Industrial Training Institute

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

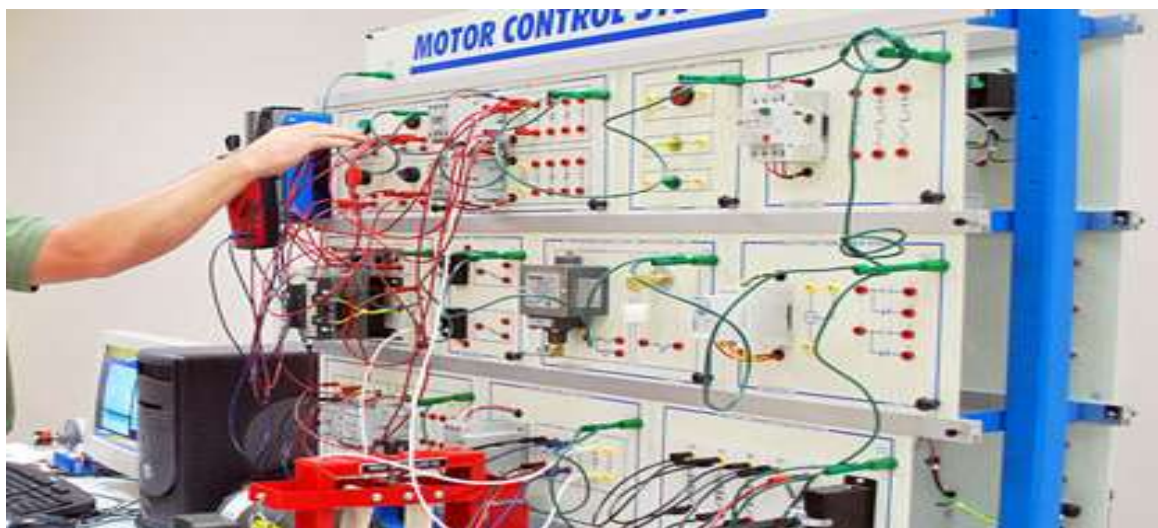**COMPETENCY BASED CURRICULUM**

TECHNICIAN POWER ELECTRONICS SYSTEMS

(Revised in 2017)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

SECTOR –ELECTRONICS & HARDWARE

Industrial Training Institute

Directorate General of Training

Skill India
कौशल भारत - कुशल भारत

TECHNICIAN POWER ELECTRONICS SYSTEMS

(Engineering Trade)

(Revised in 2017)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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![ITI Logo]
Industrial Training Institute

Technician Power Electronics Systems

ACKNOWLEDGEMENT

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\multicolumn{4}{l}{Date of Trade Committee Meeting: 16.05.2017 at I.T.I. AUNDH, PUNE, MAHARASHTRA}

S No.	Name & Designation Sh/Mr/Ms	Organization	Remarks
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4.	Dipak Ghule, Sr. Engineer	Micro Embedded Technologies, Pune	Member
5.	V. Ravi,C.E.O.	Anshuman Technologies Pvt. Ltd., Pune	Member
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9.	Pravin S Deode, MD	Sap Engineers & Consultant, Pune-38	Member
10.	Amol Kadu, Sr. Engineer	NVIS Technologies Pvt.Ltd., Indore, Electronics Complex, Pardeshipura	Member
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18.	Uday Apte, Div. Manager (Trg.)	Tata Motors, Sanand, Gujarat	Member
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21.	L.K. Mukherjee, Deputy Director	CSTARI, Kolkata	Member
22.	HN Bargal, Training Officer	DVET, Mumbai	Member
23.	Meera Karad, Instructor	ITI, Aundh, Pune	Member
24.	P Bairagi, Training Officer	CSTARI, Kolkata	Member
25.	Mrs. Deblina Roy, Instructor	Don Bosco, Kolkata	Member
26.	Mrs. Keya Basu, Supervisor	ITI Tollygunge, Kolkata	Member

MEMBERS OF SECTOR MENTOR COUNCIL			
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27.	Z A Gadyal, JTO	ITI, Belgaum	Member
28.	M V Pillai, GI	ITI, Thane	Member

Technician Power Electronics Systems

CONTENTS

1. COURSE INFORMATION

During the two years duration of Technician Power Electronics Systems trade, a candidate is trained on Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Calculation & Science and Employability Skill. In addition to this, a candidate is entrusted to undertake project work and extracurricular activities to build up confidence. The broad components covered related to the trade are categorized in four semesters each of six months duration. The semester wise course coverage is categorized as below:

1stSemester – In this semester, the trainee learns about safety and environment, use of fire extinguishers, artificial respiratory resuscitation to begin with. He gets the idea of trade tools & its standardization, familiarize with basics of electricity, test the cable and measure the electrical parameter. Skilling practice on different types & combination of cells for operation and maintenance of batteries being done. Identify and test passive and active electronic components. Construct and test unregulated and regulated power supplies. Practice soldering and de-soldering of various types of electrical and electronic components on through-hole PCBs. Assemble a computer system, install OS, Practice with MS office. Use the internet, browse, create mail IDs, download desired data from internet using search engines.

2nd Semester – In this semester, the candidate will be able to construct and test amplifier, oscillator and wave shaping circuits. Testing of power electronic components. Construct and test power control circuits. Identify and test opto-electronic devices. Able to achieve the skill on SMD Soldering and De-soldering of discrete SMD components. Verifying the truth tables of various digital ICs by referring Data book. Practice circuit simulation software to simulate and test various circuits. Identify various types of LEDs, LED displays and interface them to a digital counter and test. Construct and test various circuits using linear ICs 741 & 555.

3rd Semester – In this semester, the trainee will be able to operate DSO and perform various functions. Gaining the skill by practicing SMD Soldering and De-soldering. Introduction with protection devices. Familiarize with the instruction set of 8051 microcontroller. Interface a model application with the Microcontroller kit and run the application. Working with three phase rectifier, chopper, SMPS, inverters and UPS. Interpret electrical control circuits used in industries. Installation and setup of fibre-optic communication system. Identify construction of various electro-pneumatic circuits. Make simple project applications using ICs, transformer and other discrete components.

4th Semester – In this semester, the trainee will work on installing a solar panel, execute testing and evaluate performance by connecting the panel to the inverter. Operation of different process sensor, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments. Assemble, test & troubleshoot various digital controlled

field devices and execute the result. Perform speed control of DC machine and single phase and 3-phase AC machines. Install, configure and check the performance of AC and DC drive to control the speed. Perform speed control of servo motor and test different industrial process circuit by selecting the suitable function. Install, test & control the Electro-Pneumatic actuators using various pneumatic valves. Execute the operation of different indication on PLC modules and wire different field devices of PLC and configure the system and perform the suitable function.

2.1 GENERAL

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

Technician Power Electronics Systemstrade under CTS is one of the popular newly designed courses. The earlier course was Industrial Electronics. The course is of two years (04 semester) duration. It mainly consists of trade (skills and knowledge) and Core area (Workshop Calculation and Science, Engineering Drawing and Employability Skills). After passing out the training programme, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job, repair and maintenance work.
- Check the job with circuit diagrams/components as per drawing for functioning, diagnose and rectify faults in the electronics Components/modules.
- Document the technical parameters in tabulation sheet related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/ Technical education.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).

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

2.3 COURSE STRUCTURE:

The training duration of course in hours during a period of two-years (04 semesters) is as follows-

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2184
2	Professional Knowledge (Trade Theory)	504
3	Workshop Calculation & Science	168
4	Engineering Drawing	252
5	Employability Skills	110
6	Library & Extracurricular activities	142
7	Project work	320
8	Revision & Examination	480
	Total	**4160**

2.4 ASSESSMENT & CERTIFICATION

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 two semesters itself.

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

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NTC will be conducted by NCVT at the end of each semester as per the guideline of Government of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be 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 40%. For the purposes of determining the overall result, 25%weightage is applied to the result of each semester examination.

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 of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examining 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. - Below 70% tolerance dimension 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% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) 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% tolerance dimension achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

Brief description of job roles:

Electronics Fitter, General fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use. Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment; dismantles equipment if required and replaces faulty parts or wiring.

Electronics Fitter, other include all other workers engaged in fitting, assembling, repairing and maintaining electronic equipment, machinery, appliances, etc., not elsewhere classified.

Electronics Mechanic; Electronic Equipment Mechanic repairs electronic equipment, such as computers, industrial controls, transmitters and telemetering control systems following blueprints and manufacturer's specifications and using hand tools and test instruments. Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose cause of malfunction. Tests electronic components and circuits to locate defects, using instruments, such as oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and wiring and adjusts mechanical parts, using hand tools and soldering iron. Aligns, adjusts and calibrates testing instruments. Maintains records of repairs, calibrations and test.

Solar Panel Installation Technician is also known as 'Panel Installer', the Solar Panel Installation Technician is responsible for installing solar panels at the customers' premises. The individual at work checks the installation site, understands the layout requirement as per design, assesses precautionary measures to be taken, installs the solar panel as per customer's requirement and ensures effective functioning of the system post installation.

Optical Fiber Technician is responsible for maintaining uptime and quality of the network segment (both optical media and equipment) assigned to him by undertaking periodic preventive maintenance activities and ensuring effective fault management in case of fault occurrence. He is also required to coordinate activities for installation and commissioning of Optical Fibre Cable (OF) as per the route plan.

Field Technician: UPS and Inverter is also called, 'UPS Repair Technician', this is an after sales service job for installing and providing support to customers of different types of UPS and inverters. The individual at work installs the newly purchased UPS or inverter. The individual also interacts with customers to diagnose problems in them, assesses possible causes, rectifies faults or replaces faulty modules or recommends factory repairs for bigger faults as per the route plan.
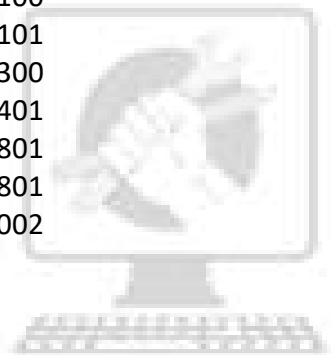
PLC Assembly Operator; is responsible for completing the printed circuit board (PCB) and box assembly of the PLC components. The individual at work assembles the power supply and micro-controller PCBs, sends them for programming and completes the box assembly thereafter.

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

Reference NCO-2015:

(i)	7421.0100
(ii)	7421.0101
(iii)	7421.0300
(iv)	7421.1401
(v)	7422.0801
(vi)	7421.0801
(vii)	8212.2002

4. GENERAL INFORMATION

Name of the Trade	Technician Power Electronics Systems
NCO – 2015	7421.0100, 7421.0101, 7421.0300, 7421.1401, 7422.0801, 7421.0801, 8212.2002
NSQF Level	Level -5
Duration of Craftsmen Training	2 Years (04 Semesters each of six months duration)
Entry Qualification	Passed 10th class examination under 10+2 System of education
Unit Strength (No. Of Students)	20 (Max. Supernumeraries seats: 6)
Space Norms	56 Sq M
Power Norms	3.04 KW
Instructors Qualification for	
1. Technician Power Electronics System Trade	Degree in Electronics/ Electronics and Telecommunication/ Electronics and Communication Engineering from recognized Engineering College/ university with one year experience in the relevant field. **OR** Diploma in Electronics/ Electronics and telecommunication/ Electronics and communication from recognized board of technical education with two-year experience in the relevant field. **OR** NTC/ NAC passed in the Trade With three-year post qualification experience in the relevant field. **Desirable:** Preference will be given to a candidate with CIC (Craft Instructor Certificate) in **Technician Power Electronics System** trade. ***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	Degree in Engineering with one year experience. **OR** Diploma in Engineering with two-year experience. **Desirable:** 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-year experience.
	OR
	NTC/ NAC in the Draughtsman (Mechanical/ Civil) with three-year experience.
	Desirable:
	Craft Instructor Certificate in RoD &A course under NCVT.
4. Employability Skill	MBA OR BBA with two-year experience OR Graduate in Sociology/ Social Welfare/ Economics with two-year experience OR Graduate/ Diploma with two-year 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

Distribution of training on Hourly basis: (Indicative only)

Total Hours / Week	Trade Practical	Trade Theory	Work shop Cal. &Sc.	Engg. Drawing	Employability Skills	Extra-curricular Activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

NSQF level for Technician Power Electronics Systems trade under CTS: **Level 5**

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

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

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

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

The broad learning outcome of Technician Power Electronics Systems trade under CTS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

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

6. LEARNING/ ASSESSABLE 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

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Electronic Mechanic course of 02 years duration:

1. Apply safe working practices.
2. Comply with environment regulation and housekeeping.
3. Interpret & use company and technical communication.
4. Demonstrate basic mathematical concepts and principles to perform practical operations.
5. Understand and explain basic science in the field of study including simple machines.
6. Read and apply engineering drawing for different application in the field of work.
7. Understand and apply the concept in productivity, quality tools, and labour welfare legislation in day-to-day work to improve productivity & quality.
8. Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.
9. Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.
10. Utilize basic computer applications and internet to take benefit of IT developments in the industry.

6.2. SPECIFIC LEARNING OUTCOME

11. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.
12. Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.
13. Test & service different batteries used in electronic applications and record the data to estimate repair cost.
14. Plan and execute soldering & de-soldering of various electrical components like Switches, PCB & Transformers for electronic circuits.
15. Test various electronic components using proper measuring instruments and compare the data using standard parameter.

16. Assemble simple electronic power supply circuit and test for functioning.

17. Install, configure, interconnect given computer system(s) and demonstrate and utilize application packages for different application.

18. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.

19. Construct, test and verify the input/output characteristic of various analog circuits.

20. Plan and construct different power electronic circuits and analyse the circuit functioning.

21. Select the appropriate opto-electronics components and verify the characteristics in different circuit.

22. Assemble, test and troubleshoot various digital circuits.

23. Simulate and analyze the analog and digital circuits using Electronic simulator software.

24. Identify, place, solder and desolder and test different SMD discrete components and IC's package with due care and following safety norms using proper tools/setup.

25. Construct and test different circuits using IC 741 Operational amplifiers & IC 555 linear integrated circuits and execute the result.

26. Measure the various parameters by DSO and execute the result with standard one.

27. Rework on PCB after identifying defects from SMD soldering and de-soldering.

28. Construct different electrical control circuits and test for their proper functioning with due care and safety.

29. Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.

30. Plan and interface the LCD/ LED/ DPM panels to various circuits and evaluate performance.

31. Assemble, test and troubleshoot single phase & 3-phase controlled and uncontrolled rectifier using SCR.

32. Construct, test & repair different chopper using MOSFET and IC based DC-DC converter and execute the result.

33. Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.

34. Prepare fiber optic setup and execute transmission and reception.

35. Install a solar panel, execute testing and evaluate performance by connecting the panel to the inverter.

36. Execute the operation of different process sensor, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments.

37. Assemble, test & troubleshoot various digital controlled field devices and execute the result.

38. Perform speed control of DC machine and single phase and 3-phase AC machines.

39. Install, configure and check the performance of AC and DC drive to control the speed.

40. Perform speed control of servo motor and test different industrial process circuit by selecting the suitable function.

41. Install, test & control the Electro-Pneumatic actuators using various pneumatic valves.

42. Execute the operation of different indication on PLC modules and wire different field devices of PLC and configure the system and perform the suitable function.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING/ ASSESSABLE OUTCOME	
LEARNING/ ASSESSABLE OUTCOME	**ASSESSMENT CRITERIA**
1. Apply safe working practices	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements and according to site policy.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store/ dispose of dangerous goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures with regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
2. Comply with environment regulation and housekeeping.	2.1 Identify environmental pollution & contribute to the avoidance of instances of environmental pollution.
	2.2 Deploy environmental protection legislation & regulations.
	2.3 Take opportunities to use energy and materials in an environmentally friendly manner.
	2.4 Avoid waste and dispose waste as per procedure.
	2.5 Recognize different components of 5S and apply the same in the working environment.

3.	Interpret & use company and technical communication.	3.1	Obtain sources of information and recognize information.
		3.2	Use and draw up technical drawings and documents.
		3.3	Use documents and technical regulations and occupationally related provisions.
		3.4	Conduct appropriate and target oriented discussions with higher authority and within the team.
		3.5	Present facts and circumstances, possible solutions &use English special terminology.
		3.6	Resolve disputes within the team.
		3.7	Conduct written communication.
4.	Demonstrate basic mathematical concepts and principles to perform practical operations.	4.1	Semester examination to test basic skills on arithmetic, algebra, trigonometry and statistics.
		4.2	Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
5.	Understand and explain basic science in the field of study including simple machine.	5.1	Semester examination to test basic skills on science in the field of study including friction, heat, temperature and simple machine.
		5.2	Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
6.	Read and apply engineering drawing for different application in the field of work.	6.1	Semester examination to test basic skills on engineering drawing.
		6.2	Applications will be assessed during execution of assessable outcome and will also be tested during theory and practical examination.
7.	Understand and apply the concept in productivity, quality tools, and labour welfare legislation in	7.1	Semester examination to test the concept in productivity, quality tools and labour welfare legislation.
		7.2	Applications will be assessed during execution of assessable outcome.

	day-to-day work to improve productivity & quality.		
8.	Explain energy conservation, global warming and pollution and contribute in day-to-day work by optimally using available resources.	8.1	Semester examination to test knowledge on energy conservation, global warming and pollution.
		8.2	Their applications will be assessed during execution of assessable outcome.
9.	Explain personnel finance, entrepreneurship and manage/organize related task in day-to-day work for personal & societal growth.	9.1	Semester examination to test knowledge on personnel finance, entrepreneurship.
		9.2	Their applications will be assessed during execution of assessable outcome.
10.	Utilize basic computer applications and internet to take benefit of IT developments in the industry.	10.1	Semester examination to test knowledge on basic computer working, basic operating system and uses internet services.
		10.2	Their applications will be assessed during execution of assessable outcome.

SPECIFIC LEARNING / ASSESSABLE OUTCOMES	
SEMESTER-I	
LEARNING/ ASSESSABLE OUTCOMES	**ASSESSMENT CRITERIA**
11. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.	11.1 Identify basic hand tools for fitting, riveting, drilling etc. with due care and safety.
	11.2 Fix surface mounting type of accessories in a panel board.
	11.3 Connect electrical accessories.
	11.4 Make and wire up of a test board and test it.
12. Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	12.1 Plan work in compliance with standard safety norms.
	12.2 Identify the type of electronic instruments.
	12.3 Determine the measurement errors while measuring resistance by voltage drop method.
	12.4 Extend the range of MC voltmeter and ammeter.
	12.5 Measure the value of resistance, voltage and current using digital multimeter.
	12.6 Calibrate analog multimeter.
13. Test &service different batteries used in electronic applications and record the data to estimate repair cost.	13.1 Identify tools and instruments for testing of batteries.
	13.2 Observe safety procedure during testing of batteries and work as per standard norms and company guidelines.
	13.3 Identify the primary and secondary cells.
	13.4 Measure and test the voltages of the given cells/battery using analog/ digital multimeter.
	13.5 Charging and discharging the battery.
	13.6 Maintain and estimate the repair cost of secondary battery.
	13.7 Use a hydro meter to measure the specific gravity of the secondary battery.

14. Plan and execute soldering & de-soldering of various electrical components like switches, PCB &transformers for electronic circuits.	14.1	Plan work in compliance with standard safety norms.
	14.2	Identify different types of mains transformers and test.
	14.3	Identify the primary and secondary transformer windings and test the polarity.
	14.4	Measure the primary and secondary voltage of different transformers.
	14.5	Solder the given components.
	14.6	Identify and test the variac.
	14.7	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
15. Test various electronic components using proper measuring instruments and compare the data using standard parameter.	15.1	Ascertain and select tools and materials for the job and make this available for use in a timely manner.
	15.2	Plan work in compliance with standard safety norms.
	15.3	Identify the different types of resistors.
	15.4	Measure the resistor values using colour code and verify the reading by measuring in multimeter.
	15.5	Identify the power rating using size.
	15.6	Measure the resistance, Voltage, Current through series and parallel connected networks using multimeter.
	15.7	Identify different inductors and measure the values using LCR meter.
	15.8	Identify the different capacitors and measure capacitance of various capacitors using LCR meter.
	15.9	Ascertain and select tools and materials for the job and make this available for use in.
16. Assemble simple electronic power supply circuit and test for functioning.	16.1	Practice soldering on components, lug and board with safety.
	16.2	Identify the passive/active components by visual appearance, Code number and test for their condition.
	16.3	Identify the control and functional switches in CRO and measure the D.C. & A.C. voltage, frequency and time

		period.
	16.4	Construct and test a half & full wave rectifiers with and without filter circuits.
	16.5	Construct and test a bridge rectifier with and without filter circuits.
	16.6	Construct and test a Zener based voltage regulator circuit.
17. Install, configure, interconnect given computer system(s) and demonstrate & utilize application packages for different application.	17.1	Plan, work in compliance with standard safety norms.
	17.2	Select hardware and software component.
	17.3	Install and configure operating systems and applications.
	17.4	Integrate IT systems into networks.
	17.5	Deploy tools and test programmes.
	17.6	Avoid e-waste and dispose the waste as per the procedure.
18. Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	18.1	Plan, analyze and estimate the cost of the particular project.
	18.2	Identify the various tools required for the job.
	18.3	Prepare the simple digital/analog electronic circuit.
	18.4	Simulate and test the prepared circuit.
	18.5	Assemble and test the circuit.
SEMESTER-II		
19. Construct, test and verify the input/ output characteristics of various analog circuits.	19.1	Ascertain and select tools and instruments for carrying out the jobs.
	19.2	Plan and work in compliance with standard safety norms.
	19.3	Practice on soldering components on lug board with safety.
	19.4	Identify the passive/active components by visual appearance, code number and test for their condition.
	19.5	Construct and test the transistor based switching circuit.
	19.6	Construct and test CB, CE & CC amplifier circuit.

		19.7	Ascertain the performance of different oscillator circuits.
		19.8	Construct and test clipper, clamper and Schmitt trigger circuit.
20.	Plan and construct different power electronic circuits and analyze the circuit functioning.	20.1	Construct and test of Transistor and JFET amplifiers, oscillators and multi vibrators.
		20.2	Construct and test a UJT as relaxation oscillator.
		20.3	Construct and test lamp dimmer using TRIAC/ DIAC with safety.
		20.4	Construct and test MOSFET, IGBT test circuit and apply for suitable operation with proper safety.
		20.5	Construct and test the universal motor speed controller using SCR with safety.
		20.6	Construct and test switching circuits using optical devices.
21.	Select the appropriate opto-electronics components and verify the characteristics in different circuit.	21.1	Plan work in compliance with standard safety norms.
		21.2	Identify the different types of LEDs and IR LEDs.
		21.3	Measure the resistance, voltage, current through electronic circuit using multimeter.
		21.4	Construct and test a circuit using photo transistor and verify its characteristics.
		21.5	Identify photocoupler/ optical sensor input/output terminals and measure the quantum of isolation between the terminals.
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.
		22.4	Construct an adder cum subtractor circuits and verify the truth table.
		22.5	Construct a decoder and encoder, multiplexer and de-multiplexer circuits and verify the truth table.
		22.6	Construct a multiplexer and de-multiplexer and verify the truth table.
		22.7	Construct and verify the truth table of various flip flop, counter and shift register circuits.

23. Simulate and analyze the analog and digital circuits using Electronic simulator software.	23.1	Plan the work incompliance with standard procedure.
	23.2	Prepare simple analog and digital electronic circuits using the simulator software.
	23.3	Simulate and test the prepared analog and digital circuits.
	23.4	Convert the prepared circuit into layout diagram.
	23.5	Explore various troubleshooting and fault finding by the resources provided in the simulation software.
24. Identify place, solder/ desolder and test different SMD discrete components and IC's package with due care and following safety norms using proper tools/setup.	24.1	Identify the various crimping tools for various IC packages.
	24.2	Identify different types of soldering guns and choose the suitable tip for the application.
	24.3	Practice soldering and de-soldering the different active and passive components, IC base on GPCBs using solder, flux, pump and wick.
	24.4	Make the necessary setting on SMD soldering station to solder and de-solder various ICs of different packages by following the safety norms.
	24.5	Identify SMD components, de-solder and solder the SMD components on the PCB.
	24.6	Check the cold continuity, identify loose/dry solder and broken track on printed wired assemblies and rectify the defects.
	24.7	Avoid waste, ascertain unused materials and components for safe disposal.
25. Construct and test different circuits using ICs 741operational amplifiers & ICs 555 linear integrated circuits and execute the result.	25.1	Demonstrate analog trainer kit with safety precautions.
	25.2	Identify various ICs, differentiate by code no. and test for their condition.
	25.3	Construct and test various OP-AMP circuits.
	25.4	Construct and test R-2R ladder type digital to analog converter circuit.
	25.5	Construct and test different configurations of 555 IC e.g. astable, monostable, bi-astable and VCO circuits.
SEMESTER-III		
26. Measure the various parameters by DSO and	26.1	Identify and demonstrate various control elements on front panel of a DSO.

execute the result with standard one.	26.2	Measure different parameters of electronic signals using DSO.
	26.3	Store the waveform of a signal in DSO.
	26.4	Connect DSO with a printer and take printout of signal waveforms.
27. Rework on PCB after identifying defects from SMD soldering and de-soldering.	27.1	Plan the work in compliance with standard safety procedures.
	27.2	Demonstrate various tools and accessories used in PCB rework.
	27.3	Construct a PCB to demonstrate defects on soldered joints.
	27.4	Repair defective soldered joints.
28. Construct different electrical control circuits and test for their proper functioning with due care and safety.	28.1	Measure the coil winding of the given motor.
	28.2	Prepare the setup and control an induction motor using a DOL starter by following the safety norms.
	28.3	Construct a direction control circuit to change direction of an induction motor.
	28.4	Connect an overload relay and test for its proper functioning.
29. Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.	29.1	Understand and interpret the procedure as per manual of Micro controller.
	29.2	Identity various ICs & their functions on the given Microcontroller Kit.
	29.3	Identify the address range of RAM & ROM.
	29.4	Write data into RAM & observe its volatility.
	29.5	Identify the port pins of the controller & configure the ports for Input & Output operation.
	29.6	Demonstrate entering of simple programs, execute & monitor the results.
30. Plan and interface the LCD/ LED/ DPM panels to various circuits and evaluate performance.	30.1	Identify LCD/LED Display module and its decoder/driver ICs and display a word on a two line LCD/LED.
	30.2	Measure/current flowing through a resistor and display it. Measure/current flowing through a sensor and

		display it on a LCD/LED module (DPM).
	30.3	Avoid waste and dispose the waste as per the procedures.
31. Assemble & repair power supply using SCR.	31.1	Ascertain and select tools and instruments for carrying out the jobs.
	31.2	Plan and work in compliance with standard safety norms.
	31.3	Practice on soldering components on lug board with safety.
	31.4	Identify the passive/active components by visual appearance.
	31.5	Construct & Test 3-phase uncontrolled half wave rectifier.
	31.6	Construct & Test 3-phase uncontrolled Bridge rectifier.
	31.7	Construct & Test single phase half control rectifier using SCR.
	31.8	Construct & Test single phase full control rectifier using SCR.
	31.9	Construct & Test 3 phase controlled rectifiers (half wave & bridge) using SCR.
32. Construct, test & repair different chopper using MOSFET and IC based DC-DC converter and execute the result.	32.1	Ascertain and select tools and instruments for carrying out the jobs.
	32.2	Plan and work in compliance with standard safety norm.
	32.3	Practice on soldering components on lug board with safety.
	32.4	Construct & test chopper circuit using MOSFET.
	32.5	Construct & test step up/step down type chopper circuit.
	32.6	Construct & test IC based DC –DC converter for different voltages.
33. Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	33.1	Identify the tools and equipments to perform the job with due care and safety.
	33.2	Dismantle the given stabilizer and find major sections/ ICs components.
	33.3	Identify various input and output sockets/ connectors of the given SMPS.

