of skills to ensure proper fit.
	20.9 Check functionality of components.
21. Construct, test and verify the input/ output characteristics of various analog circuits.	21.1 Ascertain and select tools and instruments for carrying out the jobs.
	21.2 Plan and work in compliance with standard safety norms.
	21.3 Practice on soldering components on lug board with safety.
	21.4 Identify the passive /active components by visual appearance, Code number and test for their condition.
	21.5 Construct and test the transistor based switching circuit
	21.6 Construct and test CB,CE & CC amplifier circuit
22. Assemble, test and troubleshoot various digital circuits.	22.1 Illustrate to practice the digital trainer kit with safety.
	22.2 Identify various digital ICs, test IC using digital IC tester and verify the truth table.
	22.3 Construct and verify the truth table of all gates using NOR and NAND gates
23. Construct different electrical control circuits and test for their proper functioning with due care and safety.	23.1 Measure the coil winding of the given motor.
	23.2 Prepare the setup and control an induction motor using a DOL starter by following the safety norms.
	23.3 Construct a direction control circuit to change direction of an induction motor.
	23.4 Connect an overload relay and test for its proper functioning.
24. Assemble accessories and carry out wiring of	24.1 Draw the layout diagram of 3 phase AC motor control cabinet.
	24.2 Mount the control elements & wiring accessories on the control

control cabinets and equipment.	panel.
	24.3 Carry out wiring in control cabinet for local and remote control of induction motor
	24.4 Draw & wire up the control panel for forward/ reverse operation of induction motor.
	24.5 Carry out wiring for automatic start
	24.6 Draw & wire up the control panel for a given circuit diagram and connect the motor
	24.7 Test the control panel for its performance and all the required logics.
25. Execute the operation of different process sensors, identify, wire & test various sensors of different Industrial processes by selecting appropriate test instruments.	25. 1 Ascertain and select tools, material for the job and make this available for use in the timely manner.
	25.2 Plan work in compliance with safety norms.
	25.3 Demonstrate possible solution and agree task within the team.
	25.4 Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT by their appearance.
	25.5 Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.
	25.6 Measure temperature of a lit fire using RTD and record the readings referring to data chart.
	25.7 Measure the DC voltage of a LVDT.
	25.8 Detect different objectives using capacitive, inductive and photoelectric proximity sensors
26.Troubleshootsandrepairsdifferent Electrical,Electronicsystems/ devices.[DifferentElectrical, Electronicsystems /devices:-Fuse, MCB,Powercircuit, Controlpanel, CircuitBreaker,AC/DCdrives, SMPS, Relayetc.].	26.1Planandidentifytools, instrumentsandequipment fortheworkandmakeitavailabletimely.
	26.2 Plan work in compliance with standard safetyNorms and collectingdesired information.
	26.3Demonstratepartreplacementandfault finding..
	26.4 Trouble shoot and repair electrical & Electronics System/devices observing safety procedure.
	26.5 Checkthefunctionalityof thesystem.
27. Perform speed control of AC motors by using solid state devices/ AC drives.	27.1 Plan work in compliance with standard safety norms related to AC drives.
	27.2 Enter motor data and perform auto tuning on thyristors/ AC drive
	27.3 Control speed and reverse the direction of rotation of different type of three phase induction motors using VVVF control /AC drive
	27.4 Perform connections and identify parameters of AC drives.
28.Recognizevarioustypesofconveyor systems,their components,their utility,commondefectsoccurs in differenttypesof conveyorsin industryandperformoverhaul	28.1Describedifferenttypeofconveyorsandtheirutility andcommondefectsdevelopsinconveyorsystem.
	28.2Planandestimatematerialrequirementforconveyor Overhaulingandmaintenance.
	28.3 Identify tools equipment for the work and make It available timely.
	28.4 Set up workplace/ assembly location with dueconsiderationto operationalstipulation.

ing andrepairingof eachtypeof conveyors..	28.5 Plan work in compliance with standard safety norms and collectingdesired information.
	28.6 Perform conveyor overhauling and repairing /maintenance.
29.Demonstratefunction ofdifferent typesofmeasuring,monitorin g&controlsystemdevices/ instruments,i.e. sensors,solenoid,relays,switc hes,fusesetc.	29.1Explaincontrolsystemdevicesfunctionandworking mechanism..
	29.2Identifytools&equipmentforthefittingofsensors, solenoid, relays,switches,fusesetc.
	29.3 Set up workplace/ assembly location with dueconsiderationtooperationalstipulation.
	29.4Planworkincompliancewithstandardsafetynorms andcollectingdesiredinformation.
	29.5Performfittingof instruments,devices.
30.Demonstratefunctioningo f differentmechanicalelement sin plantandperformconnection s, removal,re-fitting,servicingof fasteners,fittings,hoses,valve s, bearings,ballscrew,LMguides & rails,spindles,belts,chains & sprockets,drivebelts,pulleys, couplings,gears,pumps,press ure gaugesandgaugeindicators..	30.1Plan and estimate material requirement for maintenance/fitting of mechanicalelements.
	30.2Identifytoolsequipmentfortheworkandmakeit availabletimely.
	30.3 Set upworkplace/ assembly location with dueconsiderationto operationalstipulation.
	30.4 Plan work in compliance with standard safetyNorms and collectingdesired information.
	30.5Performmaintenance/fittingofmechanicalelements.
31.ExplainPowerpack&powe rlocks- TypesofPowerpack& powerlocks, Usesof differenttypes ofPower pack&powerlocks,common defects&maintenanceactiviti esin Powerpack&powerlocks	31.1DescribedifferenttypesofPowerpacksandPower locks.
	31.2Planandestimate materialrequirementforremoval/refitting/replacementofPowerpacksan dPowerlocks.
	31.3Identifytoolsequipmentfortheworkandmakeit availabletimely.
	31.4 Set up workplace/ assembly location with dueconsiderationto operationalstipulation.
	31.5 Plan work in compliance with standard safetyNorms and collectingdesired information.
	31.6Performremoval/refitting/replacementofPowerpacksand Powerlocks.
32. .Identify& explain theSeals&O- Rings-TypesofSeals&O-Rings, Usesof differenttypes ofSeals&O-Rings,commonmaintenance activities inSeals&O-Rings.	32.1Planandestimatematerialrequirementforremoval/ replacementof seals andO-rings.
	32.2Identifytoolsequipmentfortheworkandmakeit availabletimely.
	32.3Setupworkplacelocationwithdueconsiderationto operationalstipulation.
	32.4Planworkincompliancewithstandardsafetynorms andcollectingdesiredinformation.
	32.5Performremoval/replacementof seals andO-rings.
33.ExplainMaintenanceplan ningbasic andprepareMaintenance-	33.1Definemaintenanceplanning.
	33.2Identifymaintenancerequirementsofpantelectrical mechanicaland controlsystems.

Schedulesformechanical,electrical andcontrolsystemmaintenance undersupervisorsguidance.	33.3 Develop maintenance schedule in detail with instructionsandguidanceof supervisor.
	33.4Reviewmaintenanceschedulewithseniorsandget approval.
34.Prepare& updateMaintenance documents-Charts,reportsand register.	34.1Preparedocumentsrelatedtomaintenanceactivities andupdatemaintenanceregister.
	34.2Preparereportsaftercarryingoutmaintenanceworks.
35.Explainconceptsof allMechanical systems,components,andfunctions inplantviz Hydraulicsystem, Lubricationsystem,Coolantsystem, Pneumaticsystem.Perform preventivemaintenanceof mechanicalsystems.	35.1 Describe mechanicalsystemsandtheir components&functioninginamanufacturing plantsuchasHydraulic system,Lubricationsystem,Coolantsystem, and Pneumaticsystem.
	35.2Planandidentifytools,instrumentsandequipmentfortheworkandmakeitavailabletimely.
	35.3 Set up workplace/assembly location with due considerationtooperationalstipulation.
	35.4Plan workincompliancewithstandard safetynorms.
	35.5Performrepairandmaintenanceworkofmechanical systemssperdesign/application requirement.
36.ExplainBasicPneumaticsystemand elements.Capabletodesigningof pneumaticcircuit.Constructsimple pneumaticcircuitand check functionality.	36.1Planandidentifytools,instrumentsandequipment fortheworkandmakeitavailabletimely.
	36.2Set up workplace/ assembly location with due Considerationto operationalstipulation.
	36.3Planworkincompliancewithstandardsafetynorms(LOTO andShutoffvalve)
	36.4 Construct pneumatic controlsystem as per design/applicationrequirement.
	36.5 Construct electro-pneumatic circuit as per design/applicationrequirement.
	36.6 Checkthefunctioningof processesas per desired requirement.
37.ExplainBasic Hydraulicsystemand elements.Capabletodesigningof pneumaticcircuit.Demonstrate installation ofaccessoriesin hydraulicsystemandtroubleshoot anddefects.	37.1Planandidentifytools,instrumentsandequipment for theworkandmakeitavailabletimely.
	37.2 Set up workplace/ assembly location withDue considerationtooperationalstipulation.
	37.3 Plan work in compliance with standard safetynorms and collectingdesired information.
	37.4 Construct hydraulic control system as perdesign/applicationrequirement.
	37.5Constructhydrauliccircuitasperdesign/application requirement.
	37.6Verifyprocessestoascertainfunctioningofvalves and auxiliaries.
38.Planandorganizethework and carryoutserviceandmaintenance activities invariousmechanical assemblies(BallscrewsandLMguides)using standard procedure andpropertools, tacklesand consumables.	38.1Planandidentifytools,instrumentsandequipmentfortheworkandmakeitavailabletimely.
	38.2 Set up workplace/assembly location with due considerationto operationalstipulation.
	38.3 Plan work in compliance with standard safetyNorms and collectingdesired information.
	38.4PerformserviceandmaintenanceworkofBallscrew& LMguide assembliesasperapplication requirement.
	38.5Checkthefunctioningofassembliesasperdesired requirement.

