GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING
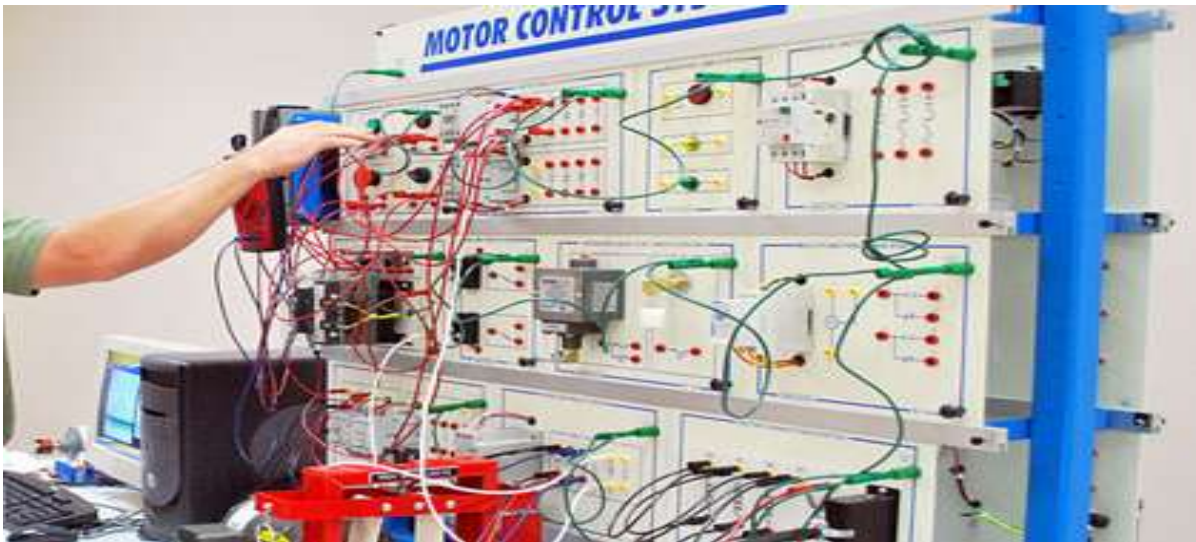
COMPETENCY BASED CURRICULUM

TECHNICIAN POWER ELECTRONICS SYSTEMS

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 5

SECTOR –ELECTRONICS & HARDWARE

TECHNICIAN POWER ELECTRONICS SYSTEMS

(Engineering Trade)

(Revised in 2018)

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
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091

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.