	33.4	Identify major sections/ ICs/components of SMPS.
	33.5	Identify and replace the faulty components and construct and test IC Based DC-DC converter for different voltages.
	33.6	Identify front panel control & indicators of UPS.
	33.7	Connect battery & load to UPS & test on battery mode.
	33.8	Open top cover of UPS & identify isolator transformer &UPS transformer& additional circuit other than inverter.
	33.9	Identify various circuit boards in UPS and monitor voltages at various test points.
	33.10	Test UPS under fault condition & rectify fault.
34. Prepare fiber optic setup and execute transmission and reception.	34.1	Plan and select appropriate tools to complete the job safely.
	34.2	Identify the resources and their need on the given fiber optic trainer kit.
	34.3	Make optical fibre setup to transmit and receive analog and digital data.
	34.4	Demonstrate and apply FM modulation and demodulation using OFC trainer kit using audio signal and voice link.
	34.5	Demonstrate PWM modulation and demodulation using OFC trainer kit using audio signal and voice link.
	34.6	Demonstrate PPM modulation and demodulation using OFC trainer kit using audio signal and voice link.
SEMESTER-IV		
35. Install a solar panel, execute testing and evaluate performance by connecting the panel to the inverter.	35.1	Select appropriate tools and equipment.
	35.2	Install a solar panel to a roof.
	35.3	Wire a solar panel to a solar controller.
	35.4	Wire a solar controller to a battery storage station.
	35.5	Connect storage batteries to a power inverter.
	35.6	Wire a power inverter to an electrical service panel.
	35.7	Connect and test solar panel to the Inverter and run the load.
	35.8	Installation of Solar Inverter.

36.	Execute the operation of the different process sensor, identify, wire & test various sensors of different industrial processes by selecting appropriate test instruments.	36.1	Ascertain and select tools, material for the job and make this available for use in the timely manner.
		36.2	Plan work in compliance with safety norms.
		36.3	Demonstrate possible solutions and tasks within the team.
		36.4	Identify sensors used in process industries such as RTDs, Temperature ICs, Thermocouples, proximity switches (inductive, capacitive and photoelectric), load cells, strain gauge. LVDT by their appearance.
		36.5	Measure temperature of a lit fire using a Thermocouple and record the readings referring to data chart.
		36.6	Measure temperature of a lit fire using RTD and record the readings referring to data chart.
		36.7	Measure the DC voltage of a LVDT.
		36.8	Detect different objectives using capacitive, inductive and photoelectric proximity sensors.
37.	Assemble, test & troubleshoot various digital controlled of field devices and execute the result.	37.1	Illustrate to practice the digital trainer kit with safety.
		37.2	Identify various digital ICs, test IC using digital IC tester and verify the truth table.
		37.3	Construct and verify the truth table of all gates using NOR and NAND gates.
		37.4	Construct an adder cum subtractor circuit and verify the truth table.
		37.5	Construct a decoder and encoder, multiplexer and a de-multiplexer circuits and verify the truth table.
		37.6	Construct a multiplexer and de-multiplexer and verify the truth table.
		37.7	Construct and verify the truth table of various flip flop, counter and shift register circuits.
38.	Perform speed control of DC machine and single phase and three phase AC	38.1	Identify different parts for different types of motor.
		38.2	Measure the coil resistance (armature and field) of AC and DC motor.

machines.	38.3	Connect & run DC shunt motor using 3 point starter.
	38.4	Control the speed of DC motor by armature control method and field control method.
	38.5	Construct PWM circuit and SCR chopper circuit for the speed control of DC shunt motors.
	38.6	Construct a self-hold contactor circuit and run a 3-Phase Induction Motor.
	38.7	Connect and run the motor (below 5hp) in star and delta connection, record the phase voltage, line voltage and line current.
	38.8	Connect and operate an induction motor using DOL starter.
	38.9	Connect and run a 3-phase motor using manual and automatic star-delta starters.
	38.10	Reverse the direction of rotation of Induction motor.
	38.11	Connect & run three phase induction motors in a sequence using contactor & relay.
39. Install, configure and demonstrate the AC and DC drive to control the speed.	39.1	Identify different cables and connectors used in the AC DRIVE setup.
	39.2	Identify various input and output terminals of the DRIVE unit, operator panel and display unit.
	39.3	Install of AC Drive(similar to SIEMENS MM-420/440)
	39.4	Adjust the pressure as per the requirements MM Drive Programming/Parameterization for different control operations.
	39.5	Perform ON/OFF, Forward/Reverse, Jog (R)/Jog (L), braking and speed control Familiarization with different parts and terminals of DC Drive.
	39.6	Perform Parameterization for variation of motor speed through POT with Armature voltage feedback (with internal setting), through POT with encoder feedback and external speed raise/ lower buttons.
40. Perform speed control of servo motor and test different industrial process circuit by selecting the suitable function.	40.1	Understand and interpret the procedure as per manual of servo motor.
	40.2	Select test methods and test use of different parts servo motor, test control circuits.
	40.3	Identify various IC and their functions on the given

			servo motor drive trainer kits.
	40.4	Construct a direction control of various parameters to change direction of a servo motor.	
	40.5	Write data into a RAM and observe its volatility.	
	40.6	Identify the port pins of the controller and configure the input and output operator.	
	40.7	Demonstrate entering of simple programs, execute and monitor the result.	
41. Install, test & control, the Electro-Pneumatic actuators using various pneumatic valves.	41.1	Identify different pneumatic and electro-pneumatic components.	
	41.2	Construct and control a single acting cylinder and double acting cylinder.	
	41.3	Construct and control single/double acting cylinder using series/ parallel circuits.	
	41.4	Construct and perform bidirectional control of a cylinder.	
	41.5	Construct and control, automatic return of a double acting cylinder.	
	41.6	Construct and control the oscillating motion of a double acting cylinder.	
	41.7	Construct and control a latching circuit using single or double acting cylinder.	
	41.8	Construct and control, automatic return initiated by a limit switch.	
42. Execute the operation of different indication on PLC modules and wire different field devices of PLC and configure the system and perform the suitable function.	42.1	Identify various indicators on PLC Modules and interpret.	
	42.2	Connect PLC hardware and configure the software.	
	42.3	Wire in various digital and analog input and output devices to the respective modules.	
	42.4	Develop and run simple programs to read sensor status and to control various outputs.	
	42.5	Perform online editing of a rung/network and prepare data tables and monitor.	

	SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE		
	FIRST SEMESTER- 6 MONTHS		
Week No.	**Reference Learning Outcome**	**Professional Skills (Trade Practical) with Indicative Hours**	**Professional Knowledge (Trade Theory)**
1	• Apply safe working practices	**Trade and Orientation** 1. Visit to various sections of the institute and identify location of various installations. (05 hrs) 2. Identify safety signs for danger, warning, caution & personal safety message. (03 hrs) 3. Use of personal protective equipment (PPE). (05 hrs) 4. Practice elementary first aid.(05 hrs) 5. Preventive measures for electrical accidents & steps to be taken in such accidents.(02 hrs) 6. Use of Fire extinguishers.(05 hrs)	Familiarization with the working of Industrial Training Institute system. Importance of safety and precautions to be taken in the industry/shop floor. Introduction to PPEs. Introduction to First aid. Response to emergencies e.g. power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Occupational safety &health: Health, safety and environment guidelines, legislations & regulations as applicable.
2-3	• Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.	**Hand tools and their uses** 7. Identify the different hand tools. (05 hrs) 8. Selection of proper tools for operation and precautions in operation. (07 hrs) 9. Care & maintenance of trade tools. (08 hrs) 10. Practice safety precautions while working in fitting jobs. (10 hrs) 11. Workshop practice on filing and hacksawing. (05 hrs) 12. Practice simple sheet metal works, fitting and drilling.(05	Identification, specifications, uses and maintenance of commonly used hand tools. State the correct shape of files for filing different profiles. Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets.

		hrs)	
		13. Make an open box from metal sheet. (10 hrs)	
4-5	• Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	**Basics of AC and Electrical Cables** 14. Identify the Phase, Neutral and Earth on power socket, use a testers to monitor AC power. (06 hrs) 15. Construct a test lamp and use it to check mains healthiness. (07 hrs) 16. Measure the voltage between phase and ground and rectify earthing. (05 hrs) 17. Identify and test different AC mains cables. (07 hrs) 18. Prepare terminations, skin the electrical wires/cables using wire stripper and cutter.(07 hrs) 19. Measure the gauge of the wire using SWG and outside micrometer. (05 hrs) 20. Refer table and find current carrying capacity of wires. (03 hrs) 21. Crimp the lugs to wire end. (05 hrs) 22. Measure AC and DC voltages using multimeter. (05 hrs)	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 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.
6	• Select and perform electrical/ electronic measurement of single range meters and calibrate the instrument.	**Single range meters** 23. Identify the type of meters by dial and scale marking/ symbols. (03 hrs) 24. Demonstrate various analog measuring Instruments. (03 hrs) 25. Find the minimum and maximum measurable range of the meter. (03 hrs) 26. Carryout mechanical zero setting of a meter. (05 hrs) 27. Check the continuity of wires,	Introduction to electrical and electronic measuring instruments. Basic principle and parts of simple meters. Specifications, symbols used in dial and their meaning.

		meter probes and fuse etc. (05 hrs) 28. Measure voltage and current using clamp meter. (06 hrs)	
7	• Test &service different batteries used in electronic applications and record the data to estimate repair cost.	**Cells & Batteries** 29. Identify the +ve and -ve terminals of the battery. (02 hrs) 30. Identify the rated output voltage and Ah capacity of given battery. (01 hr) 31. Measure the voltages of the given cells/battery using analog/ digital multimeter. (03 hrs) 32. Charge and discharge the battery through load resistor. (05 hrs) 33. Maintain the secondary cells. (05 hrs) 34. Measure the specific gravity of the electrolyte using hydrometer. (03 hrs) 35. Test a battery and verify whether the battery is ready for use or needs recharging. (06 hrs)	**Cells & Batteries** Construction, types of primary and secondary cells. Materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/battery. Selection of cells/ batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series/ parallel connection of batteries and purpose of such connections.
8-9	• Test various electronic components using proper measuring instruments and compare the data using standard parameter.	**AC & DC measurements** 36. Use the multimeter to measure the various functions (AC V, DC V, DC I, AC I, R) (08 hrs) 37. Identify the different types of meter for measuring AC & DC parameters (08 hrs) 38. Identify the different controls on the CRO front panel and observe the function of each control (12 hrs) 39. Measure DC voltage, AC voltage, time period using CRO sine wave parameters (10 hrs)	Introduction to electrical measuring instruments. Importance and classification of meters. Forces necessary to work a meter. MC and MI meters. Range extension, need of calibration. Characteristics of meters and errors in meters. Multimeter, use of meters in different circuits. Care and maintenance of meters. Use of CRO, Function generator, LCR meter

		40. Identify the different controls on the function generator front panel and observe the function of each control. (12 hrs.)	
10	• Plan and execute soldering & de-soldering of various electrical components like Switches, PCB & Transformers for electronic circuits.	**Soldering/ De-soldering and Various Switches** 41. Practice soldering on different electronic components, small transformer and lugs. (05 hrs) 42. Practice soldering on IC bases and PCBs. (05 hrs) 43. Practice de-soldering using pump and wick (02 hrs) 44. Join the broken PCB track and test (03 hrs) 45. Identify and use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries (05 hrs) 46. Make a panel board using different types of switches for a given application (05 hrs)	Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement. Soldering and De-soldering stations and their specifications. Different switches, their specification and usage.
11-13	• Test various electronic components using proper measuring instruments and compare the data using standard parameter.	**Active and Passive Components** 47. Identify the different types of active electronic components. (03 hrs) 48. Measure the resistor value by colour code and verify the same by measuring with multimeter. (03 hrs) 49. Identify resistors by their appearance and check physical defects. (02 hrs) 50. Identify the power rating of carbon resistors by their size. (03 hrs) 51. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage	Ohm's law and Kirchhoff's Law. Resistors; types of resistors, their construction & specific use, colour coding, power rating. Equivalent Resistance of series parallel circuits. Distribution of V & I in series parallel circuits. Principles of induction, inductive reactance. Types of inductors, construction, specifications, applications andenergy storage concept. Self and Mutual induction. Behaviour of inductor at low and high frequencies. Series and parallel combination, Q factor. Capacitance and Capacitive