39.Plan& Organizeworkto Install hydraulicpump,motorsand carryoutmaintenanceof thesecomponents.	39.1Planandidentifytools,instrumentsandequipment for theworkandmakeitavailabletimely.
	39.2 Set up workplace/assembly location with dueconsiderationtooperationalstipulation.
	39.3Planworkincompliancewithstandardsafetynorms andcollectingdesiredinformation.
	39.4Installhydraulicpump&motors asperdesign/applicationrequirement.
	39.5 Check the functioning of system as per desired requirement.
	39.6Carryoutmaintenanceofthesecomponentsduringnon-functioning.
40.Constructdifferenthydraulicsystem andoperatetoachievedesired functions.[Differenthydraulic system:- Clamp control,injection control,reciprocatingscrew,oil filtration,hydraulicpresscontrol, accumulatorcontrol.].	40.1Planandidentifytools, instrumentsandequipment for theworkandmakeitavailabletimely.
	40.2 Set up workplace/ assembly location with due considerationto operationalstipulation.
	40.3Planworkincompliancewithstandardsafetynorms andcollectingdesiredinformation.
	40.4Demonstratethe possiblesolutionandagreetasks within theteam.
	40.5 Constructhydraulicsystemasperdesign/application requirement.
	40.6 Operateto verifyfunctioningof hydraulicsystem.

8. SYLLABUS

SYLLABUS - MECHATRONICS TECHNICIAN			
WEEK	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
First Year			
1-3	Recognize & comply Health, Safety & Environment practices in a vehicle manufacturing plant& Industry Orientation	**Trade and Orientation & Basics of Automobile and Manufacturing Process (82 Hr)** 1 Visit to various sections of the instituteandidentifylocationof variousinstallations. 2 Identifysafetysignsfordanger,warning,caution&personalsafetymessage. 3 Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE) / Behavior based safety 4 Practiceelementaryfirstaid 5 Preventivemeasuresforelectricalaccidents & steps to be taken in suchaccidents. 6 UseofFireextinguishers 7 Hazard identification and avoidance. 8 Preventive measures for electrical accidents & steps to be taken in such accidents 9 Practice and understand precautions to be followed while working in fitting jobs. 10 Rescue a person and practiceartificial respiration. 11. Disposal procedure of waste materials. 12. Practice on cleanliness and procedure to maintain it. 13. Type & Use of LOTO. 14. 5S training.	**Trade and Orientation & Basics of Automobile and Manufacturing Process (10Hr)** Familiarizationwiththeworkingof Industrial Training Institutesystem. Importanceofsafetyandprecautionsto betakenintheindustry/shopfloor.IntroductiontoPPEs. IntroductiontoFirstAid. Responsetoemergenciese.g.powerfailure,fire,andsystemfailure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application. **Occupational Safety & Health:** Health, Safety and Environment guidelines, legislations & regulations as applicable..

		Basics of Automobile and Manufacturing Process 1. Brief Vehicle manufacturing process. 2. Plant visit to vehicle manufacturing industry in following departments. • Press shop making body shell • Fabrication & welding shop manufacturing frames & body shell • Painting shop • Assembly lines assembling different components to produce a car (Trim line, Chassis assembly line, Final assembly line) • final inspection & testing of car	**Basics of Automobile and Manufacturing Process** •Knowledge about automobile industry • Basic automotive terms and familiarization to various types of vehicles • Basics of Vehicle manufacturing process • Basics of Blanking process • Basics of Stamping process • Basics of Welding process • Basics of Painting process • Basics of Assembly process • Basics of Vehicle Inspection and testing process • Introduction to Tools and equipment used in vehicle manufacturing • Conveyors types Spot Welding guns • Stamping presses • Pneumatic tools • Electric tools • Sealant application guns • Special tools and equipment • Robotic welding & Automation
4	Understand & Explain maintenance, purpose & types of maintenance in general, requirement of maintenance in manufacturing industry.	**Basics of Automobile and Manufacturing Process (34Hr)** 1. Visit to plant assembly shop and list out different mechanical and electrical equipment's 2. Visit to plant tool room and list out different machines and tools available and their uses.) 3. Visit Utility plant and list out various equipment and piping installed 4. List out the different hand & power tools and equipment available with maintenance department.	**Basics of Automobile and Manufacturing Process (5Hr)** • Definition of maintenance. Purpose and importance of maintenance. • Types of maintenance i.e. Preventive, Protective & Repair maintenance. Shutdown maintenance. • Job description of a Technician – • Plant Maintenance. • Broad maintenance activities in a plant. • Reading and analysing the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
5	Plan and organize the work to make job as per specification applying different types of basic fitting operation	**Safety rules - Safety signs - Hazards (28Hr)** 1. Identify trade tools and machineries. 2. Practice safe methods of lifting and handling of tools & equipment. 3. Select proper tools for operation	**Safety rules - Safety signs - Hazards (5Hr)** Concept of Standards andadvantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011

	and Check for dimensional accuracy. [Basic fitting operation – Filing, Marking, Hack sawing, Drilling, Taping, chipping and Grinding etc.	and precautions in operation. 4. Care & maintenance of trade Tools	
6-9		**Basic Workshop Practice (137Hr)** 1. Identification of tools & equipment as per desired specifications for filing and marking, visual inspection of rawmaterial for rusting, scaling, corrosion etc. 2. Familiarization of bench vice. 3. Filing- File top of the "U" channel, check and measure with steel rule. 4. Mark with scriber and steel rule 5. Familiarization of Vernier Height Gauge Measuring practice with steel rule, Vernier Height Gauge. 6. File, mark straight and parallel lines with scriber and steel rule/Vernier Height Gauge as per drawing. 7. Dot punching and letter and number punching. *8.* File "U" channel to size and by using straight edge, try-square and Vernier calliper measure and check-Accuracy +/-0.1mm. *(Note down all dimensions and submit to instructor for verification)* 9. Sawing different types of metals of different sections- round piece and Angle Iron. 10. Prepare mushroom head on round bar by hammering 11. Make "S" bend by Hammering on flat piece. 12. Grinding of center punch, dot punch, flat chisel and scriber. 13. Drill grinding practice. 14. Drill Centering Practice. 15. Chain drilling practice 16. Practice on measuring instruments. 17. Job setting and tool setting on drilling machine.	**Basic Workshop Practice (14Hr)** Bench work – Metal working hand tools and devices –Work bench – vices – files – hacksaw – hammer – chisels – spanners – screw drivers – scrapers. Linear measurements- its units, steel rule dividers, callipers – types and uses, Punch – types and uses. Description, use and care of marking table. Vernier calliper – its parts, principles, reading, uses and care. Outside micro meter – its parts, principles, reading, uses and care, Vernier height gauge. Marking tools – scriber, Dividers, Dot punch, Centre punch. Marking out – Coordinates system, Rectangular – Polar – Rules for marking media, marking blue, Prussian blue, chalk and their special application, description. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance. Drill, Tap, Die-types & application. Determination of tap drill size. Reamer- material, types (Hand and machine reamer), parts and their uses, determining hole size for reaming, Reaming procedure. Drilling machines-types &their application, construction of Pillar & Radial drilling machine. Countersunk, counter bore and spot facing-tools and nomenclature. Cutting Speed, feed, depth of cut and Drilling time calculations. Measuring Instruments – purpose – Function- types – Calculation of Least count of :-Vernier Caliper, Micro meter, height gauge, Spirit Level Gauge, Vernier bevelprotector

			and Sine bar. Bevel protractor, combination set theircomponents, uses and cares. Pedestal grinder, star wheel dresser, safety precautions, care andmaintenance.
10-12	Plan and organize to prepare jobs for sheet metal brazing, electric resistance welding, and structure steel, plates, piping for welding work using power tools such as abrasive cutter and grinder. Perform perfect V joint for weld filling. Perform joining of metals by welding and brazing observing standard procedure.	**Practice on Welding (102Hr)** 1. Cut 1.2 mm M.S. sheets in different sizes for brazing lap joint and T-joint. 2. Take two numbers of 100 x 50 x 10mm M.S. plates and prepare edges by grinding, filing for Butt welding. 3. Take two numbers of 100 mm long 50 x 50 x 5mm Angles and prepare for T-joint welding. 4. Take two number 4 inch dia x 100 mm long pipes and prepare edges for Butt welding. 5. Identify different parts of gas welding / arc welding / MIG welding equipment and demonstrate their functioning. 6. Simple welding and brazing practice.	**Theory on Welding (6 Hr)** Welding process definition, types of welding i.e. Oxy-acetylene brazing, Metal arc welding, MIG, TIG, Plasma welding. Welding electrodes. Preparation for welding. PPE for welding. Welding joints type. Base metal preparation for welding. Explanation of gas welding, arc welding and MIG welding techniques description of welding equipments and welding joints. Knowledge about flux, filler rod material.
13	Prepare electrical wire joints, carry out soldering, crimping	**Wires, Joints - Soldering - U.G. Cables (34Hr)** 1. Prepare terminations of cable ends 2. Practice on skinning, twisting and crimping. 3. Identify various types of cables and measure conductor size using SWG and micro meter.	**Basic theory on electricity (5Hr)** Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their Comparison
14-15	Selectandperformelectrical/ electronicmeasurementofsinglerangemeters	**BasicsofACandElectricalCables(70Hr)** 1. Measures to rescue a person from Livewires. IdentifythePhase,NeutralandEarthon power socket, use a testers to monitorACpower) 2. Construct attest lampanduseittocheckmainshealthiness. 3. Measurethevoltagebetweenphase andgroundandrectifyearthing	**BasicsofACandElectricalCables(07Hr)** Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, -ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase

		4. Identify and test different AC mainscables. 5. Prepareterminations,skintheelectricalwires /cables using wire stripper andcutter. 6. Measure the gauge of the wire usingSWGandoutsidemicrometer. 7. Refer table and find current carryingcapacityofwires 8. Crimpthelugstowireend.Measure ACandDCvoltagesusingmultimeter.	voltage/ currents. Insulators, conductors and semiconductor properties. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG). Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc.
16		**Electrical/ electronic Measurement (35Hr)** 1. Identifythetypeofmetersbydialandscalemarking/symbols. 2. Demonstratevariousanalogmeasuringlnstruments. 3. Findtheminimumandmaximummeasurablerangeofthemeter. 4. Checkthecontinuityofwires,meterprobesandfuseetc.) **5.** Measurevoltageandcurrentusingclampmeter	**Singlerangemeters(3Hr)** Introductiontoelectricalandelectronicmeasuringinstruments.Basicprincipleandpartsofsimplemeters. Specifications,symbolsusedindialandthe irmeaning.
17	Testdifferent batteriesusedinelectronicapplicationsandrecordthedatatoestimaterepaircost.	**Cells&Batteries(34Hr)** 1. Identifythe+veand-veterminalsofthebattery. 2. IdentifytheratedoutputvoltageandAh capacityofgivenbattery. 3. Measurethevoltagesofthegivencells/batteryusinganalog/digitalmultimeter. 4. Test a battery and verify whether the battery is ready for use of needs recharging 5. Charge and discharge the battery through load resistor. 6. Maintain the secondary cells. 7. Measure the specific gravity of the electrolyte using hydrometer. 8. Test a battery and verify whether the battery is ready for use of needs recharging.	**Cells&Batteries (5Hr)** Construction,typesofprimaryandsecondary cells. Materials used,Specificationofcellsandbatteries. Chargingprocess,efficiency,lifeofcell/ battery. Selectionofcells/Batteriesetc.UseofHydrometer. Typesofelectrolytesusedincellsandbatteries. Series/parallelconnectionofbatteriesandpurposeofsuchconnections.
18	Planandexecute Soldering&desolderingofvariouselectrical components like Switches,PCB	**Soldering/ De-soldering and VariousSwitches(35Hr)** 1. Practicesolderingondifferentelectroniccomponents,smalltransformerandlugs	**Soldering/ De-soldering and VariousSwitches (4 Hr)** Differenttypesofsolderingguns,relatedtoTemperatureandwattages,typesoftips.