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		sources. (09 hrs)	Reactance, Impedance.
		52. Measurement of current and voltage in electrical circuits to verify Kirchhoff's Law. (05 Hrs)	Types of capacitors, construction, specifications and applications. Dielectric constant. Significance of Series parallel connection of capacitors.
		53. Verify laws of series and parallel circuits with voltage source in different combinations. (05 hrs)	Capacitor behaviour with AC and DC. Concept of Time constant of a RC circuit.
		54. Measure the resistance, Voltage, Current through series and parallel connected networks using multimeter. (08 hrs)	Concept of Resonance and its application in RC, RL & RLC series and parallel circuit. Properties of magnets and their materials, preparation of
		55. Identify different inductors and measure the values using LCR meter. (05 hrs)	artificial magnets, significance of electro magnetism, types of cores.
		56. Identify the different capacitors and measure capacitance of various capacitors using LCR meter. (05 hrs)	Relays, types, construction and specifications etc.
		57. Identify and test the circuit breaker and other protecting devices. (05 hrs)	
		58. Dismantle and identify the different parts of a relay. (05 hrs)	
		59. Connect a timer relay in a circuit and test for its working. (03 hrs)	
		60. Connect a contactor in a circuit and test for its working. (02 hrs)	
		61. Construct and test RC time constant circuit. (04 hrs)	
		62. Construct a RC differentiator circuit and convert triangular wave into square wave. (05 hrs)	
		63. Construct and test series and parallel resonance circuit. (03 hrs)	
14-15	• Assemble simple	**Power Supply Circuits**	Semiconductor materials,

| | electronic power supply circuit and test for functioning. | 64. Identify different types of diodes, diode modules and their specifications. (05 hrs)
65. Test the given diode using multimeter and determine forward to reverse resistance ratio. (05 hrs)
66. Measure the voltage and current through a diode in a circuit and verify its forward characteristic. (08 hrs)
67. Identify different types of transformers and test. (03 hrs)
68. Identify the primary and secondary transformer windings and test the polarity (02 hrs)
69. Construct and test a half wave, full wave and Bridge rectifier circuit. (10 hrs)
70. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors. (05 hrs)
71. Identify and test Zener diode. (02 hrs)
72. Construct and test Zener based voltage regulator circuit. (05 hrs)
73. Calculate the percentage regulation of regulated power supply. (05 hrs) | components, number coding for different electronic components such as Diodes and Zeners etc.
PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications.
Forward current and Reverse voltage.
Packing styles of diodes.
Different diodes, Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple.
Working principles of Zener diode, varactor diode, their specifications and applications.
Working principle of a Transformer, construction, Specifications and types of cores used.
Step-up, Step down and isolation transformers with applications. Losses in Transformers.
Phase angle, phase relations, active and reactive power, power factor and its importance. |
| 16-20 | • Install, configure, interconnect given computer system(s) and demonstrate & utilize application packages for different application. | **Computer Hardware, OS, MS office and Networking**
74. Identify various indicators, cables, connectors and ports on the computer cabinet. (05 hrs)
75. Demonstrate various parts of the system unit and motherboard components. (05 hrs)
76. Identify various computer peripherals and connect it to | Basic blocks of a computer, Components of desktop and motherboard.
Hardware and software, I/O devices, and their working.
Different types of printers, HDD, DVD.
Various ports in the computer.
Windows OS
MS windows: Starting windows and its operation, file management using explorer, |

		the system. (05 hrs) 77. Disable certain functionality by disconnecting the concerned cables SATA/ PATA. (05 hrs) 78. Replace the CMOS battery and extend a memory module. (05 hrs) 79. Test and Replace the SMPS (05 hrs) 80. Replace the given DVD and HDD on the system (05 hrs) 81. Dismantle and assemble the desktop computer system. (10 hrs) 82. Boot the system from different options (05 hrs) 83. Install OS in a desktop computer. (05 hrs) 84. Install a Printer driver software and test for print outs. (05 hrs) 85. Install antivirus software, scan the system and explore the options in the antivirus software. (5 hrs) 86. Install MS office software. (05 hrs) 87. Create folder and files, draw pictures using paint. (05 hrs) 88. Explore different menu/ tool/ format/ status bars of MS word and practice the options. (08 hrs) 89. Explore different menu/ tool/ format/ status bars of MS excel and practice the options. (07 hrs) 90. Prepare power point presentation on any three known topics with various design, animation and visual effects. (05 hrs) 91. Convert the given PDF File	Display & sound properties, screen savers, font management, installation of program, setting and using of control panel, application of accessories, various IT tools and applications. Concept of word processing: MS word – Menu bar, standard tool bar, editing, formatting, printing of document etc. Excel – Worksheet basics, data entry and formulae. Moving data in worksheet using tool bars and menu bars, Formatting and calculations, printing worksheet, creating multiple worksheets, creating charts. Introduction to power point Basics of preparing slides, different design aspects of slides, animation with slides etc. Concept of Internet, Browsers, Websites, search engines, email, chatting and messenger service. Downloading the Data and program files etc. **Computer Networking:** Network features- Network media, Network topologies, protocols- TCP/IP, UDP, FTP, models and types. Specification and standards, types of cables, UTP, STP, Coaxial cables. Network components like hub, Ethernet switch, router, NIC Cards, connectors, media and firewall. Difference between PC & Server.

		into Word file using suitable software. (05 hrs) 92. Browse search engines, create email accounts, practice sending and receiving of mails and configuration of email clients. (05 hrs) 93. Identify different types of cables and network components e.g. Hub, switch, router, modem etc. (05 hrs) 94. Prepare terminations, make UTP and STP cable connectors and test. (05 hrs) 95. Connect network connectivity hardware and check for its functioning. (05 hrs) 96. Configure a wireless Wi-Fi network. (05 hrs)	
21	• Assemble simple electronic power supply circuit and test for functioning.	**IC Regulators** 97. Construct and test a +12V fixed voltage regulator. (05 hrs) 98. Identify the different types of fixed +ve and −ve regulator ICs and the different current ratings (78/79 series). (05 hrs) 99. Identify different heat sinks for IC based regulators. (02 hrs) 100. Observe the output voltage of different IC 723 metal/ plastic type and IC 78540 regulators by varying the input voltage with fixed load. (08 hrs) 101. Construct and test a 1.2 V – 30V variable output regulated power supply using IC LM317T. (05 hrs)	Regulated Power supply using 78XX series, 79XX series. Op-amp regulator, 723 regulator (Transistorized & IC based). Voltage regulation, error correction and amplification etc.
22-23	• Plan and carry out the selection of a	Make simple project applications using ICs, zener diode,	Discussion on the identified projects with respect to data of

project, assemble the project and evaluate performance for domestic/commercial applications.	transformer and other discrete components.
	  a) Full wave bridge rectifier with indicator.
	  b) Modular Rectifiers.
	  c) Transformer less 12V dual power supply.
	  d) Half wave dual power supply with zener diode.
	  e) Versatile regulated power supply.
	  f) AC/DC voltage tester.
	(Instructor will pick up any five of the project for implementation)
		the concerned ICs, components used in the project.

24-25	Revision	
26	Examination	

	SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE		

	SECOND SEMESTER – 06 MONTHS		

Week No.	Learning Outcome Reference	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
27	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Transistor** 102. Identify different transistors with respect to different package type, B-E-C pins, power, switching transistor, heat sinks etc. (05 hrs) 103. Test the condition of a given transistor using ohmmeter. (05 hrs) 104. Measure and plot input and output characteristics of a CE amplifier. (07 hrs) 105. Construct and test a transistor based switching circuit to control a relay (use Relays of different coil voltages and Transistors of different β). (08 hrs)	Construction, working of a PNP and NPN Transistors, purpose of E, B & C Terminals. Significance of α, β and relationship of a Transistor. Need for Biasing of Transistor. VBE, VCB, VCE, IC, IB, Junction Temperature, junction capacitance, frequency of operation. Transistor applications as switch and amplifier. Transistor input and output characteristics. Transistor power ratings & packaging styles and use of different heat sinks.
28-29	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Amplifier** 106. Construct and test fixed-bias, emitter-bias and voltage divider-bias transistor amplifier. (12 hrs) 107. Construct and test a common emitter amplifier with and without bypass capacitors. (05 hrs) 108. Construct and test common base amplifier. (05 hrs) 109. Construct and Test common collector/emitter follower amplifier. (05 hrs) 110. Construct and test Darlington amplifier. (05 hrs) 111. Construct and test a two stage RC Coupled amplifier.	Different types of biasing, various configurations of transistor (C-B, C-E & C-C), their characteristics and applications. Transistor biasing circuits and stabilization techniques. Classification of amplifiers according to frequency, mode of operation and methods of coupling. Voltage amplifiers- voltage gain, loading effect. Single stage CE amplifier and CC amplifier. Emitter follower circuit and its advantages. RC coupled amplifier,

		(05 hrs) 112. Construct and test a Class B complementary push pull amplifier. (08hrs) 113. Construct and test class C Tuned amplifier. (05hrs)	Distinguish between voltage and power amplifier, Push pull amplifier and class C tuned amplifier. Alpha, beta, voltage gain, Concept of dB dBm. Feedback and its types.
30	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Oscillators** 114. Demonstrate Colpitts oscillator, Hartley oscillator circuits and compare the output frequency of the oscillator by CRO. (07 hrs) 115. Construct and test a RC phase shift oscillator circuits. (05 hrs) 116. Construct and test a crystal oscillator circuits. (05 hrs) 117. Demonstrate Astable, monostable, bistable circuits using transistors. (08 hrs)	Introduction to positive feedback and requisites of an oscillator. Study of Colpitts, Hartley, Crystal and RC oscillators. Types of multivibrators and study of circuit diagrams.
31	• Construct, test and verify the input/ output characteristics of various analog circuits.	**Wave shaping circuits** 118. Construct and test shunt clipper. (06 hrs) 119. Construct and test series and dual clipper circuit using diodes. (07 hrs) 120. Construct and test clamper circuit using diodes. (05 hrs) 121. Construct and test Zener diode as a peak clipper. (07 hrs)	Diode shunt clipper circuits, Clamping/limiting circuits and Zener diode as peak clipper, uses their applications.
32-33	• Plan and construct different power electronic circuits and analyze the circuit functioning.	**Power Electronic Components** 122. Identify different power electronic components, their specification and terminals. (06 hrs) 123. Construct and test a FET Amplifier. (06 hrs) 124. Construct a test circuit of SCR using UJT triggering. (07hrs) 125. Identify different heat sinks used in SCRs. (03 hrs) 126. Construct a snubber circuit	Construction of FET & JFET, difference with BJT. Purpose of Gate, Drain and source terminals and voltage/ current relations between them and Impedances between various terminals. Heat Sink- Uses &purpose. Suitability of FET amplifiers in measuring device applications. Working of different power electronic components such as

		for protecting SCR use freewheeling diode to reduce back emf. (07 hrs) 127. Construct a jig circuit to test DIAC. (07 hrs) 128. Construct a simple dimmer circuit using TRIAC. (07 hrs) 129. Construct UJT based free running oscillator and change its frequency. (07 hrs)	SCR, TRIAC, DIAC and UJT.
34	• Plan and construct different power electronic circuits and analyze the circuit functioning.	**MOSFET & IGBT** 130. Identify various Power MOSFET by its number and test by using a multimeter. (05 hrs) 131. Identify different heat sinks used with various power MOSFET devices. (05 hrs) 132. Construct MOSFET test circuit with a small load.(05hrs) 133. Identify IGBTs by their numbers and test by using a multimeter. (05 hrs) 134. Construct an IGBT test circuit with a small load. (05 hrs)	MOSFET, Power MOSFET and IGBT, their types, characteristics, switching speed, power ratings and protection. Differentiate FET with MOSFET. Differentiate Transistor with IGBT.
35	• Select the appropriate opto-electronics components and verify the characteristics in different circuit.	**Opto-Electronics** 135. Test LEDs with DC supply and measure voltage drop and current using multimeter. (05 hrs) 136. Construct a circuit to test photovoltaic cell. (05 hrs) 137. Construct a circuit to switch a lamp load using photo diode. (05 hrs) 138. Construct a circuit to switch a lamp load using photo transistor. (05 hrs) 139. Identify optocoupler input and output terminals and measure the quantum of isolation between input/output terminals and	Working and application of LED, IR LEDs, Photodiode, photo transistor, their characteristics and applications. Optical sensor, Opto-couplers, circuits with Opto-Isolators. Characteristics of LASER diodes.

		operate a relay by connecting a switch. (05 hrs)	
36	• Assemble, test and troubleshoot various digital circuits.	**Basic Gates** 140. Identify different Logic Gates (AND, OR, NAND, NOR, EX-OR, EX-NOR, NOT ICs) with the number printed on them. (06 hrs) 141. Verify the truth tables of all Logic Gate ICs by connecting switches and LEDs. (08 hrs) 142. Construct and verify the truth table of all the gates using NAND and NOR gates. (06 hrs) 143. Use a digital IC tester to test the various digital ICs (TTL and CMOS). (05 hrs)	Introduction to Digital Electronics. Difference between analog and digital signals. Logic families and their comparison, logic levels of TTL and CMOS. Number systems (Decimal, binary, octal, Hexadecimal). BCD code, ASCII code and code conversions. Various Logic Gates and their truth tables.
37	• Assemble, test and troubleshoot various digital circuits.	**Combinational Circuits** 144. Construct Half Adder circuit using ICs and verify the truth table. (03 hrs) 145. Construct Full adder with two Half adder circuit using ICs and verify the truth table. (05 hrs) 146. Construct the adder cum subtractor circuit and verify the result. (05 hrs) 147. Construct and test a 2 to 4 Decoder. (03 hrs) 148. Construct and test a 4 to 2 Encoder. (03 hrs) 149. Construct and test a 4 to 1 Multiplexer. (03 hrs) 150. Construct and test a 1 to 4 DeMultiplexer. (03 hrs)	Combinational logic circuits such as Half Adder, Full adder, Parallel Binary adders, 2-bit and four bit full adders. Magnitude comparators. Half adder, full adder ICs and their applications for implementing arithmetic operations. Concept of encoder and decoder. Basic Binary Decoder and four bit binary decoders. Need for multiplexing of data. 1:4 line Multiplexer/De-multiplexer.
38	• Assemble, test and troubleshoot various digital circuits.	**Flip Flops** 151. Identify different Flip-Flop (ICs) by the number printed on them. (05 hrs) 152. Construct and test four bit latch using 7475. (05 hrs)	Introduction to Flip-Flop. S-R Latch, Gated S-R Latch, D-Latch. Flip-flop: Basic RS Flip Flop, edge triggered D Flip Flop, JK Flip Flop, T Flip Flop.

		153. Construct and test R-S flip-flop using IC7400 with clock and without clock pulse. (05 hrs) 154. Verify the truth tables of Flip-Flop ICs (RS, D, T, JK, MSJK) by connecting switches and LEDs. (10 hrs)	Master-Slave flip flops and Timing diagrams. Basic flip flop applications like data storage, data transfer and frequency division.
39-40	• Simulate and analyze the analog and digital circuits using the Electronic simulator software.	**Electronic circuit simulator** 155. Prepare simple digital and electronic circuits using the software. (10 hrs) 156. Simulate and test the prepared digital and analog circuits. (16 hrs) 157. Convert the prepared circuit into a layout diagram.(10 hrs) 158. Prepare simple, power electronic and domestic electronic circuit using simulation software. (14 hrs)	Study the library components available in the circuit simulation software. Various resources of the software.
41-43	• Assemble, test and troubleshoot various digital circuits.	**Counter & shift registers** 159. Construct and test a four bit asynchronous binary counter using 7493. (10 hrs) 160. Construct and test 7493 as a modulus-12 counter. (10hrs) 161. Construct and test a four bit Synchronous binary counter using 74163. (10 hrs) 162. Construct and test synchronous Decade counter. (05 hrs) 163. Construct and test an up/down synchronous decade counter using 74190 and monitor the output on LEDs. (10 hrs) 164. Identify and test common anode and common cathode seven segment LED display using a multimeter. (05 hrs) 165. Display the two digit count value on seven segment	Basics of Counters, types, two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. 3-bit Synchronous counters and synchronous decade counters. Types of seven segment display. BCD display and BCD to decimal decoder. BCD to 7 segment display circuits. Basics of Register, types and application of Registers.

		display using decoder/driver ICs. (05 hrs) 166. Construct a shift register using RS/D/JK flip flop and verify the result. (05 hrs) 167. Construct and test four bit SIPO register. (05 hrs) 168. Construct and test four bit PIPO register. (05 hrs) 169. Construct and test bidirectional shift registers. (05 hrs)	
44-47	• Construct and test different circuits using ICs 741operational amplifiers & ICs 555 linear integrated circuits and execute the result.	**Op – Amp & Timer 555 Applications** 170. Use analog IC tester to test the various analog ICs. (05 hrs) 171. Construct and test various Op-Amp circuits Inverting, Non-inverting and Summing Amplifiers. (15 hrs) 172. Construct and test Differentiator and Integrator (10 hrs) 173. Construct and test a zero crossing detector. (05 hrs) 174. Construct and test Instrumentation amplifier (10 hrs) 175. Construct and test a Binary weighted and R-2R Ladder type, Digital-to-Analog Converters. (15 hrs) 176. Construct and test Astable timer circuit using IC 555. (10 hrs) 177. Construct and test mono stable timer circuit using IC 555. (10 hrs) 178. Construct and test VCO (V to F Converter) using IC 555. (10 hrs) 179. Construct and test 555 timers as pulse width modulator (10	Block diagram and Working of Op-Amp, importance, Ideal characteristics, advantages and applications. Schematic diagram of 741, symbol. Non-inverting voltage amplifier, inverting voltage amplifier, summing amplifier, Comparator, zero cross detector, differentiator, Integrator and instrumentation amplifiers, other popular Op-Amps. Block diagram of 555, functional description w.r.t. different configurations of 555 such as monostable, astable and VCO operations for various application.

		hrs)	
48-50	• Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	Make simple project applications using ICs, transformer and other discrete components. a) Pencil charger indicator. b) Delayed automatic power on the circuit. c) Neon flasher circuit using IC741. d) UJT act as a relaxation oscillator. e) Up/down synchronous decade counter. f) Test a 4 to 1 multiplexer circuit. g) Dimmer circuit of Light & Fan using DIAC & TRIAC. h) Timer Circuit using IC-555. (The instructor will pick up any five of the project for implementation)	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.
51	Revision		
52	Examination		

	SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE		
	THIRD SEMESTER - 06 Months		
Week No.	**Learning Outcome Reference**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
53.	• Measure the various parameters by DSO and execute the result with standard one.	**Digital Storage Oscilloscope:** 180. Identify the different front panel control of a DSO.(05 hrs) 181. Measure the Amplitude, Frequency and time period of typical electronic signals using DSO &Store a portion of signal waveform using DSO. (07 hrs) 182. Take a print of a signal from the DSO by connecting it to a printer & tally with applied signal. (06 hrs) 183. Construct and test function generator using IC 8038. (07 hrs)	Block diagram of CRO and applications of CRO, application of digital CRO, block diagram of function generator. Differentiate a CRO with DSO. Advantages of DSO.
54	• Identify, place, solder, desolder and test different SMD discrete components and IC's package with due care and following safety norms using proper tools/setup.	**Basic SMD (2, 3, 4 terminal components)** 184. Identification of 2, 3, 4 terminals SMD components. (05 hrs) 185. De-solder the SMD components from the given PCB. (05 hrs) 186. Solder the SMD components on the same PCB. (05 hrs) 187. Check for cold continuity of PCB. (03 hrs) 188. Identification of loose/dry solder, broken tracks on printed wired assemblies. (07 hrs)	Introduction to SMD technology Identification of 2, 3, 4 terminals SMD components. Advantages of SMD components over conventional lead components. Soldering of SM assemblies - Reflow soldering. Tips for selection of hardware, Inspection of SM.

55-56	• Identify, place, solder and de-solder and test different SMD discrete components and IC's Package with due care and following safety norms using proper tools/setup.	**SMD Soldering and De-soldering:** 189. Identify various connections and the setup required for the SMD soldering station. (05 hrs) 190. Identification of crimping tools for various IC packages.(03 hrs) 191. Make the necessary settings on SMD soldering station to de-solder various ICs of different packages (at least four) by choosing proper clamping tools. (14 hrs) 192. Make the necessary settings on SMD soldering station to solder various ICs of different packages (at least four) by choosing proper clamping tools.(14 hrs) 193. Make the necessary setting rework of a defective surface mount component used soldering/de-soldering method. (14 hrs)	Soldering/ de-soldering of the above components. Identification of PGA packages. Soldering/ de-soldering of above PGA components. Cold/Continuity check of PCBs. Identification of lose/dry solders, broken tracks on printed wiring assemblies.
57-58	• Rework on PCB after identifying defects from SMD soldering and de-soldering.	**PCB Rework:** 194. Check and repair Printed Circuit Boards single, Double layer, and important tests for PCBs. (12 hrs) 195. Inspect soldered joints, detect the defects and test the PCB for rework. (08 hrs) 196. Remove the conformal coatings by different methods. (08 hrs) 197. Perform replacement of coating. (08 hrs)	ESD Control in Electronics Introduction to Static charges, Prevention of Static charges, Handling of static sensitive devices, Various standards for ESD Introduction to non-soldering interconnections Introduction to crimping, wire wrapping, Conductive adhesives, Chip on Board, Tape Automated bonding. Introduction to components, Printed Circuit Boards Introduction to components,

		198. Perform baking and preheating. (08 hrs) 199. Repair solder mask and damage pad. (06 hrs)	Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs Introduction to Static charges, prevention, handling of static sensitive devices, various standards for ESD. Introduction to non-soldering interconnections. Construction of Printed Circuit Boards (single, Double, multi-layer), Important tests for PCBs. Introduction to rework and repair concepts. Repair of damaged track. Repair of damaged pad and plated through hole. Repair of solder mask.
59	• Construct different electrical control circuits and test for their proper functioning with due care and safety.	**Protection devices:** 200. Identify different types of fuses along with fuse holders. (06 hrs) 201. Wire an MCB to a motor and run it. (04 hrs) 202. Test and rectify defects associated with MCBs.(07 hrs) 203. Connect an ELCB and test the leakage of an electrical motor control circuit. (08 hrs)	Fuse ratings, types of Fuses, Fuse bases, single/three phase MCBs, single phase ELCBs. Types of Contactors, contactor coils and working voltages, contactor contact currents, protection to contactors and high current applications.
60	• Construct different electrical control circuits and test for their proper functioning with due care and safety.	**Electrical control circuits:** 204. Measure the coil winding resistance of the given motor. (06 hrs) 205. Prepare the setup and Control an induction motor using a DOL Starter. (07 hrs) 206. Construct a direction	Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency, torque–speed characteristics, Starters used for Induction motors.

		control circuit to change the direction of an induction motor. (06 hrs) 207. Connect a overload relay and test for its proper function.(06 hrs)	
61-63	• Test, service and troubleshoot the various components of different domestic/ industrial programmable systems.	**Microcontroller** 208. Identify various ICs & their functions on the given Microcontroller 8051 Kit. (05 hrs) 209. Identify the address range of RAM & ROM. (05 hrs) 210. Write data into RAM & observe its volatility. (05 hrs) 211. Measure the crystal frequency, connect it to the controller. (05 hrs) 212. Identify the port pins of the controller & configure the ports for Input & Output operation. (10 hrs) 213. Connect an input switch & control a lamp using necessary program. (10 hrs) 214. Demonstrate the initialization, load & turn on an LED with delay using Timer. (10 hrs) 215. Demonstrate the use of a Timer as an even counter to count external events. (10 hrs) 216. Demonstrate entering of simple programs, execute & monitor the results. (15 hrs)	Introduction to 8051 Microcontroller, architecture, pin details & the bus system. The function of different ICs used in the Microcontroller Kit. Differentiate microcontroller with microprocessor. Interfacing of memory to the microcontroller. Internal hardware resources of microcontroller. I/O port pin configuration. Different variants of 8051 & their resources. Register banks & their functioning. SFRs & their configuration for different applications. Utilization of on chip resources such as ADC. Availability of assembly software & compiler for 8051. Application of microcontroller in domestic, consumer & industries.
64-65	• Plan and interface the LCD, LED DPM panels to various circuits and evaluate performance.	**Digital panel meter**: 217. Identify LED Display module and its decoder/driver ICs. (06 hrs)	Different types of seven segment displays, decoders and driver ICs for them. Concept of multiplexing and its advantages.

		218. Display a word on a two line LED. (08 hrs) 219. Measure/current flowing through a resistor and display it on LED Module. (08 hrs) 220. Measure/current flowing through a sensor and display it on an LED module (DPM). (10 hrs) 221. Identify LCD Display module and its decoder/driver ICs. (08 hrs) 222. Display a word on a two line LCD. (04 hrs) 223. Measure/current flowing through a sensor and display it on an LCD module (DPM). (06 hrs)	Block diagrams of 7106 and 7107 and their configuration for different measurements. Use of DPM (Digital Panel Meter) with seven segment displays to display different voltage & current signals. Principles of working of LCD. Different sizes of LCDs. Decoder/Driver ICs used with LCDs and their pin-out diagrams. Scrolling displays and its design. Use of DPM (Digital Panel Meter) to display different voltage & current signals.
66	• Assemble, test and troubleshoot single phase & 3-phase controlled and uncontrolled rectifier using SCR.	**3-Phase Rectifier (controlled &uncontrolled)** 224. Construct & test three phase uncontrolled rectifiers (half wave & bridge). (04 hrs) 225. Construct & test single phase Half controlled rectifier using SCR. (04 hrs) 226. Construct & test single phase full controlled rectifier using SCR. (04 hrs) 227. Identify and replace the faulty components. (04 hrs). 228. Test, 3-phase controlled rectifiers under fault condition & rectify faults. (04 hrs) 229. Construct & test three phase controlled rectifiers (half wave & bridge) using	High current rectifiers. Differentiate uncontrolled and controlled rectifiers. Discuss on 3-phase uncontrolled rectifier, control and power circuits and their applications. Discussion on 3-phase controlled rectifiers, control and power circuits and their applications.