	&Transformersforelectroniccircuits.	2. PracticesolderingonICbasesandPCBs 3. Practicede-solderingusingpumpandwick 4. JointhebrokenPCBtrackandtest 5. IdentifyanduseSPST,SPDT,DPST,DPDT,tumbler,pushbutton,toggle,pianoswitchesusedinelectronicindustries 6. Makeapanelboardusingdifferenttypesofswitchesforagivenapplication	Soldermaterialsandtheirgrading.Useoffluxandothermaterials.Selectionofsolderinggunforspecificrequirement.SolderingandDe-solderingstationsandtheirspecifications.Differentswitches,theirspecificationandusage.
19-20	Test variouselectronic componentsusingproper measuringnstrumentsandcompare thedatausingstandardparameter.	**AC&DCmeasurements(68Hr)** 1. Use the multi meter to measure thevariousfunctions(ACV,DCV,DCI,ACI,R) 2. Identify the different types of meter formeasuringAC&DCparameters 3. Identifythedifferentcontrolsonthe CROfrontpanelandobservethefunctionofeachcontrol 4. Measure DC voltage, AC voltage, timeperiodusingCROsinewaveparameters 5. Identify the different controls on thefunctiongeneratorfrontpanelandobservethefunctionofeachcontrols	**AC&DCmeasurements(6Hr)** Introductiontoelectricalmeasuringinstruments. Importanceandclassificationofmeters. Forcesnecessarytoworkameter.MCandMImeters. Rangeextension,needofcalibration. Characteristicsofmetersanderrorsinmeters. Multimeter,useofmetersindifferentcircuits. Careandmaintenanceofmeters.UseofCRO,Function generator,
21-22		**ActiveandPassiveComponents(69Hr)** 1. Identifythedifferenttypesofactiveelectroniccomponents 2. Measuretheresistorvaluebycolourcodeand verify the same by measuring withmultimeter 3. Identifyresistorsbytheirappearanceandcheckphysicaldefects 4. Identifythepowerratingofcarbonresistorsbytheirsize. 5. Practice on measurement of parametersincombinationalelectricalcircuitbyapplyingOhm'sLawfordifferentresistorvaluesandvoltagesources 6. Measurement of current and voltage inelectricalcircuitstoverifyKirchhoff'sLaw 7. Verifylawsofseriesandparallelcircuitswithvoltagesourceindiff	**ActiveandPassiveComponents(4Hr)** Ohm'slawandKirchhoff'sLaw.Resistors;typesofresistors,theirconstruction&specificuse,colorcoding,powerrating. EquivalentResistanceofseriesparallelcircuits. Distribution of V & I in series parallelcircuits. Principlesofinduction,inductivereactance. Typesofinductors,construction,specifications,applicationsandenergystorageconcept. SelfandMutual induction. Behaviourofinductoratlowandhighfrequencies. Seriesandparallelcombination,Qfactor. CapacitanceandCapacitiveReactance,Impedance.

		erentcombinations. 8. Measuretheresistance,Voltage,Currentthrough series and parallel connectednetworksusingmulti meter **9.** Test the Electronic components using component tester and Multi meter, CRO and Test ICs using IC Tester. **10.** Identify and test the circuit breaker and other protecting devices.	Typesofcapacitors,construction,specificationsandapplications.Dielectricconstant. SignificanceofSeriesparallelconnectionofcapacitors. Capacitor behaviour with AC and DC. Relays, types, construction andspecificationsetc.
23-24	Assemble simpleelectronic powersupplycircuit andtestforfunctioning.	**PowerSupplyCircuits(68Hr)** 1. Identify different types of diodes, diodemodulesandtheirspecifications 2. Testthegivendiodeusingmultimeterranddetermineforwardtoreverseresistanceratio. 3. Measurethevoltageandcurrent through hadiodeinacircuitandverifyitsforwardcharacteristic. 4. Identifydifferenttypesoftransformersandtest. 5. Identifytheprimaryandsecondarytransformerwindingsandtestthepolarity 6. Constructandtestahalfwave,fullwaveandBridgerctifiercircuit. 7. Measureripplevoltage, ripplerequencyandripplefactorofrectifiersfordifferentloadandfilterc apacitors. 8. IdentifyandtestZenerdiode. 9. Construct and test Zener based voltageregulatorcircuit. 10. Calculate the percentage regulation ofregulatedpowersupply.	**Basics of electronics(07Hr)** Semiconductor materials, components, number coding for different electronic componentssuch as Diodes and Zeners etc. PN Junction, Forward and Reversebiasing of diodes. Interpretation ofdiode specifications. Forward currentand Reverse voltage. Packing stylesof diodes. Different diodes, Rectifier configurations, their efficiencies, Filter components and their role inreducing ripple. Working principles ofZener diode, reactor diode, theirspecifications and applications. Working principle of a Transformer,construction, Specifications andtypes of cores used. Step-up, Stepdown and isolation transformers withapplications. Losses in Transformers. Phase angle, phase relations, active and reactive power, power factorand its importance.
25		**ICRegulators(34Hr)** 1. Construct and test a +12V fixed voltageregulator. 2. Identifythedifferenttypesoffixed+veand–veregulatorICsandthedifferentcurrentratings(78/79series) Identify different heat sinksfor IC based regulators. (4hrs)	**Basics of Voltage regulation (3Hr)** RegulatedPowersupplyusing78XXseries,79XXseries. Voltageregulation,

		3. Construct and test a 1.2V – 30V variable output regulated power supply using IC LM317T.	
26-27	Make different fit of components for assembling as per required tolerance observing principle of interchangeability and check forfunctionality. [Different Fit – Open & Square Fit; Required tolerance: ±0.05 mm]	**Limit ,Fits ,Tolerance(70Hr)** 1. Make Male & Female 'Open'fitting with accuracy ±0.05 mm. 2. Make Male & Female 'Square' 3. Fitting with accuracy ±0.05 mm. 4. Scraping practice.	**Limit ,Fits ,Tolerance(9Hr)** Limit and Fits – Limit, Fits -Types and Tolerances and allowances with IS919(ISO System)
28	Construct, test and verify the input/ output characteristics of various analog circuits.	**Switching devices(35Hr)** 1. Identify different transistors with respect to different package type, B-E-C pins, power, switching transistor, heat sinks etc. 2. Test the condition of a giventransistor using ohm-meter / Multi meter Construct and test a transistor based switching circuit Identify various Power MOSFET by its number and test by using multi meter. 3. Identify different heat sinks used with various power MOSFET devices. Construct MOSFET test circuit	**Basics of Transistors and Mosfet(5Hr)** Construction, working of a PNPand NPN Transistors, purposeof E, B & C Terminals. Significance of a, ß andrelationship of a Transistor. Need for Biasing of Transistor. VBE, VCB, VCE, IC, IB, . Transistor and mosfetapplications as switch and amplifier. different heat sinks. MOSFET, Power MOSFET their types,characteristics, switching speed, power ratings andprotection. Differentiate FET with MOSFET.
29-30	Assemble, test andtroubleshoot variousdigital circuits.	**Basic Gates (70Hr)** 1. Identify different Logic Gates (AND, OR, NAND, NOR, EXOR, EX-NOR,NOT ICs) by the number printed onthem. 2. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. 3. Use digital IC tester to test the various digital ICs (TTL and CMOS). 4. Construct and verify the truth table of all the gates using NAND and NOR gates.	**Number Systems and Logic Gates(10Hr)** Introduction to Digital Electronics. Differencebetween analog and digitalsignals. Logic families andtheir comparison, logic levelsof TTL and CMOS. **Number System:** Binary, Decimal, Octal, Hexa Decimal Number systems and its Conversions. Binary Arithmetic and logical operations. **Digital Logic:** Boolean algebra. Logic gates: AND,

			OR, NOT, NAND, NOR, XOR.
31-33	Construct different electrical control circuits and test for their proper functioning with due care and safety.	**Protection devices (105Hr)** 1. Identify different types of fuses along with fuse holders, overload (no volt coil), current adjust (Biometric strips to set thecurrent). 2. Test the given MCBs. 3. Connect an ELCB and test the leakage of an electrical motor control circuit 5. Identify different types of electrical components and its uses. 6. Switching on and off procedure for the control panel 7. Construct a simple circuit to test the operation of push button and its uses. 8. Usage of terminal block and emergency switches, Lamps and connecting wires 9. Construct a simple circuit to test the operation of a Relay. 10. construct Holding logic exercises 11. Construct a simple circuit to test the operation of a Contactor 12.Construct and perform forward and Reverse operation of AC Motors. 13. Sequence wiring practice with circuits.	**Protection devices (12Hr)** Necessity of fuse, fuse **m**ratings, types of fuses, fusebases. Single/ three phaseMCBs, single phase ELCBs. Types of contactors, relaysand working voltages. Contactcurrents, protection tocontactors and high currentapplications. 1.Basics of sequence control, Auxiliary devices, Purpose of using protective devices, 2.Explanation about lamp and color coding of lamps and its applications and wiring practice. 3.Explanation about wires and color coding of wires and its Applications demonstrations. 4. Explanation about Push buttons, Limit switches, Micro switches, detection switches, Solenoids, Float switch, OLRs, Photo electric sensors, 5.Ues and working method of Relay and applications relay logic 6. Uses and working method of timer and applications and timer circuit practice with timer chart. 7.Sequence wiring practice withcircuits. For logical thinking
34 - 35		**Domestic Circuits(70Hr)** 1. Draw layouts and practice in PVC Casing-capping, Conduit wiring withminimum to more number of points of minimum 15 mtr length. 2. Wire up PVC conduit wiring to control one lamp from two different places. 3. Wire up PVC conduit wiring to control one lamp from three different places 4. Wire up PVC conduit wiring and practice control of sockets and lamps in different combinations using switching concepts.	**wiring system.(12 Hr)** Different types of wiring -Power, control, Communicationand entertainment wiring. Wiring circuits planning,permissible load in sub-circuitand main circuit
36-50		**Electrical control circuits(500Hr)** 1. Check/Test the line, neutral and	**Motor Basics&Electrical control circuits (48Hr)**