		SCR. (05 hrs)	
67	• Construct, test & repair different chopper using MOSFET and IC based DC-DC converter and execute the result.	**Chopper** 230. Construct & test chopper circuit using MOSFET. (05 hrs) 231. Construct and test step up type chopper circuit. (05 hrs) 232. Construct and test step down type chopper circuit. (05 hrs) 233. Construct and test IC Based DC-DC converter for different voltages. (05 hrs) 234. Test chopper circuit under fault condition and rectify fault. (05 hrs)	Various types of chopper circuits step up, step down, inverting types. Introduction to DC-DC Converters. Applications of DC-DC converters. ICs used for converting DC-DC. Applications of DC-DC converters.
68-69	• Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	**Power Supplies & SMPS** 235. Identify different front panel controls and connectors of the given power supply. (04 hrs) 236. Test the given power supply and limit the output to a specific voltage and current. (04 hrs) 237. Open the power supply and identify major sections and power components with heat sinks. (04 hrs) 238. Test the semiconductor power switches of a power supply. (04 hrs) 239. Operate a programmable power supply and test its features. (04 hrs) 240. Identify various input and output sockets/ connectors of the given SMPS. (04 hrs)	Specifications & block diagram of Linear power supplies. Front panel controls and features of various power supplies. Different types of power switches and heat sinks used in power supplies. Block Diagram of Switch mode power supplies and their working principles. Various ICs used in different types of SMPS. Principles of Inversion and Inverter circuits using different techniques. Pulse width modulation and their applications.

		241. Apply input and measure outputs using a multimeter. (04 hrs)	
		242. Test capacity of the given SMPS. (04 hrs)	
		243. Identify major sections/ ICs/ components of SMPS. (08 hrs)	
		244. Measure/ monitor major test points of SMPS. (05 hrs)	
		245. Identify and replace the faulty components. (05 hrs)	
		(Use SMPS used in TVs and PCs for practice)	
70-71	• Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	**Inverters** 246. Construct & test simple inverter circuit using transistors/ MOSFET. (04 hrs)	Inverter – their principle & operation, power rating, change over period. Installation of Inverters, Protection circuits used in inverters– battery level, over load, over charging etc. Various faults and its rectification.
		247. Prepare a load bank using resistive & Inductive load up to 2KW for testing of Inverter & UPS. (04 hrs)	Three phase inverter circuits– principle and working.
		248. Identify front panel control & indicators of Inverter. (04 hrs)	Installation of single phase & three phase Inverter.
		249. Identify & understand the use of back panel sockets & connections.(04 hrs)	
		250. Connect battery & load to Inverter & test on battery mode. (04 hrs)	
		251. Open Top cover of Inverter & identify isolator transformer &inverter transformer. (04 hrs)	
		252. Identify various circuit boards in Inverter and monitor voltages at various test points. (04 hrs)	
		253. Make load test to	

		measure backup time. (04 hrs)	
		254. Test Inverter under faulty condition & rectify fault. (08 hrs)	
		255. Perform all above experiments for three phase Inverter. (04 hrs)	
		256. Measure battery current when inverter is working on Battery Mode & measure load current. (06 hrs)	
72-73	• Detect the faults and troubleshoot Power supplies, SMPS, UPS and inverter.	**UPS** 257. Identify front panel control & indicators of UPS. (04 hrs) 258. Identify & understand the use of back panel sockets & connections. (06 hrs) 259. Connect Battery & load to UPS & test on battery mode. (06 hrs) 260. Measure whether battery current UPS is working on Battery Mode & measure load current. (04 hrs) 261. Open Top cover of UPS & identify isolator transformer & UPS transformer & additional circuit other than an inverter. (10 hrs) 262. Identify various circuit boards in UPS and monitor voltages at various test points. (05hrs) 263. Perform a load test to measure backup time. (05 hrs) 264. Test UPS under faulty condition & rectify fault. (05 hrs) 265. Perform all above	Concept of UPS, Difference between Inverters and UPS. Basic block diagram of UPS & operating principle, explanation of rectifier, battery, inverter, static transfer switch. Types of UPS: Offline UPS, Online UPS, Line interactive UPS & their comparison UPS specifications. Load power factor & types of indications & protections UPS circuit description and working- controlling circuits, Microcontroller circuits, power circuits, charging circuits, alarm circuits, Indicator circuits. Three phase UPS Circuits. Installation of single phase & three phase UPS

		experiments for three phase UPS. (05 hrs)	
74	• Prepare fiber-optic setup and execute transmission and reception.	**Fiber optic** 266. Demonstrate the use of the fiber-optic trainer kit. (03 hrs) 267. Make optical fiber setup to transmit and receive analog and digital data. (04 hrs) 268. Demonstrate FM modulation and demodulation using the OFC trainer kit using audio signal and voice link.(06 hrs) 269. Demonstrate PWM modulation and demodulation using the OFC trainer kit using audio signal and voice link. (06 hrs) 270. Demonstrate PPM modulation and demodulation using the OFC trainer kit using audio signal and voice link. (06 hrs)	Introduction to optical fiber as a transmission Media, its advantages over other media, properties of optic-fiber, testing, losses, types of fiber-optic cables and specifications. Encoding of light. Fiber optic joints, splicing, testing and the related equipments/measuring tools, precautions to be taken laying of cables, safety aspects while handling optical cables.
75-76	• Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	Make simple project applications using ICs, transformer and other discrete components. a) Speed control of Motor/Fan. b) Electronic code lock. c) Programmable musical bell. d) Three phase uncontrolled rectifier using SCR. e) Single phase controlled rectifier using SCR. f) LCD display module with decoder/driver ICs.	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.

		(The instructor will pick up any five of the project for implementation)	
77	Revision		
78	Examination		

	SYLLABUS FOR TECHNICIAN POWER ELECTRONICS SYSTEMS TRADE		
	FOURTH SEMESTER – 06 MONTHS		
Week No.	**Learning Outcome Reference**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
79-81	• Install a solar panel, execute tests and evaluate performance by connecting the panel to the inverter.	**Solar Inverter** 271. Connect and test solar panel to the Inverter and run the load. (05 hrs) 272. Mount a solar panel to a roof. (1 0hrs) 273. Wire a solar panel to a solar controller.(10 hrs) 274. Wire a solar controller to a battery storage station. (10 hrs) 275. Connect storage batteries to a power inverter. (10 hrs) 276. Wire a power inverter to an electrical service panel. (05 hrs) 277. Test circuits for voltages. (05 hrs) 278. Installation of Solar Inverter. (05 hrs) 279. Take the trainees to the nearest solar power installation and demonstrate various aspects to cover skills as specified above. (15 hrs)	Need for renewable energy sources, Solar energy as a renewable resource. Materials used in solar cells. Principles of conversion of solar light into electricity. Basics of photovoltaic cell. Types of solar cells. Mono crystalline and poly crystalline PV cells. Define components like Solar cell, Module, panel and Arrays. Factors that influence the output of a PV module. SPV systems and the key benefits. Difference between SPV and conventional power. Define solar charge controller or regulator and its role. Safety precautions while working with solar systems.
82-83	• Execute the operation of the different process sensor, identify, wire & test various sensors of different industrial processes by selecting	**Sensor** 280. Identify & test different sensors such as RTDs, thermocouples, proximity sensors, inductive, capacitive& photoelectric), load cells, strain gauge & LVDT, Hall	Basics of passive and active transducers – Role, selection and characteristics. Working principles of RTD, Thermocouple, LVDT, Strain gauge, Proximity sensor, Hall Sensor, Tacho-generator,

appropriate test instruments.	sensor, Tacho-generator. (10 hrs) 281. Test the functionality of all the sensors mentioned above using the trainer kit. (05 hrs) 282. Refer the data chart & record various parameter ranges in respect of the sensors mentioned above. (10 hrs)	optical sensors. Sensor voltage and current formats.
• Assemble, test & troubleshoot various digital controlled of field devices and execute the result.		Digital/ logical/on-off control of electrical machines and other actuators. Industrial control system: electro-magnetic control, static control; comparison; general block diagram; Information gathering section in the input section, Decision making section or logic section and Actuating device section or output section; advantages and disadvantages of static control over magnetic relay control; input devices for solid state logic contact bounce problem; Capacitive Switch Filters
	Digital control of field devices **Input Devices to develop START (Logic 1) and STOP (Logic 0) pulses** 283. Develop AC – DC SIGNAL CONVERTER using push to ON switch, centre tapped transformer type full wave rectifier, filter and a pot to get Logic 1 (+5V); (START pulse) view pulse on an oscilloscope. (05 hrs) 284. Develop AC – DC SIGNAL CONVERTER using push to ON switch, bridge type full wave rectifier working on 24 V AC, filter, pot, 12V DC reed relay and separate stabilized + 5V supply to get Logic 1; (START pulse) view pulse on an oscilloscope. (05hrs) 285. Develop AC – DC SIGNAL CONVERTER using push to OFF switch, center tapped transformer type full wave rectifier, filter and a pot to get Logic 0 (0V); (STOP pulse) view pulse on an oscilloscope. (05hrs) 286. Develop AC – DC SIGNAL	

		CONVERTER using push to OFF switch, bridge type full wave rectifier working on 24 V AC, filter, pot, 12V DC reed relay and separate stabilized + 5V supply to get Logic 0 (0V); (STOP pulse) view pulse on an oscilloscope. (05hrs) 287. Develop AC – DC SIGNAL CONVERTER – using Optocoupler method, push to ON switch, bridge type full wave rectifier working on 24 V AC, filter, pot, optocoupler or LDR & Lamp source and separate stabilized + 5V supply to develop START pulse. (05 hrs)	
84-86	• Perform speed control of DC machine and single phase and 3-phase AC machines.	**Electrical control of AC/DC machines** 288. Identify (unmarked) terminals of 3 phase induction motors. (04 hrs) 289. Construct a self hold contactor circuit and run a 3-Phase Induction Motor (4hrs) 290. Familiarize with different types of motor and identify the different parts. (04hrs) 291. Study & connect the motor and run (below 5hp) in star, note phase Voltage, line voltage and current. Study and connect and run the motor in Delta and note phase current line current. Phase voltage and line voltage.(07 hrs) 292. Connect and operate an	Fundamentals of AC 3 phase & single phase Induction motors, synchronous speed, slip, rotor frequency, torque – speed characteristics, Starters used for Induction motors, speed control of Induction motors Types of motors: Advantages &disadvantages among each other. DC Motors– types, working, torque speed characteristics, staring of DC Motors & change the DOR, 3 point and 4 point Starters, speed control of DC motor, Field flux control & armature current control. Brushless DC Motors.

		induction motor using DOL starter.(04 hrs)	
		293. Connect and run a 3-phase motor using manual and automatic star-delta starters.(04hrs)	
		294. Change the direction of rotation of Induction motor. (04 hrs)	
		295. Connect & run three phase induction motors in a sequence using contactor & relay. (04 hrs)	
		296. Construct, run, stop and jog in both directions of an induction motor. (04 hrs)	
		297. Understand all the information on a Motor template. (04 hrs)	
		298. Familiarize with different types of DC motors. (04 hrs)	
		299. Connect & run DC shunt motor using 3 point starter. (04 hrs)	
		300. Change the direction of rotation of DC motor. (04 hrs)	
		301. Control the speed of DC motor by armature control method. (04 hrs)	
		302. Control the speed of DC motor by the field control method. (04 hrs)	
		303. Construct the circuit for speed control of DC shunt motor (phase control method). (04 hrs)	
		304. Construct the PWM circuit for the speed control of DC shunt motors. (04 hrs)	
		305. Control the speed of DC shunt motor using SCR	

87-89	• Install, configure and demonstrate the AC and DC drive to control the speed.	**AC Drives**	Block diagram of AC Drive – (Sources of supply – Converter/Rectifier – DC Link – Inverter –Motor Load) 1 phase & 3 phase rectifier circuits. Inverter – 1 phase Inverter 3 phase Inverter Switching circuit (Sequence and Switching timing control – PWM Technique & Switching Devices. Microprocessor/ Microcontroller) - VFD (Variable Frequency Drive) VVVF Control – (3 phase induction motor) Speed control. Introduction of PID controller. Installation of AC Drive/ Siemens Micro master Drive – MM-420/440 Commissioning/ Quick Commissioning of MM – 420/440 Micro – Master Drive – Programming (Parameterization)
		chopper by using a trainer. (05 hrs)	
		306. Study the AC Drive set up and its connections. (05 hrs)	
		307. Identify different cables and connectors used in the AC DRIVE setup. (05 hrs)	
		308. Identify various input and output terminals of the DRIVE unit, Operator panel and display unit.(05 hrs)	
		309. Familiarization with PMU & different terminals of Micro – Master AC Drive.(05 hrs)	
		310. Demonstration – Access parameter number & values. (05 hrs)	
		311. Familiarization with parameters. (05 hrs)	
		312. Parameter values for various operations. (05 hrs)	
		313. Commissioning parameter numbers and values. (05hrs)	
		314. Installation of AC Drive(similar to SIEMENS MM-420/440).(05hrs)	
		315. Familiarization with: Commissioning & Quick Commissioning(similar to SIEMENS MM-420/440). (05 hrs)	
		316. Reset to default values/ Factory setting values. (05 hrs)	
		317. MM Drive Programming/Parameteri zation for different	

		control operations. (10 hrs) 318. ON/OFF, Forward/ Reverse, Jog (R)/Jog (L), braking and speed control. (10 hrs)	
90-91	• Install, configure and demonstrate the AC and DC drive to control the speed.	**DC Drives** 319. Familiarization with different parts and terminals of DC Drive. (08 hrs) 320. Familiarization with parameters and operation for accessing parameter number and values. (08 hrs) 321. Start up procedure demonstration. (08 hrs) 322. Parameterization for variation of motor speed through POT with Armature voltage feedback (with internal setting). (08hrs) 323. Parameterization – Control drive through POT with encoder feedback (with internal setting). (10hrs) 324. Parameterization – Control the drive speed through external speed raise/ lower buttons. (08hrs)	Tacho-generator/Encoder technical data Related to DC drive. Block diagram of DC Drive. Converter bank – Gate Trigger set circuit. Hardware description of DC Drive. Description of 6RA70 Siemens (or similar) master drive. Start up procedure (Quick Commissioning) Terminal Diagram of 6RA70 DC Drive Function of 6RA70. BICO Technology. Parameterization of DC Drive – 6RA70 – BICO Parameterization
92-93	• Perform speed control of servo motors and test different industrial process circuit by selecting the suitable function.	**Servo Motor** 325. Construct a simple circuit to control servo motor using IC 555.(10 hrs) 326. Connect servo motor with drive & control its parameters. (10 hrs) 327. Connect the servo motor to computer for	Servo mechanism, Servo motor principal, Difference between motors & servo motor. Types of servo motor, AC & DC - brushless servo motor &permanent magnet servo motor construction & application.