		earth wires before connecting cable in to plugs. 2. From the given Electrical circuit/board familiarization with different types of plugs, sockets, switches, fuses and fuse holder. 3. Construct different DC sources by serial and parallel connection of batteries. 4. Ascertain different electrical instruments as per the drawings. 5. Measure the voltage and current in AC/DC Circuits using ammeter, voltmeter, and multi meter. Tong Tester 6. Measure different parameters in poly- phase circuit using ammeter, voltmeter and wattmeter readings. 7. Construct series and parallel combination circuits and verify them. 8. Construct a simple circuit to test the operation of a Relay 11. Measure input and output voltages in stabilizers, power supply unit in the control panel. 12. Application of test lamp and multi meter for identifying single and three phase supply. 13. Physical identification of Mechanical parts and winding details of AC/DC Motors. 14. Develop work plan to test AC Machine winding continuity and insulation resistance. 15. Check the Motor speed and its line current using Tacho Generator and Clamp on meter. 16. Perform wiring to control one lamp from different places. 17. Perform wiring to install buzzer, buttons, and protection alarm. 18. Prepare panel mains board with switch and distribution fuse box. 19. Estimate the materials for a given panel board connection plan. 20. Perform Wiring of power and control circuits in the panel board. 21. Measure earth resistance using earth tester. 2. Test the switches, pushbuttons,	Fundamentals of singlephase Induction motors,synchronous speed, slip,rotor frequency. Torque speedcharacteristics, Starters used for Inductionmotors. Measureement of Current,Voltage,temperature of field output devices Connections methods and settings parameters of various electrical devices of electrical control systems

		limit switches, Foot pedal switch, Micro switches for its operation 23. Practice on working of protective elements such as MCB, OLR, ELCBs and fuses in power circuits. 24. Ascertain different safety symbols and signs used in workshop 25. Measure the coil winding resistance of the given motor 26. Prepare the setup of DOL starter and Control an induction motor. 27. Construct a direction control circuit to change direction of an induction motor. 28. Connect an overload relay and test for its proper functioning. 29. Check the Motor speed and its line current using Tacho Generator and Clamp on meter.	
51-52	**Revision &Project work -25 Hr**		
	Examination-40 Hr		
53-54	Assemble accessories and carry out wiring of control cabinets and equipment.	**Wiring of control cabinets and equipment.(60Hr)** Design layout of control cabinet, assemble control elements and wiring accessories for: (i) Local and remote control of induction motor. (ii) Forward and reverse operation of induction motor. (iii) Automatic star-delta starter with change of direction of rotation. Hrs) (iv) Sequential control of three motors.	**Electrical Auxillary devices(6Hr)** Study and understand Layout drawing ofcontrol cabinet, power and controlcircuits. Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc.
55-57	Execute the operation of different process sensors, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments.	**Sensors, Transducers (105Hr)** • Sensors, Transducers and Applications • Identify sensors used in process industries such as RTDs, Temperature ICs, • Thermocouples, proximity switches (inductive, capacitive and photo electric), load cells, strain gauge. LVDT PT 100 (platinum resistance sensor), water level sensor, thermostat float switch, float valve by their appearance	**Sensors, Transducers (10Hr)** Basics of passive and activetransducers. Role, selectionand characteristics. Sensorvoltage and current formats. Thermistors / Thermocouples - Basic principle, salient features, operating range,composition, advantages anddisadvantages. Strain gauges/ Load cell – principle, gauge factor, types of strain gauges. Inductive/ capacitive

		• Measure temperature using a Thermocouple and record the readings • Detect different objectives using capacitive, inductive and photoelectric proximity sensors 1. Behaviour of Proximity Sensors, inductive sensor, capacitivesensor, magnetic sensor. 2. Construct simple control circuit using Proximity sensor and reed switch and limit switch. 3. Identify Behaviour of Reflex Photoelectric Sensors. 4. Identify Behaviour of ultrasonic sensor. 5. Identify Behaviour of reed switch and limit switch. 6. Identify Behaviour of Temperature Sensors. 7. Identify Behaviour of Level Control. 8. Understand Logical operation of sensors 9. Understand Interfacing od Sensors and Electrical Actuators. 10. Interfacing of Sensors and Pneumatic Actuators.	transducers - Principle of operation, advantages anddisadvantages. Principle of operation of LVDT,advantages and disadvantages. Proximity sensors – applications, working principles of eddy current, capacitive and inductive proximity sensors
58-67	Trouble shoots and repairs different Electrical, Electronic systems/ devices. [Different Electrical, Electronic systems/ devices:- Fuse, MCB, Power circuit, Control panel, Circuit Breaker, Stabilizer, AC/DCdrives,SMPS,Relay etc.]	**Trouble shooting-on job training(350Hr)** 1. Replacement of fuses, Locating OLR and its resetting practice 2. Locating faults in power circuit such as fuse blown, MCB Tripped, control fuse blown etc. 3. General checking of loose contacts in the control panel wirings. 4. Troubleshoot and Service a circuit breaker. 5. Service and troubleshoot the AC motor starter. 6. Maintain, Service, and troubleshoot AC Machine 7. Identify controls, trace the circuit and test the function of stabilizer. 8. Trouble shoot and maintenance of UPS and stabilizer. 9. Trouble shooting of AC/DC Drives. Check the feedback sensors.	**Basics of maintenance(10Hr)** Introduction to maintenance, Importance of maintenance andtypes.Guidelines for trouble shooting of electrical, electronic systems and PLC.

		10. Trouble shooting of Motors & Insulation Resistance Testing	
68-69	Perform speed control of AC Motors by using solid state devices/AC Drives.	• Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive. **(70 Hr)**	**VFD Basics(10Hr)** . Basics of Magnetism and faradays law, flemming rule Basics and types of DC motors and their behavior AC drive (VFD) basics, Construction and wiring, Parameter setting Speed control of 3 phase induction motorby using VVVF/AC Drive.
70-71	Recognize various types of conveyor systems, their components, their utility, common defects occurs in different types of conveyors in industry and perform overhauling and repairing of each type of conveyors.	**Conveyor systems(70Hr)** 1. Visit plant and make a list of types of conveyors. 2. Dismantle conveyors, observe components and list their functions and re-assemble after servicing. 3. Repair or replace any damaged or faulty component 4. Lubricate movable parts of conveyors.	**Conveyor systems(10Hr)** Defining conveyors, purpose and utility of conveyors in assembly line, types of conveyors, overhead conveyors, drive and speed setting. Common defects or faults occur in conveyor system of plant and procedure to repair / replace them
72-73	Demonstrate function of different types of measuring, monitoring & control system devices / instruments, i.e. sensors, solenoid, relays, switches, fuses etc.	**control system(65Hr**) 1. Identify different control system devices in plant. 2. Check circuits and observe functioning of these devices. 3. Remove / re-fit or replace these devices.	**control system(5 Hr)** Understanding of control systems in plant, control system devices, working principle and functioningof control system devices.
74-75	Demonstrate functioning of different mechanical elements in plant and perform connections, removal, re-fitting, servicing of fasteners, fittings, hoses, valves, bearings, ball screw, LM guides & rails, spindles, belts, chains &	**Basic Mechanical Elements(54Hr)** 1. Identify basic mechanical elements in a plant • Fasteners • Fittings • Hoses • Valves • Bearings • Linear & Rotary Movements • Ball Screw • LM Guides & Rails • Spindles • Belts • Chain , Pulley • Couplings, Gears & Sprockets	**Basic Mechanical Elements(10Hr)** Concepts of Controlling the Fluids 1. Transfer 2. Joints 3. Pressure Generation & Distribution Concepts of Movements 1. Linear Motion 2. Rotary Motion 3. Inter-conversion of Movements 4. Concept of Friction & Force Concepts of Power Transmission 5. Energy Transmission 6. Engagement

	sprockets, drive belts, pulleys, couplings, gears, pumps, pressure gauges and gauge indicators.	• Pumps 2. Types, Functions, Purpose & Usage for the basic Mechanical Elements(3. Demonstrate Connection of Steel pipes & Hose 5. Pressure gauge/Indicator Fitment of gaskets, seals and strainer 7. Troubleshooting of Hydraulic System	7. Concepts for Transmissions
76	Explain Power pack & power locks - Types of Power pack & power locks, Uses of different types of Power pack & power locks, common defects & maintenance activities in Power pack & power locks	**Power pack & power lock(34Hr)** 1. Identify different types of power packs and power locks fitted in different equipment in plant. 2. Practice removal, service & refit the power packs and power locks.	**Power pack & power lock(7Hr)** Define power packs and power locksand their functional utility. Procedure of servicing and maintenance of power packs & power locks.
77	Identify & explain the Seals & ORings - Types of Seals & O-Rings, Uses of different types of Seals & O-Rings, common maintenance activities in Seals & O-Rings.	**Seals and Oring(32Hr)** 1. Identify different types of seals and O-rings. 2. Observe fitting of seals and O rings in pneumatic and hydraulic systems. 3. Practice removal and replacement of seals and O-rings using	**Seals and Oring(7Hr)** Difference between seals and O rings, function of seals and O-rings,materials of seals & O-rings. Special purpose tools and procedureto remove and fitting of seals and O-rings.
78-79	Explain Maintenance planning basics and prepare Maintenance - Schedules for mechanical, electrical and control system maintenance under supervisorsguidance.	**Maintenance Planning(70 Hr)** 1. Study maintenance planning of each and every machine or device and system in plant. 2. Prepare maintenance plan for one machine or device. Study maintenance schedule of plant. Analyze and note down 3. Maintenance schedule of cycle ofdifferent systems. 4. Prepare maintenance schedule forone shop.	**Maintenance Planning(8Hr)** What is planning and basics ofmaintenance planning. Different maintenance plan fordifferent system or machine. Define maintenance schedule andits importance. Why periodic maintenance in schedule
80	Prepare & update Maintenance documents - Charts,reports and register.	**Maintenance Documents(35 Hr)** 1. Study existing maintenance documents and reports. 2. Prepare maintenance chart, maintenance report for five	**Maintenance Documents(5 Hr)** Documentation required for plantmaintenance. Importance of documents inmaintenance.

		machines.	Understanding maintenancedocuments. Documents to prepare and update by Technician – Plant Maintenance
81-83	Explain concepts of all Mechanical systems, components, and functions in plant viz Hydraulic system, Lubrication system, Coolant system, Pneumatic system. Perform preventive maintenance of mechanical systems	**Hydraulics& Pneumatics Basics(100 Hr)** 1. Concepts of Hydraulic System • Hydraulic Oil • Hydraulic Power Pack • Hydraulic Pump • Motor • Radiator • Filters • Hydraulic Directional Valves • Hydraulic Cylinders • Accumulator 2. Concepts of Lubrication Systems • Lubrication Oil • Grease • Usage & Application • Need & Advantages 3. Concepts of Coolant System • Types of Coolant • Different Operating Conditions • Usage & Functions • Need & Advantages 4. Concepts of Pneumatic System • Compressed Air • Filters & regulators • Pneumatic Valves • Pneumatic Cylinders	**Hydraulics& Pneumatics Basics(15Hr)** • Hydraulic Power pack description, parts details and uses. Function of each parts. • Pump description, function, types and uses. Pump parts and understanding of each parts and method of flow and pressure checking and adjusting • Description, function and types of Hydraulic valves, Cylinders & Accumulators • Lubrication description, property of oil – viscosity – types – function and uses. • Property of grease, types and uses. • Coolant description, types and uses • Pneumatic system description, parts and uses.
84-87	Explain Basic Pneumatic systemand elements. Capable to designingof pneumatic circuit. Construct simple pneumatic circuit and check functionality	**Pneumatic Control System(140Hr)** 1. Identify various parts of pneumatic system 2. Practice on selection of pneumatic element for given circuit 3. Practice on preparing pneumatic circuit 4. Measure pneumatic pressure, temperature, flow level of pneumatic system 5. Select appropriate air compressor, receiver for given application. 6. Use and maintain of FRL unit in pneumatics. 7. Describe piping layout. 8. Select and maintain appropriate pneumatic elements (actuators, motors and cylinders). 9. Select and maintain appropriate	**Pneumatic Control System(12Hr)** • Definition and history of Pneumatic. • Pneumatic system: i. Basic components ii. Comparison to pneumatic systems. iii. Advantages and limitations. iv. Application of pneumatics. • Basic pneumatic system. • Types, construction, working, specifications and selection criteria of following air preparation and conditioning elements: i. Air compressors ii. Air receivers iii. Air dryers iv. Air filters, regulators and lubricators (FRL unit). • Pneumatic pipes- materials, BIS,

		pneumatic control valves. 10. Use logic valves in pneumatic circuit. 11. Describe ISO symbols and guiding rules for designing pneumatic system. 12. Describe various components of pneumatic circuit based on given system requirements. 13. Design pneumatic logic circuit based on given system requirements 14. Use logic valves and construct in pneumatic circuit. 15. Construct and perform the operation of Pressure control valves. 16. Using Time Delay valves perform the operation of pneumatic actuator.	ASME and DIN designations, standards, properties and selection criteria. • Piping layout-important considerations, precautions and route optimization. • Pneumatic cylinders- types, construction, working, materials, specifications, mounting & cushioning. • Types, constructions, designations, working, applications and selection criteria of following: i. Directional control valves. ii. Flow control valves. iii. Pressure control valves. iv. Special valves- quick exhaust valve and time delay valve. v. Logic valves- shuttle valve • ISO symbols used in pneumatic circuits • Circuit diagram, components, working and application of following pneumatic circuits: i. Control of single acting cylinder. ii. Control of double acting cylinder. iii. Speed control circuit. iv. Automatic cylinder reciprocation circuit. v. Quick exhaust circuit. vi. Two step feed control circuit vii. Time delay circuit. viii. Two hand safety control circuit. • Pneumatic logic circuit design: Classic method, cascade method, step counter method, • Components of electrical controls- switches, relays, solenoids, timers. • Electro-pneumatic circuits: i. Reciprocation of cylinder using pressure switches. ii. Control of a cylinder using a single limit switch. iii. Automatic dual cylinder sequencing circuits. iv. Pneumatic cylinders types, construction, working, materials, specifications, mounting and cushioning.

88-91	Explain Basic Hydraulic systemand elements. Capable to designingof pneumatic circuit. Demonstrate installation of accessories in hydraulic system and trouble shootand defects.	**Hydraulic Control System(140Hr)** 1. Check of pressure built up and setting relief valve pressure in hydraulic system and checking of Line filter 2. Tabulate the selection criteria of different grades of Hydraulic oil for the system 3. Construct simple hydraulic circuit a. Pressure Regulating Circuit b. Safety Circuit c. Dual Pressure Regulating Circuit d. Sequence Control Circuit e. Pressure Counterbalancing Circuit f. Pressure Reducing Circuit g. Meter-In Flow Control Circuit h. Meter-Out Flow Control Circuit i. Bleed-Off Control Circuit j. Pressure Keeping Circuit k. Differential Circuit l. Synchronizing Circuit m. Accumulator Control Circuit n. Hydraulic Motor Control Circuit 4. Practice on Hydraulic and Pneumatic	**Hydraulic Control System (15Hr)** Introduction and Definitions of important terms like Hydraulics, Pressure, Force, Vacuum etc. i. Pascal's Law and its Application of hydraulics ii. Bernoulli's Principle iii. Hydraulic Jacks iv. Hydraulic Symbols and Circuit Building as per Standards DIN/ISO. v. Advantages and Disadvantages of Hydraulic System. vi. Hydraulic Oil and Types. vii. Importance of Hydraulic Oil. viii. Ideal Characteristics of Hydraulic Oil ix. Properties of hydraulic oil e.g. viscosity, ageing stability x. Grades of hydraulic oil xi. Maintenance of Hydraulic Oil Reading, understanding of Hydraulic Symbols for construction of circuit diagrams. **Types and Function of Components and Connectors** i) Steel pipe ii) Tubing iv) Hose Gauges v) Packing and Seals vi) Filters and Strainers vii) Hydraulic Tank
92-93		**Hydraulic Circuits(70Hr)** 1. Construct and perform the operation of Speed control of Hydraulic cylinder through Throttle valve. 2. Construct and verify the functionality of Flow control valve in Meter-in and Meter-out circuit. 3. Construct and check the function of cartridge valves in Lubrication system. 4. Construct Electro Hydraulic circuit –Speed and Pressure control of double acting cylinder for hydraulic Press 5. Construct control based hydraulic circuit for operation of double acting cylinder through 5/2 solenoid	**Hydraulic Circuits (10Hr)** Construction, Types and working of: • Directional Control Valves • Pressure Control Valves • Flow Control Valves • Pressure Intensifiers • Accumulators • Cartridge Valves and Cylinder • Relief Valve

		operated D.C. valve and PLC Controller (Counter based circuit). 6. Practice on Hydraulic and Pneumatic Simulation software	
94-96	Plan and organize the work and carryout service and maintenance activities in various mechanical assemblies (Ball screws and LM guides) using standard procedure and proper tools, tackles andconsumables.	**Maintenance mechanical assemblies(100Hr)** 1. Ball Screw: Pitch, lead, dimension checking, preload, backlash and play checking, Assembly of ball screw, replacement and repairing, uses, care and maintenance 2. LM Guide: Dimension checking, preload, backlash and play checking, Assembly of LM guide, replacement and repairing, uses, care and maintenance	**Maintenance mechanical assemblies(12Hr)** Principle and understanding of Ball screw and parts, types, application, use and care – maintenance- nomenclature – preload – backlash - dimension Principle and understanding of LM guide and parts, types, application, use and care –maintenance nomenclature– preload – backlash - Dimension
97-98	Plan & Organize work to Install hydraulic pump, motors and carryout maintenance of these components.	**Installation and Maintenance of Hydraulic Pumps.(70Hr.)** 1. Demonstrate the different types and working of Pumps using cut section Models 2. Install Hydraulic Pump and Motor and verify its function in hydraulic power pack. 3. Maintenance of Hydraulic Motor and Pump.	**Construction and Working, Specifications (14Hr)** • Gear Pump • Vane Pump • Radial Piston Pump • Pump Maintenance and Trouble Shooting, Hydraulic Motor Specifications
99-102	Constructdifferenth ydraulicsystem andoperatetoachiev edesired functions.[Different hydraulic system:- Clamp control,injection control,reciprocatin gscrew,oil filtration,hydraulicpr esscontrol, accumulatorcontrol]	**Construction and operation of hydraulic circuit (115 Hr)** 1. Construct and verify One-Cycle Cylinder Reciprocation using limit switches, timer, Pushbutton and Single-Solenoid Valve and double solenoid valve. 2. Construct a hydraulic control circuit for clamping and de clamping operation of part handling system. 3. Construct and perform the operation of Hydraulic press control using hydraulic elements.	Construction of circuits and operation of hydraulic circuit i.e. clamp unclamp circuit, hydraulic press**(14Hr)**
103-104	**Revision &Project work -25 Hr**		
	Examination -40 Hr		