		monitoring & controlling of various parameters. (10 hrs) 328. Parameter programming of servo motor. (10 hrs) 329. Various control method for controlling velocity & torque. (10 hrs)	Control method for servo motor. Study of servo drive.
94-95	• Install, test & control, the Electro Pneumatic actuators using various pneumatic valves.	**Electronic Pneumatics** 330. Identify different pneumatic and electro pneumatic components. (04hrs) 331. Construct and control a single acting cylinder. (04hrs) 332. Construct and control a double acting cylinder. (04hrs) 333. Construct and control single/double acting cylinder using series/ parallel circuits. (04hrs) 334. Construct and perform bidirectional control of a cylinder.(06hrs) 335. Construct and control, automatic return of a double acting cylinder. (06hrs) 336. Construct and control the oscillating motion of a double acting cylinder. (04 hrs) 337. Construct and control a latching circuit using single or double acting cylinder. (04 hrs) 338. Construct and control, automatic return initiated by a limit switch. (04 hrs) 339. Throttle a cylinder to adjust forward and	Introduction to pneumatic power source and measure of compressed air, storage and transmission of compressed air, applications of pneumatics in the industries. Symbols of different pneumatic and electro-pneumatic components. Various supply elements such as compressors, reservoir, pressure regulating valve, service unit etc. Various input elements such as push button valves, roller lever valves, proximity switches, Air barriers etc. Various pneumatic control elements, processing elements such as directional control valves, shuttle valves, non-return valves, pressure control valves, Timers and sequencers etc. Function and application of solenoid valves. Limit switches, memory valves, pressure dependent valves and time dependent valves.

		return strokes. (06 hrs) 340. Adjust the pressure as per the requirements. (04 hrs)	
96-99	• Execute the operation of different indication on PLC modules and wire different field devices of PLC and configure the system and perform the suitable function.	**PLC** 341. Identify various indicators on PLC Modules and interpret.(15hrs) 342. Wire in various digital input and output devices to the respective modules. (10 hrs) 343. Wire analog input and output devices to the respective modules. (10hrs) 344. Connect and configure PLC hardware and the software. (15 hrs) 345. Develop and run simple programs to read sensor status and to control various outputs. (15 hrs) 346. Force input and output devices using the software. (15 hrs) 347. Perform online editing of a rung/network. (10hrs) 348. Prepare data tables and monitor. (10hrs)	Evolution of control technology. Advantages of PLCs Modular architecture of PLCs, working principle of PLCs. Various modules and addressing Wiring of field devices to various modules, interpretation of indications on CPU and other modules Specification of PLC Modules Implementation of relays, timers and counters using PLCs
100-102	• Plan and carry out the selection of a project, assemble the project and evaluate performance for domestic/commercial applications.	Make simple project applications using ICs, transformer and other discrete components. a) Smoke detector. b) Water level sensor. c) Run a three phase motor using manual and automatic star-delta starters. d) Solar power inverter. e) Control single/double acting cylinder using series/parallel circuit.	Discussion on the identified projects with respect to data of the concerned ICs, components used in the project.

		f) Simple programs to read sensor status and to control. (The instructor will pick up any five of the project for implementation)	
103	Revision		
104	Examination		

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

S No.	Workshop Calculation and Science	Engineering Drawing
First Semester		
Duration: Six Month		
1.	<u>Unit</u>: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units.	Engineering Drawing: Introduction and its importance. - Relationship to other technical drawing types - Conventions - Viewing of engineering drawing sheets - Method of Folding of printed Drawing Sheet as per BIS SP: 46-2003
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.	Drawing Instruments: their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins/ Clips.
3.	**Square Root**: Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines: - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment
4.	**Ratio & Proportion**: Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of - Angle: Measurement and its types, method of bisecting.

		- Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
5.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	**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.	Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
7.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	Free hand drawing of - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
8.	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.	Sizes and Layout of Drawing Sheets - Basic principle of Sheet Size - Designation of sizes - Selection of sizes - Title Block, its position and content - Borders and Frames (Orientation marks and graduations) - Grid Reference - Item Reference on Drawing Sheet (Item List)
9.	**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.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view

| 10. | ----- | Symbolic Representation (as per BIS SP:46-2003) of:

- Fastener (Rivets, Bolts and Nuts)
- Bars and profile sections
- Weld, brazed and soldered joints
- Electrical and electronics element
- Piping joints and fittings |

Second Semester Duration: Six Months		
S No.	**Workshop Calculation and Science**	**Engineering Drawing**
1.	**Algebra**: Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi-circle, Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere.	Practice of Lettering and Title Block
3.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
4.	**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.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse& Parabola)
5.	**Basic Electricity**: Introduction, use of electricity, how electricity is produced,	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid)

	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.	with dimensions.
6.	**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.	Free hand sketch of hand tools and measuring tools used in respective trades.
7.	–	Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification.
8.	–	Drawing of Orthographic projection from isometric/3D view of blocks
9.	–	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10.	–	Drawing details of two simple mating blocks and assembled view.

Third Semester	
Duration: Six Months	
S No.	**Workshop Calculation and Science**	**Engineering Drawing**
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1.	**Elasticity:** Stress, strain, Modulus of elasticity, elastic limit, Hooks law, Young's modulus.	**CRO:** Block diagram of Cathode Ray Oscilloscope (CRO). Block diagram of Digital storage Oscilloscope (DSO). Front panel view of CRO & DSO.
2.	**Material:** Introduction, types and properties. Uses of Conducting, Semi-conducting and insulating materials.	**Surface Mounting devices (SMD):** Front panel view of SMD Stations. IC package of SMD. Freehand drawing of Logic gates and circuits.
3.	**Magnetism:** Magnetic material, magnetic field, flux density, magnetic moment, m.m.f. Reluctance, permeability, susceptibility, electromagnet, solenoid and its practical applications.	**Electrical Protective Devices:** Symbol of MCB (Miniature Circuit Breaker), ELCB (Earth Leakage Circuit Breaker), DOL starter, Relays.
4.	**Pressure:** Pneumatic pressure, PSI, bar, atmospheric pressure, pressure gauge and absolute pressure, Heat treatment process.	**Microcontroller:** Block diagram of 8051. Pin configuration of 8051.
5.	**Indices:** Laws of indices related problems. **Quadratic Equation:** Introduction, solution of simple Quadratic equation and related problems.	**Modulation:** Block diagram of super Heterodyne Radio Receiver. Block diagram of AM and FM receiver. Sketches of analog and digital modulation waveforms
6.	Solution of simple A.C. Circuit with R.L.C. Calculation of power factor, etc.	**Generator:** Front panel control for function Generator, IC tester, power supply, Remote control, In plane switching
7.	**A.C. Waveform Calculation:** Calculation of r.m.s, average, instantaneous value, peak value. Peak to peak value, Frequency and wavelength calculation and their relationship.	-----

| 8. | **Series And Parallel Connection of Electrical and Electronic components:**
1. Calculation Series and parallel connection of Resistors.
2. Calculation Series and parallel connection of Capacitors.
3. Calculation Series and parallel connection of Inductors.
4. Calculation Series and parallel connection of Batteries.
Conversion of power flow to H.P.
Calculation of KVA. | ----- |

Fourth Semester	
Duration: Six Months	
S No.	**Workshop Calculation and Science**	**Engineering Drawing**

S No.	Workshop Calculation and Science	Engineering Drawing
1.	**Power supply:** Calculation of SMPS, regulation, Calculation of load and wattage for selection of UPS, calculate of back up time of Battery related to UPS and Load, calculate of voltage regulation, firing angle calculation of ripple factor, voltage regulation of DC voltage. Calculate the regulation of solar power.	**Symbol of electronic component:** A. Thermocouple B. Strain Gauge C. LVDT(Linear variable differential transformer) D. Proximity Sensor E. Free hand sketches of computer ports
2.	**Motor parameters & Calculation:** Speed and frequency calculation of AC Motors, D.C motors.	**DTH system:** Block diagram connections of Home system. Direct To Home (DTH).
3.	**Modulation:** AM/FM modulation index calculation, calculation of Bandwidth, Percentage of modulation in FM/AM.	**Cell Phone:** Block diagram of cell phone receiver system.
4.	**Number Systems:** Introduction, Decimal, Binary, Octal, Hexadecimal, BCD code, ASCII code, Bit, Byte, KB, MB, GB, Conversion, Addition, Subtraction, Multiplication, Division, 1st and 2s complement method, 9s and 10s complement method.	**Power supply:** Block diagram of SMPS. Block diagram of UPS-ONLINE, OFFLINE, LINE INTERACTING.
5.	**Boolean Algebra:** Simplification of Boolean Algebra equations.	**Project related drawings:** A. Dancing LEDs B. Smoke detector C. Mobile charger D. Metal detector
6.	**Project costing:** Project selection, cost of project, Simple estimation, simple problems on profit and loss, Balance sheet etc.	**Solar power:** Solar power generation block diagram.
7.	Power transmission by shaft, belts and ropes.	**Fibre-optic communication:** Block diagram of fibre-optic communication.

8.	**Friction:** Law of friction, co-efficient of friction, angle of friction, advantage and disadvantage of friction.	
9.	**Force:** Resolution and composition of forces. Representation of forces by vectors, simple problems on lifting tackles like Jib wall, crane solution of problems with the aid of vectors, General condition of equilibrium for series of forces on a body.	
10.	**Gravity:** Centre of Gravity, simple experiments, stable, unstable and neutral equilibrium.	

9.2 EMPLOYABILITY SKILLS

CORE SKILL – EMPLOYABILITY SKILL	
First Semester	
1. English Literacy	**Duration : 20 hrs** **Marks : 09**
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, voice change, change of tense, spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking/ Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on known people, picture reading, gain confidence through role-playing and discussions on current happenings, job description, asking about someone's job, habitual actions. Cardinal (fundamental) numbers, ordinal numbers. Taking messages, passing on messages and filling in message forms, greeting and introductions, office hospitality, resumes or curriculum vitae essential parts, letters of application reference to previous communication.
2. IT Literacy	**Duration : 20 hrs** **Marks : 09**
Basics of Computer	Introduction, computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down the computer.
Computer Operating System	Basics of Operating System, WINDOWS, User interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD , etc. Use of common applications.
Word Processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing documents, Use of shortcuts, Creating and Editing Text, Formatting the text, Insertion & creation of tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking	Basic of Computer Networks (using real life examples), Definitions of

and Internet	Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web browser, Website, Webpage and Search Engines. Accessing the Internet using a web browser, Downloading and printing web pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
3. Communication Skills		**Duration : 15 hrs** **Marks : 07**
Introduction to Communication Skills	Communication and its importance Principles of effective communication Types of communication - verbal, non-verbal, written, email, talking on the phone. Nonverbal communication- characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.	
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active listening skills.	
Motivational Training	Characteristics essential to achieving success. The power of positive attitude. Self-awareness Importance of commitment Ethics and values Ways to motivate oneself. Personal goal setting and employability planning.	
Facing Interviews	Manners, etiquettes, dress code for an interview. Do's & Don'ts for an interview.	
Behavioral Skills	Problem solving, confidence building, attitude.	
Second Semester		
4. Entrepreneurship Skills		**Duration : 15 hrs** **Marks : 06**
Concept of	Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue	

Entrepreneurship	Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, and the process of setting up a business.
Project Preparation & Marketing Analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution management. Difference between small scale & large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's Support	Preparation of project. Role of various schemes and institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non-financial support agencies to familiarize with the Policies/ programs, procedure & the available scheme.
Investment Procurement	Project formation, feasibility, Legal formalities i.e., Shop Act, Estimation & costing, Investment procedure - Loan procurement - Banking processes.

5. Productivity	**Duration : 10 hrs** **Marks : 05**
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How it improves or slows down productivity.
Comparison with Developed Countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries, e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, Safe cash handling, Personal risk and insurance.

6. Occupational Safety, Health and Environment Education	**Duration : 15 hrs** **Marks : 06**
Safety & Health	Introduction to occupational safety and health, importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygiene, Occupational Diseases/ Disorders & its prevention.
Accident & Safety	Basic principles for protective equipment.

	Accident prevention techniques - control of accidents and safety measures.
First-aid	Care of injured & sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. Safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. The relationship between society and environment, Ecosystem and factors causing imbalance.
Pollution	Pollution and pollutants, including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of energy, re-use and recycle.
Global Warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, Ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in-house environment.

7. Labour Welfare Legislation		Duration : 05 hrs Marks : 03
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's Compensation Act.	

8. Quality Tools		Duration: 10 hrs Marks : 05
Quality Consciousness	Meaning of quality, Quality characteristic.	
Quality Circles	Definition, Advantage of small group activity, Objectives of quality circle, Roles and function of quality circles in organization, Operation of quality circle. Approaches to starting quality circles, Steps for continuation quality circles.	
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
House Keeping	Purpose of housekeeping, Practice of good housekeeping.	
Quality Tools	Basic quality tools with a few examples.	