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION &SCIENCE

S No.	Workshop Calculation	Workshop Science
FIRST YEAR-75 Hr		
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	**Material Science**: properties - Physical & Mechanical, Types – Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals,introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non- Ferrous Alloys.
2.	**Fractions:** Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	**Mass,Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.
3.	**Square Root:** Square and Square Root, method of finding out square roots, Simple problem using calculator.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.
4.	**Ratio & Proportion**: Simple calculation on related problems.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.
5.	**Percentage:** Introduction, Simple calculation. Changing percentage todecimal and fraction and vice-versa.	
6.	**Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.
7.	**Mensuration :**Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced, Types of current - AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy.
8.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	**Levers and Simple Machines:** levers and its types. Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency,

		velocity ratio and Mechanical Advantage.
SECOND YEAR-75 Hr		
1.	Geometrical construction & theorem:division of line segment, parallel lines,similar angles, perpendicular lines, isoscelestriangleand right angled triangle.	- Forces definition. - Compressive, tensile, shear forces andsimple problems. - Stress,strain, ultimate strength, factor ofsafety. - Basic study of stress-strain curve for MS.
2.	- Area of cut-out regular surfaces: circle andsegment and sector of circle.	- Temperature measuring instruments. - Specific heats of solids & liquids.
3.	- Area of irregular surfaces. - Application related to shop problems.	- Thermal Conductivity, Heat loss andheat gain.
4.	- Volume of cut-out solids: hollow cylinders,frustum of cone, block section. - Volume of simple machine blocks.	- Average Velocity, Acceleration &Retardation. - Related problems.
5.	- Material weight and cost problemsrelated to trade.	- Circular Motion: Relation betweencircular motion and Linear motion,Centrifugal force, Centripetal force
6.	- Finding the value of unknown sides andangles of a triangle by Trigonometricalmethod.	- Friction- co-efficient of friction,application and effects of friction inWorkshop practice. - Centre of gravityand its practicalapplication.
7.	- Finding height and distance bytrigonometry.	- Magnetic substances- natural andartificial magnets. - Method of magnetization. Use ofmagnets.
8.	Application of trigonometry in shop problems. (viz. taper angle calculation).	- Electrical insulating materials. - Basic concept of earthing.
9.	**Graph:** - Read images, graphs, diagrams bar chart, pie chart. - Graphs: abscissa and ordinates, graphs ofstraight line, related to two sets of varyingquantities.	- Transmission of power by belt,pulleys& gear drive. - Calculation of Transmission ofpower by belt pulley and gear drive.
10.	Simple problem on Statistics: - Frequency distribution table - Calculation of Mean value. - Examples on mass scale productions. - Cumulative frequency - Arithmetic mean	- Heat treatment and advantages.
11.	Acceptance of lot by sampling method(within specified limit size) with simpleexamples (not more than 20 samples).	Concept of pressure – units ofpressure, atmospheric pressure,absolute pressure, gauge pressure –gauges used for measuring pressureIntroduction to pneumatics &hydraulics systems.

Syllabus – Engineering Drawing

Engineering Drawing (For First year& Second Year) Under CRAFTSMAN TRAINING SCHEME (CTS) (For all Engineering Trades duration) will be followed.

9.2 EMPLOYABILITY SKILLS

First Year- 120 Hr.

Module	Topics	
1. Behavioral Skills		**Duration:10 Hr. Marks:**
Expectation Setting	Creating a focused and responsible learning environment	
Personal Strength Analysis/ Strength Blindness	Self –awareness and confidence building	
Perception Management	Display Professionalism at the institute and workplace	
Ethics, Values &Etiquette	Increased social initiations relationships and networks Acceptance of peers from different cultures and social groups and work with them. Collaboration with team to prioritize the common goal and compromise individual priorities.	
Social Etiquette	Characteristic of a responsible citizen- Display the same by respecting self, others, environment, care for duty and value for time.	
Role Modeling	Adopting best practices and aspire to follow success stories of individual for personal development.	
2. English Literacy		**Duration: 20 Hr. Marks:**
Functional English	Importance of Learning English Different Naming words, Words used for replacing names, Action words, Describing people, place and their use. Introduction to punctuation -Comma, Full stop, Question mark. Singular plural Change of tense- Simple present, past; present, past progressive Construction of simple sentences-Kinds of sentences Usage of appropriate words to express themselves Greetings & Self Introduction Asking & responding to questions Sharing information with others Formal &Informal communication Speak and provide information about workplace Discussions on current happenings.	
Reading	Reading simple sentences about: a) Self b)Work c)Environment	
Written English	Simple writing skill	
3. Communication Skills		**Duration: 10 Hr.**

		Marks:
Self-Introduction	Interview Skills/Confidence Building	
Perception Management	Professionalism and Display of same at the institute and workplace	
a. Verbal Communication	Understand the usage of appropriate words to express themselves Communicate effectively on telephone.	
b. Non-Verbal Communication	Manage Personal Hygiene and Presentation	
	Positive body language: adopt and use it appropriately to build a positive Impression	
	Different spatial zones: Understanding and need to maintain it, create safezones for communication	
	Maintaining appropriate eye-contact in building trust and confidence	
	Impact of touch in a formal environment. Acceptable and unacceptable touch.	
	Role of tone in any communication.	
Campus to Work	Time Management and Planning Skills	
	Interview skills- its phases & ways to crack interview.	
	Handling setbacks/rejection and recover from it with an action plan.	
	Developing strong professional contacts/network to gain support in learning Process and career as a whole.	
4. I.T. Literacy		**Duration: 20 Hr.** **Marks:**
Basics of Computers	Introduction to Computers and its applications. Hardware and peripherals. Starting and shutting down of computer. Basic of computer Networks.	
Operating System	Basics of Operating System. Types of Operating Systems. User interface of Windows 10 OS/latest. Create, Copy, Move and delete Files and Folders. Use of External memory like pen drive, CD, DVD etc, Introduction to in built windows apps, Tools and features.	
MS-Word	Basic operating of Word Processing. Creating, opening and closing Documents. Use of shortcuts, Creating and Editing of Text, Formatting the Text. Creating simple document like-resume, letter writing, job application etc., Printing document.	
MS-Excel	Basics of Excel worksheet &its importance. Creating simple worksheets.	

	Adding and average functions. Printing of simple excel sheets.
Web browsers & Search Engines	Introduction to world wide web (WWW), Useful websites, web browser- usage, search engine etc. Using popular sites like Bharat Skills, Skill Training related Government portals, naukri.com and other job portals, CITS applications, Apprenticeship portal (NAPS), resize images, signing up, Online fund transfer using UPI gateway.
Email	Creating &using an email account–like Gmail or any other. Usage of CC & BCC. Attaching documents Checking email and composing Email.
Mobile application	Scanning QR/AR code, Sharing best practices and downloading trade related videos using Wi-Fi, Fund transfer through App like BHIM
5. Entrepreneurship Skills	**Duration:10Hr.** **Marks:**
Entrepreneur	Need of becoming entrepreneur.
	Ways to become a good entrepreneur.
	Enabling environment available to become an entrepreneur. Different Govt. institutions/schemes promoting Entrepreneur viz., Gram in banks, PMMY-MUDRA loans, DIC, SIDA, SISI, NSIC, SIDO. Ways to set up an enterprise and different aspects involved viz., legal compliances, Marketing aspect, Budgeting, etc. Day to day monitoring mechanism for Maintaining an enterprise. Different Government schemes supporting entrepreneurship. Examples of successful and unsuccessful entrepreneurs.
6. Maintaining Efficiency at Workplace	**Duration: 10Hr.** **Marks:**
Maintaining Efficiency at Workplace	Factors affecting productivity
	Improving Productivity
	Personal finance literacy Planning, Saving, Tax, Govt. schemes for financial safety e.g. Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), etc.
7. Occupational Safety, Health and Environment Education	**Duration: 10 Hr.** **Marks:**
Safety and Health	Introduction to Occupational Safety &health at workplace, Occupational Hygiene
Occupational Hazards	Basic Hazards. Chemical, Physical (Electrical, Temperature, Illumination) Ergonomic, Biological, Vibro acoustic, Mechanical, Psychosocial
Accident and Safety	Different types of Personal Protective Equipment (PPE). Accident

	Prevention techniques.
First-aid	Care of injured & Sick at the workplace. First-Aid & Transportation of sick person.
Basic provisions on safety And Health	Basic provisions of safety &health
Environmental Issues	Introduction to Environment, ecosystem and factors causing imbalance Pollution and pollutants include liquid, gaseous, solid and hazardous waste Protecting the environment-Energy Conservation, groundwater, global warming. Responsibility about the environment Segregation and disposal of waste
Environmental ethics	Different actions people that affect others and the environment.
Disaster Management	Types, causes &effects, are as in India that are prone to be affected, preparedness & mitigation, dos and don'ts-Before, During and After any Disaster, how to reduce man-made disasters.
8. Essential skills for success	**Duration: 10Hr. Marks:**
Essential skills for success	Building basic skills to navigate life and career. Self-Awareness, articulating personal values, Value-based decision making, Dilemma situations. Identify sources and types of stress (positive/negative stress), Managing stress (long-term/ short-term), Handling rejection and building resilience, Identify day wasters.
9. Labour Welfare Legislation	**Duration: 05Hr. Marks:**
Labour Welfare Legislation	Benefits guaranteed under various acts-Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act, POSH. Interpret applicable labour and industrial laws.
10.Quality Management	**Duration: 05Hr. Marks:**
Quality Concept and Consciousness	Create awareness on introduction of quality Concepts.
Concept of Quality Management(QMS)&PDCA	Concept of Quality Management (QMS), PDCA, Fishbone, 5S, 5D, KAIZEN
Concept of ISO	Introduction of ISO
11. Preparation to the world of work	**Duration: 05 Hr.**

		Marks:
Career Plan	Identify the difference between job and career	
Basic Professional Skills	Job roles available in respective trades	
Career Pathways	Awareness of industries, and the respective professional pathways	
Search and apply for a job	Awareness of higher education/up skilling (short-term) options Steps involved in online application for Instructor course, Apprenticeship and different jobs in popular site like the indiajobs.com, naukri.com, monsterindia.com, Govt. website.	
12.CustomerInteraction/ service		**Duration: 05 Hr. Marks:**
Greeting customers	Forms of greeting	
Probing-understanding Customer requirements	Use of positive body language	
Handling grievances	Handling grievances (Use of ask-listen-repeat technique)	
Relationship building with customers	Relationship building with customers, importance of probing.	
To identify the importance of probing	Use of open-ended/close-ended questions to gauge requirement	

Second Year-60 Hr		
Module	**Topics**	**Methodology**
1. English Literacy		**Duration: 20Hr. Marks:12**
Me/Myself,We/Ourselves	Greetings Introducing yourself Talking about your family Likes and dislikes	Student speaks & writes 1 paragraph about themselves
Role Models	Introduce their role model Discuss strength and weakness/ criticism etc. Adjectives, verbs, pronouns etc. all covered. Write-up about this person	Group activity–who are the role models of each group. Displayed on a chart with pictures and text– make a collage and present.
My Society	Describe your surrounding Changes in your environment Dos and dont's Dumping of garbage Use of plastic Water conservation Strength and weakness Roads /pollution Gardens	Summarizing the discussion Pictures of something in the past/ what it is now
My Interests	Theme parks Historical areas/cities (places) Adventure–sea, mountain, beaches Hobbies	Student speaks about their favorite place/area of interest/ hobby and why they like it
My Work	What they want to do	Bring a newspaper clipping/news