	LIST OF TOOLS & EQUIPMENTS		
	TECHNICIAN POWER ELECTRONICS SYSTEMS		
S No.	**Name of the Tools and Equipments**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT (For each additional unit, trainees tool kit Sl. 1-12 is required additionally)			
1.	Connecting screwdriver	100 mm	10 nos.
2.	Neon tester 500 V.	500 V	6 nos.
3.	Screwdriver set	Set of 7	10 nos.
4.	Insulated combination pliers	150 mm	6 nos.
5.	Insulated side cutting pliers	150mm	8 nos.
6.	Long nose pliers	150mm	6 nos.
7.	Soldering iron	25 Watt, 240 Volt	10 nos.
8.	Electrician knife	100 mm	6 nos.
9.	Tweezers	150 mm	10 nos.
10.	Digital Multimeter	(3 3/4 digit),4000 Counts	10 nos.
11.	Soldering Iron Changeable bits	15 Watt, 240 Volt	6 nos.
12.	De-soldering pump electrical heated, manual operators	230 V, 40 W	10 nos.
B. SHOP TOOLS, INSTRUMENTS, EQUIPMENTS – For 2 (1+1) units no additional items are required			
Lists of Tools:			
1.	Steel rule graduated both in Metric and English Unit	300 mm	4 nos.
2.	Precision set of screwdrivers	T5, T6, T7	2 nos.
3.	Tweezers – Bend tip		2 nos.
4.	Steel measuring tape	3 meters	4 nos.
5.	Tools makers vice	100mm (clamp)	1 no.
6.	Tools maker vice	50mm (clamp)	1 nos.
7.	Crimping tool (pliers)	7 in 1	2 nos.

8.	Magneto spanner set	8 Spanners	2 nos.
9.	File flat bastard	200 mm	2 nos.
10.	File flat second cut	200 mm	2 nos.
11.	File flat, smooth	200 mm	2 nos.
12.	Plier - Flat Nose	150 mm	4 nos.
13.	Round Nose pliers	100 mm	4 nos.
14.	Scriber straight	150 mm	2 nos.
15.	Hammer ball pen	500 grams	1 no.
16.	Allen key set (Hexagonal-set of 9)	1 - 12 mm, set of 24 Keys	1 no.
17.	Tubular box spanner	Set - 6 - 32 mm	1 set
18.	Magnifying lenses	75 mm	2 nos.
19.	Continuity tester		6 nos.
20.	Hacksaw frame, adjustable	300 mm	2 nos.
21.	Chisel - Cold - Flat	10 mm X 150 mm	1 no.
22.	Scissors	200mm	1 no.
23.	Handsaw 450mm	Hand saw - 450 mm	1 no.
24.	Hand Drill Machine Electric with Hammer Action	13 mm	2 nos.
25.	First aid kit		1 no.
26.	Bench Vice	Bench Vice - 125 mm	1 no. each
		Bench Vice - 100 mm	
		Bench Vice - 50 mm	
List of Equipments			
27.	Dual DC regulated power supply	30-0-30 V, 2 Amps	4 nos.
28.	DC Regulated Variable Programmable DC Power Supply	0-30V/3A	2 nos.
29.	LCR meter (Digital) Handheld		1 no.
30.	CRO Dual Trace	20 MHz (component testing facilities)	2 nos.
31.	Signal Generator with Digital Display for Frequency Amplitude	10 Hz to 100 kHz, 50/600 Ohms (output impedance)	2 nos.

32.	Battery Charger	0 - 6 - 9 - 12 - 24 , 15 Amps	1 no.
33.	Analog multimeter		4 nos.
34.	Clamp meter	0 - 10 A	2 nos.
35.	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	2 nos.
36.	Dimmer starter	3 Amps	2 nos.
37.	Autotransformer	15 Amps	2 nos.
38.	Analog Component Trainer	Breadboard for Circuit design with necessary DC /AC power supply: • 8 pin ZIF socket • 16 pin ZIF socket • Resistor bank • Capacitor bank • Potentiometers • Diodes • Zener diodes • NPN Transistor • N-channel MOSFET • LED • Bread board • Ready to use Experimental Boards Lab Manual with list of experiments to perform various experiments	4 nos.
39.	Milli Ammeter (AC)	0 – 200 mA	2 nos.
40.	Milli Ammeter (DC)	0 – 500 mA	2 nos.
41.	Op Amp trainer	• ±15V, ±12 and +5V fixed DC power supply • 8pin ZIF socket • 16 pin ZIF socket • Resistor bank • Capacitor bank • Potentiometers	2 nos.

		• Bread board • Built in oscillator: sine, square and tri-angular waveform	
42.	Digital IC Trainer	Breadboard for Circuit design with necessary DC Power Supply, Graphical LCD, Clock Frequency 4 different steps, Data Switches: 8 nos., LED Display: 8 nos. (TTL), Seven Segment Display, Teaching Simulation Software	4 nos.
43.	Digital and Analog IC Tester		1 no.
44.	Digital and Analog Bread Board Trainer	DC/AC Power Supply, Sine/ Square/ TTL Generator Data Switches,LED indication, LED Display: 8 in nos. Simulation/Teaching Content through software	6 nos.
45.	Rheostats various values and ratings		2 nos. Each
46.	POWER ELECTRONICS TRAINER With at least 6 nos. of application board MOSFET Characteristics SCR Characteristics SCR Lamp Flasher SCR Alarm Circuit Series Inverter Single Phase PWM Inverter		4 no.
47.	Computers in the assembled form (including cabinet, motherboards, HDD, DVD, SMPS, Monitor, KB, Mouse, LAN card, Blue-Ray drive and player), MS Office education version.		4 nos.
48.	Laptops latest configuration		1 no.

49.	Laserjet Printer		1 no.
50.	INTERNET BROADBAND CONNECTION		1 no.
51.	Electronic circuit simulation software with 6 user licenses	Circuit Design and Simulation Software with PCB Design with Gerber and G Code Generation, 3D View of PCB, Breadboard View, Fault Creation and Simulation.	1 no.
52.	Different types of electronic and electrical cables, connectors, sockets, terminations		As required
53.	Different types of Analog electronic components, digital ICs, power electronic components, general purpose PCBs, bread board, MCB, ELCB		As required
54.	DSO (colour)	4 Channel, 50MHz Real Time Sampling 1G Samples/Sec, 12 Mpts Memory with PC Interface USB, LAN and math function includes +, -, FFT, differential, integral, ABS, logs etc.	1 no.
55.	Soldering & De-soldering Station		1 no.
56.	SMD Soldering & De soldering Station with necessary accessories	SMD Rework Station: Soldering station: Output Voltage:26V – 40V AC Temp Range: 50 to 4800 C Desoldering Station: Output Voltage: 24V – 40V AC Vacuum Generator: Vacuum pump: double cylinder type Vacuum Pressure: 80 k Pa Suction flow: 15 L/min.	2 nos.

		Hot air station: Air flow: 1-9 L/min Temp:50 o 500 °C Hand piece of Hot air accessories	
57.	DOL starter	½ HP	1 no.
58.	AC Motor Trainer Kit ¼ HP motor Single Phase Contactors Relays MCB DOL Starter		1 no.
59.	Microcontroller kits (8051) along with programming software (Assembly level Programming)	Core 8051, ready to run programmer for AT89C51/52 & 55, programming modes Key Pad and PC circuits. Detailed learning content through simulation software.	4 nos.
60.	Application kits for Microcontrollers 6 different applications	1. Input Interface: 4x4 Matrix Keypad, ASCII Key PAD, Four Input Switch 2. Display Module 16X2 LCD, Seven Segment, LED Bar Graph 3. ADC/DAC Module with most popular DC/DAC0808 4. PC Interface: RS232 & USB 5. Motor Drive: DC, Servo, Stepper 6. DAQ: Data Acquisition to sense different sensor signals	1 set
61.	Sensor Trainer Kit containing following Sensors 1. Thermocouple 2. RTD 3. Load Cell/ Strain Gauge 4. LVDT 5. Smoke Detector Sensors	Graphical touch LCD with inbuilt processor for viewing the output waveforms, Inbuilt DAQ, and standard processing circuits like Inverting , Non – Inverting, Power, Current, Instrumentation Differential Amplifier,	2 nos.

	6. Speed Sensor 7. Limit Switch 8. Photo sensors 9. Optocouplor 10. Proximity Sensor	F/V,V/F,V/I,I/V Converter, Sensors: RTD, NTC Thermistor,LM35 Thermocouple, Gas(Smoke) Sensor, Load cell, LVDT Sensor, Speed Sensor	
62.	Various analog and digital ICs useful for doing project works mentioned in the digital and analog IC application modules		As required
63.	Different types of electronic and electrical cables, connectors, sockets, terminations.		As required
64.	Fiber-optic communication trainer	Full Duplex Analog & Digital Trans-receiver with 660nm & 950nm, Noise Generator with variable gain, Four, Seven Segment Display BER Counter, Eye Pattern.	2 nos.
65.	Seven segments DPM trainer		6 nos.
66.	Precision set of screwdrivers-	T5, T6, T7	2 nos.
67.	SMPS of different make		4 nos.
68.	UPS trainer	PWM switching technology, Test points to measure the voltages of different sections Overall functioning of UPS Trainer, AVR transformer, UPS with load condition	1 no.
69.	UPS 3 KVA with backup time minimum30 minutes		1 no.
70.	Allen key screwdriver	5 no. of set	1 set
71.	Jacket stripper/ Coring tool for 500 series cable		1 no.
72.	Center conductor cleaner		1 no.
73.	Universal drop trimmer for RG 6/11 cables		1 no.

74.	F - connector tool for RG 6/11 cables		1 no.
75.	F – connector compression tool for RG 6/11 cables		1 no.
76.	Solar Training Kit/ Simulator	With built in meters for DCV, DCA, AC Multifunction Meter (for ACI, ACV, Power, Frequency), Protection Circuits, BS-10 terminals for making the connection, Single/ Dual axis tracking system Charge Controller: PWM based MPPT, Charging Stage: Bulk, Absorptions and Float	1 no.
77.	LED lighting system	Measurement of Power, Voltage, Current, Power Factor and Light output performance of different lighting products like LED, CFL at variable input voltages 0 to 245V variable AC	2 sets
78.	DC shunt motor	1HP with 3 point starter	1 no.
79.	Tachometer	Digital type 10000 RPM	2 nos.
80.	Rheostat	1Kohm	2 nos.
81.	3 phase induction motor	1Hp with DOL starter	1 no.
82.	Squirrel induction motor	5 HP with star-delta starter	1 no.
83.	1hp motor	DC drives trainer with phase control method	1 no.
84.	1hp motor	DC drive trainer with SCR chopper circuit	1 no.
85.	Programmable DC drive with motor	(Simoreg DC master) 6RA70	1 no.
86.	Solar panel based Inverter	500VA	1 no.
87.	3 phase motor	1 HP, VVVF drive trainer	1 no.

88.	AC motor	1hp, AC drive (Siemens Micro master 420)	1 no.
89.	PLC Systems with digital I/P, O/P modules Trainer kit and software	6 Digital Inputs (24V DC). 4 Digital Outputs (24V DC) 2K Words of memory, 256 words of register. Powerful features like built in Floating Point, Sub Routines etc. One RS232 C communication facility for PC interface. Three channels can be configured as follows, Pulse width modulation output or Pulse train output or High speed counter input.	3 nos.
90.	Solenoid	24 V AC	4 nos.
91.	Lamp	24 V AC	6 nos.
92.	AC power supply	24 V, 50 Hz, 2 A	2 nos.
93.	DC power supply	+12 V 2 A	2 nos.
94.	DC power supply	+5 V 2 A	2 nos.
95.	Electronic Pneumatics Trainer kit		2 nos.
96.	Servo Motor drives Trainer kit		2 nos.
D. Shop Floor Furniture and Materials - For 2 (1+1) units no additional items are required.			
97.	Instructor's table		1 no.
98.	Instructor's chair		2 nos.
99.	Metal Rack	100cm x 150cm x 45cm	4 nos.
100.	Lockers with 16 drawers standard sizes		2 nos.
101.	Steel Almirah	2.5 m x 1.20 m x 0.5 m	2 nos.
102.	Black board/white board	12' x 4'	2 no. (one for lab and one

			classroom)
103.	Fire Extinguisher		2 nos.
104.	Fire Buckets		2 nos.
105.	Classroom furniture (dual desk)		10 nos.
106.	Lab tables (work bench)		6 nos.
107.	Stools for lab		20 nos.

Note: All the tools and equipment are to be procured as per BIS specification.

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
S No.	Name of the Equipment	Quantity
1	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software.	10 nos.
2	UPS - 500Va	10 nos.
3	Scanner cum Printer	1 no.
4	Computer Tables	10 nos.
5	Computer Chairs	20 nos.
6	LCD Projector	1 no.
7	White Board 1200mm x 900mm	1 no.

Note: Above Tools & Equipments not required, if Computer LAB is available in the institute.

FORMAT FOR INTERNAL ASSESSMENT

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

S No.	Candidate Name	Father's/Mother's Name	Safety Consciousness	Workplace Hygiene	Attendance/ Punctuality	Ability to Follow Manuals/ Written Instructions	Application of Knowledge	Skills to Handle Tools &Equipment	Economical Use of Materials	Speed in Doing Work	Quality in Workmanship	VIVA	Total Internal Assessment Marks	Result (Y/N)
	Maximum Marks (Total 100 Marks)		15	5	10	5	10	10	5	10	15	15		
1														
2														