	Why they want to do it What do they know about this opportunity Competition/sector	item of that industry and discuss it [individual activity–everyone has to talk about it and write about it]
App based Learning	Actual speaking practice–all 4 skills tested Gamified Vernacular Capability Mapped to what is covered in class Benefits Interactive Self-confidence High engagement	App based learning practice by the trainee using popular apps available
2. Communication Skills		**Duration: 10 Hr.** **Marks: 12**
Personal	Reflection Template Revision Importance of Communication Managing Emotions Create online profile +Form al Introduction of self (based on the industry)	Self-reflection-Pg193 Case study from the workplace-videos Reflection on Industry visit Digital practice + Classroom Practice
Interpersonal	Giving and Receiving Feedback Communication based on context-Formal, Informal Verbal &Non-verbal Listening Skills Gender Sensitivity Application of Gender sensitivity	Burgar Feedback Template & Practice Role play and Peer Evaluation Role Play & Reflection Gender Pledge
Workplace Communication	Interview Preparation (With Resume, Formal Dress) Communication Etiquette: a. MobileApplicationsfor theworkplace b. FakeNews Customer Interaction a. Definingmycustomer(other department, client) b. Communicationbased on the customerbaseWorkplaceCommunication-Peer,Superior, Junior Formal Communication - Practice	Career Day: Scenario based activity, with Guest Lecture or HR person Reflection of Market Scan Trade specific examples + Role play Case Study, Role Play Case Study, Digital practice via email
3.I.T.Literacy		**Duration: 10Hr.**

		Marks: 10
MS-PowerPoint	Basics -creating, opening, closing, slide show	ppt, audiovisual, task-based activities.
File Conversion & Reducing file size	Identify file types, types of files- pdf, jpg, doc, excel, ppt Converting files to other types	ppt, demonstration & practice
Data/webcasting Through mobile	Casting desktop application or web application By WIFI or Bluetooth	Demonstration &practice
Server & cloud computing	Introduction to server and cloud computing accessing, storing and retrieving file through google drive	audio visual, task-based activity, demonstration
Language translation	Language translation throughvoice Voice to text, text to voice application	task-based, demonstration
Customize and use online CVs	Access CV templates online Customize CVs as per requirement	task-based, demonstration
Artificial Intelligence	latest technology based model or simulated software	Demonstration &practice
4. Entrepreneurship Skills		**Duration: 10Hr.** **Marks:6**
Entrepreneurship Mindset	Aspect of inspiring/motivating should be sprinkled across all topics. Recall the qualities/characteristics. Being a leader (your values, personal code of conduct)(ownership for my enterprise). Listen, Learn and Observe (framework of an effective leader) Grit (***Addressing difficulties/ challenges in an entrepreneur's life positively***) Managing personal time ***Focus on breaking myths related to entrepreneurship wherever possible.***	Share experience of successful entrepreneurs (examples of alumni from ITI)(Can be given as an instruction to teachers)
Opportunity identification	Selection of type of business - Product/service/trading UVP–unique idea about the	Systems thinking and then doing market research (***related to***

	business Being environment friendly (to be touched upon in as many activities that learner is taking part in) Reminder about Business model framework	***innovation and problem solving done by other players in the market***)
Being Resourceful	Being resourceful Identify ways of being resourceful– Inexpensive ways of marketing Networking Importance of Networking (interpersonal skills, communication skills related activity) How to connect (through Net and otherwise– bring in English and IT skills related activity) Business model revisit	communication skills related activity project English and IT skills related activity Business model revisit Connecting with likeminded people
Ease of Doing Business	Single window mechanism for running thebusiness How to apply for business, awareness of statutory compliances, and govt or non govt schemes Business model revisit activity	learner can be directed to it through communication and inter personal focused activities
Managing Resources	Human resource (customers and internal employees or other entities in the business cycle) Finance(activities to bring about importance of financial literacy) Infrastructure (location, equipment, machinery etc.) Use of Internet (importance of IT skills)Business model revisit activity	Activities will bring about Importance of communication and interpersonal skills
Mentorship and Role Models	Importance of mentorship They will to look at mentors in their own ecosystem, connecting with them through Net or otherwise again.	Interpersonal skills, communication and IT skills can be reinforced
Learning Cycle	Business model revisit (it's an ever-evolving Model and you may need to revisit the model and different aspects of	Role Play/live demonstration Skills and attitudes displayed by other successful entrepreneurs

	it along with your own capabilities, revisit mindsets frequently, being a lifelong learner by being aware of skills and attitudes displayed by other successful entrepreneurs.	
5. Sustainable Career		**Duration:10 Hr.** **Marks:10**
Career Awareness	Learn and explore upcoming advances in the industry Students will be able to connect all the subsequent topics with real-life experience, and understand the importance of mastering career planning and readiness topics Gain exposure to a modern workplace from his/ her industry	Webinar / online pre-recorded lectures from industry representatives. Visit / view a video on online portal /interact with industry experts. A video about the evolution of workplace in the past few years (past to future). The students must get a template to record the insights from the visit/interaction like a simple worksheet.
Career Planning	Learn and apply growth mindset to career planning Ashok Leyland shares an example- they are undergoing an extensive tech. overhaul and technicians will have to learn new things to stay relevant/ updated in thei.r jobs. Learn about personal skills and interests Adapt to ever-changing business environment Learn about continuous upskilling/ re skilling learning requirements in their industry ITI students should be aware that their skilling Journey will continue for life, and will not end with the end of final year. Map career pathways within your sector	Case studies / self-awareness activities/ mapping the barriers to growth mind set in everyday life, and devising strategies to apply growth mindset through easy-to- implement actions everyday. Write 16PF, or other relevant personality tests that gives students an insight into their strengths, and also provides them a vocabulary to express their personal strengths and interests Case studies/team work activities to practice adaptability/ working in ambiguity /openness to change in industry. Online job search / advanced market scanning related to their chosen sectors- update your year 1market scan. Within the same market scan activity-explore both-jobs and self-employment opportunities Share a template on which students can envision their future of

		work - identify what your workplace looks liketoday - through market research, online content etc. and what it will look like in a decade. QA has developed videos on how new jobs will look different from today's jobs. Anticipate challenges (apprenticeships, untimely termination, location of job-be open to migration, assess cost of living etc.) Common future plan template –for planning a self- employment journey/career options Share relevant keywords / direction for conducting a career pathway search for each trade
Career Readiness	Practice writing technical evaluations / aptitude test. Communicate their fit (positive attitude /adaptability/self-led learner) during the interview. Final year students are placement read. Hence, placement preparation. Prepare and review final resume. Identify and apply for apprenticeships on NAPS. Register on government job portals (national and state). Learn and apply for DST / internship opportunities. Apply for jobs (practice reading key words in job descriptions, understand salaries and benefits) Request and receive feedback to improve performance. Develop cultural intelligence. Respecting gender equality at workplace. Cultivating professional attitude. Apply green practices in life and career.	Conduct a mock interview exercise involving a panel, which includes industry representative, college faculty, HR (desired) Scores/internship experience etc. is most relevant Employment Exchange / Youth Employability Services What is an internship? Structured and unstructured. State Skill Development Missions portals. Respecting my time/others time, work/life balance, cooperativeness/ quality conscious /teamwork/empathy /commitment/ deliver on time.

ANNEXURE-I

List of Tools and Equipment			
MECHATRONICS TECHNICIAN (For a batch of 20 candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TOOLS, EQUIPMENT &GENERAL OUTFIT			
1	Connectingscrewdriver(Minus)	10X100mm	08Nos.
2	Connecting screwdriver(Plus)	10 X 100 mm	08 Nos.
3	Screw driver set	Set of 7	8 Nos.
4	Insulated combination pliers	150 mm	8 Nos.
5	Insulated side cutting pliers	150mm	8 Nos.
6	Long nose pliers	150mm	8 Nos.
7	Soldering iron	25 Watt, 240 Volt	8 Nos.
8	Tweezers	150 mm	8 Nos.
9	Digital Multimeter	(3 3/4 digit) ,4000 Counts	08 Nos.
10	Soldering Iron Changeable bits	15 Watt, 240 Volt	10 Nos.
11	De- soldering pump electrical heated, manual operators	230 V, 40 W	08 Nos.
12	Steel Rule with metric	150 mm, Stainless steel	16 nos.
13	Try Square.	150 mm blade	16 nos.
14	Centre Punch	10 mm and Length - 120	16 nos.
15	Chisel cold flat	20 mm X 150 mm High	16 nos.
16	Safety goggles.		16 nos.
17	Dot punch	100 mm	16 nos.
18	Safety Helmets		16 nos.
B. SHOP TOOLS, INSTRUMENTS –			
19	Steel measuring tape	3 meter	4 Nos.
20	Tools makers vice	125mm (clamp)	16 Nos.
21	Micrometer outside.	0 - 25 mm	2 nos.
22	Micrometer outside.	25 - 50 mm	2 nos.
23	Micrometer outside.	50 - 75 mm	2 nos.
24	Vernier caliper	150 mm	16 nos.
25	Vernier height gauges	0 - 300 mm with least count =0.02 mm	16 nos.
26	Surface plate C.I/Granite with Stand and Cover	600 x 600 mm	16 nos.
27	V-Block pair with clamps	150 x 100 x 100 mm	16 nos.
28	Angle plate	150 X 150 X 250 mm	16 nos.
29	Punch letter set.	3 mm	4 no.
30	Punch number set.	3 mm	4 no.
31	Portable hand drill (Electric)	0 to 13 mm Capacity	1 no.

3233	Drill twist straight shank	3 mm to 12 mm by 0.5 mm	2 sets
34	Drill twist Taper shank	8 mm to 20 mm by 0.5 mm	2 sets
35.	Taps and dies complete set	5, 6, 8, 10 & 12 mm set of 5	16 Sets
36.	File card.	3"x5" size, brass or steel wire	16 nos.
37.	Oil Can	250 ml	2 nos.
38	Spanner- Double Ended	6x7, 8x9, 10x11, 12x13,14x15, 16x17, 18x19, 20x22	1 set each
39.	Spanner adjustable	150 mm	2 nos.
40.	Clamp "C"	100 mm	4 nos.
41.	Hand Reamer set (Tapar pin straight flute)	Nominal Dia 6, 8, 10, 12, 16mm	1 set
42.	Chisel cold flat	9 mm X 100 mm	8 nos.
43.	Drill chuck with key	12 mm.	2 no.
44.	File flat bastard	200 mm	16 Nos.
45.	File flat second cut	200 mm	16 Nos.
46	File flat smooth	200 mm	16Nos.
47	Scriber straight	150 mm	16Nos.
48	Hammer ball pen	500 grams	8 No.
49	Allen key set (Hexagonal -set of 9)	1 - 12 mm, set of 24 Keys	8 No.
50	Tubular box spanner	Set - 6 - 32 mm	1 set.
51	Hacksaw frame adjustable	300 mm	16 Nos.
52	Chisel - Cold – Flat	10 mm X 150 mm	1 No.
53	Scissors	200mm	1 No.
54	Hand Drill Machine Electric with Hammer Action	13 mm	2 Nos.
55	First aid kit		1 No.
56.	Crimping tool (pliers)	7 in 1	2 Nos.
List of electronics Equipment			
57	DC Regulated Variable DC Power Supply	0-30V/3A	8 Nos.
58	LCR meter (Digital) Handheld		1 No.
59	CRO Dual Trace	20 MHz (component testing facilities)	8 Nos.
60	Battery Charger	0 - 6 - 9 - 12 - 24 - 48 V, 30	1 No.
61	Digital multimeter		8 Nos.
62	Clamp meter	0 - 10 A	2 Nos.
63	Function generator (DDS Technology (Sine, Square, Triangle, Ramp, Pulse, Serial Data, TTL and Modulation.)	1 mHz -10 MHz Function-Pulse – Modulation Generator with Built in 40MHz Frequency Counter	8 Nos.
64	Autotransformer	15 Amps	2 Nos.

65	Digital IC Trainer	Breadboard for Circuit design with necessary DC Power Supply Clock Frequency 4 different steps, Data Switches: 8 Nos, LED Display: 8 Nos. (TTL), Seven Segment Display,	1 Nos.
66	Digital IC Tester		1 No.
67	Laptops latest configuration		4 No.
68	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
63	Electrical training kits		4 No.
69	Domestic wiring kits		8 Nos
70	Motor control kit		4 No.
71	Sensor Trainer Kit Containing following Sensors 1. RTD 2. Smoke Detector Sensors 3. Limit Switch 4. Photo sensors 5.Optocouplor 6.Proximity Sensor		4 Nos.
C. Shop Floor Furniture and Materials -.			
72	Instructor's table		1 No.
73	Instructor's chair		2 Nos.
74	Metal Rack	100cm x 150cm x 45cm	4 Nos.
75	Lockers with 16 drawers standard		
76	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 Nos.
77	Black board/white board		1 No.
78	Fire Extinguisher		2 Nos.
79	Fire Buckets		2 Nos.
D. GENERAL MACHINERY INSTALLATION-			
80	Pillar Type Drilling machine	Sensitive 0-20 mm cap. with swivel table motorised with	2 no.
81	Drilling machine bench	Sensitive 0-12 mm cap motorised with chuck and key.	2 nos.
82	D.E. pedestal Grinding machine with wheels rough and smooth	2 H.P.-3Phase-415V, 1500 rpm,250 Dia wheel	1 no.
E. LIST OF ADDITIONAL TOOLS FOR ALLIED TRADE IN WELDING			
83	Transformer welding set -	300 A, OCV 60 - 100 V,	
84	Welder cable	Able to carry 300 amps. With	
85	Lugs for cable		12

86	Earth clamps.		2 Nos.
87	Arc welding table (all metal top)	1200 X 1200 X 750 mm	
88	Chipping hammer.		4 Nos
89	Gloves (Leather)		4 Pairs
90	Leather apron.		4 Nos
91	Welding goggles		4
92	Welding helmet with coloured		
F. LIST OF TOOLS & ACCESSORIES FOR PNEUMATICS AND HYDRAULICS-			
1	Compressor unit	suitable for Pressure: 8 bar, Delivery: 50 lpm (or more), Reservoir capacity: 24 Litres (or more), 230V, 50 Hz, with	1 No.
2	Pneumatic Trainer Kit, each consisting of the following matching components and accessories:		04 sets
	I. Single acting cylinder	Max. stroke length 50 mm, Bore dia 20 mm	1 No
	II. Double acting cylinder	Max. stroke length 100 mm, Bore dia 20 mm, magnetic type	1 No
	III. 3/2-way valve	manually-actuated, Normally	2 Nos
	IV. 3/2-way valve	pneumatically-actuated, spring	1 No
2	V. One-way flow control valve		2 Nos
	VI. 5/2-way valve	with manually-operated switch	1 No
	VII. 5/2-way valve	pneumatically-actuated, spring	1 No
	VIII. 5/2-way pneumatic actuated valve	double pilot	1 No
	IX. 3/2-way roller lever valve	direct actuation Normally	2 Nos
	X. Shuttle valve (OR)		1 No
	XI. Two-pressure valve (AND)		1 No
	XII. Pressure gauge	0-16 bar	1 Nos
	XIII. Manifold with self-closing	NRV, 6-way	1 No
	XIV. Pushbutton station for electrical signal input	with 3 illuminated momentary-contact switches (1 NO + 1 NC) and 1 illuminated maintained-contact switch (1 NO + 1 NC),	1 No
	XV. Relay station	with 3 ralays each with 4 contact sets (3NO+1NC or	1 No
	XVI. 3/2-way single solenoid valve	with LED	1 No
	XVII. 5/2-way single solenoid valve	with manual override and LED	1 No
	XVIII. 5/2-way double solenoid valve	with manual override and LED	1 No
	XIX. Power supply unit,	Input voltage 85 – 265 V AC, Output voltage: 24 V DC, Output current: max. 4.5 A, short-	1 No

	XX. Profile plate, Anodised Aluminium	1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto the pneumatic workstation)	1 sets
3	Pneumatic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide:	(1) Work Table – Size(Approx.) L1200mmXW900mmXH900mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mmxW495mm xH158mm each, and overall size of Drawer unit (Approx.) - L470mmxW495mmxH825mm and (3) Drawer slide height	1 No
4	Carrier for mounting components, such as PB & relay boxes.		1 No
5	Cut section model for pneumatic components		1 set
6	Hydraulic Trainer Kit, each consisting of the following matching components and accessories:		01 set
	I. Hydraulic Power pack	with (1) external gear pump having a delivery rate of 2.5 lpm, (approx.) @ 1400 rpm operating pressure 60 bar, coupled to a single-phase AC motor (230 V AC) having start capacitor and ON/OFF switch and overload protection, (2) pressure relief valve adjustable from 0 – 60 bar, (3) oil reservoir, ≥5 litres capacity	1 No.
	II. Pressure relief valve	pilot-operated	1 No
	III. Drip tray, steel	size 1160 mm x 760 mm.	1 No.
	IV. Pressure Gauge	Glycerin-damped, Indication range of: 0 – 100 bar	1 No.
	V. Four-Way distributor	with five ports, equipped with a pressure gauge	1 No.
	VI. Double acting hydraulic cylinder	with a control cam, Piston diameter16 mm, Piston rod diameter10 mm, Stroke length 200 mm.	1 No.
	VII. Suitable Weight	for vertical loading of hydraulic	1 No.
	VIII. Mounting kit for weight	for realizing pulling and pushing load.	1 No.
	IX. 3/2-way directional control valve	with hand lever actuation.	1 No.

	X. 4/2-way directional control valve	with hand lever actuation.	1 No.
	XI. 4/3-way directional control valve	closed-centre position, with hand lever actuation.	1 No.
	XII. Non-return valve.		1 No.
	XIII. Pilot-operated check valve	pilot to open.	1 No.
	XIV. One-way flow control valve	with integrated check valve.	1 No.
	XV. T-Connector with self sealing coupling nipples (2 Nos.) and quick coupling socket (1 No.).		2 Nos.
	XVI. Profile plate,	Anodised Aluminium, 1100x700 mm, with carriers, mounting frames and mounting accessories (To be fitted onto	1 set
7	Hydraulic Workstation with 40 square mm aluminium profile legs, wooden work surface, and one pedestal drawer unit having 5 drawers, each with handles and individual locks, on metallic full panel drawer slide:	(1) Work Table – Size(Approx.) L1200mmXW900mmXH900mm, with four castor wheels including two lockable wheels at the front side, (2) Drawer – Size (Approx.) – L460mmxW495mm xH158mm each, and overall size of Drawer unit (Approx.) - L470mmxW495mmxH825mm and (3) Drawer slide height	1 No
8	Cut-section models for hydraulic components		1 set

ANNEXURE - II

TRAINEE INTERNAL ASSESSMENT REPORT							
Name:					Batch No.:		
Card ID No.					Dept:		
Attendance %:					Trade:		
Quarters	**Month**	**Attend %**	**Month**	**Attend %**	**Month**	**Attend %**	**Quarterly Average Attend %**
Qtr – 1							
Qtr – 2							
Qtr – 3							
Qtr – 4							

General Assessment

Sl No.	**Attributes**		**Score Qtr - 1**	**Score Qtr - 2**	**Score Qtr – 3**	**Score Qtr - 4**	**Score Sum of 4 Qtr Qtr – Sum**
1	Safety	Knowledge, follow safety precautions and rules					
2	Sense of Responsibility	Does he obey Sup/Line i/c instructions					
		Does he attend shift start meetings regularly					
		Does he take supervisors feedback properly					
		Whether he takes planned leaves					
		Does he participates in new drives					
		Does he take care in handling tools					
		Is Punctual					
		Positive, Behaviour , response, learning					
		Maintain 5S at his work station					
		Co-operation - Consider team work, willingness to work with and for others					
		Able to identify and report irregularities at his work place					
3	Method	Follow WIS/MOS					
		Able to check faults of previous station					
		Understands tools/equipment functions and its different parts					
		Able to perform the job independently					
4	Speed	Able to match line "TACT" time					
		Willingness to learn/flexibility for alternate job					
		Work completion/target achievement					
5	Quality	Able to contain defects					
		Awareness about GCA/PDI					
		Skill acquired during "On job training"					
		Total Score					
		Max Marks.					

(Fill score in relevant box) Excellent: 4, Very Good: 3, Good: 2, Fair: 1, Need Improvement: 0

Remarks (Supervisor):Mention Achievement / Critical Incidents							
Remarks (Shift In charge / Dept Manager)							
Remarks (ITP Training Coordinator)							