

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

COMPETENCY BASED CURRICULUM

ELECTRICIAN

(Duration: Two Years) Revised in July 2022 CRAFTSMEN TRAINING SCHEME (CTS) NSQF LEVEL- 4



SECTOR – POWER



ELECTRICIAN

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL-4

Developed By

Ministry of Skill Development and Entrepreneurship Directorate General of Training **CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE** EN-81, Sector-V, Salt Lake City, Kolkata – 700 091

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30.	Demonstrate basic	Solve different mathematical problems
	mathematical concept	Explain concept of basic science related to the field of study
	and principles to	
	perform practical	
	operations. Understand	
	and explain basic	
	science in the field of	
	study.	

SYLLABUS FOR ELECTRICIAN TRADE				
		FIRST YEAR		
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)	
Professional Skill 40 Hrs.; Professional Knowledge 10 Hrs.	Prepare profile with an appropriate accuracy as per drawing following safety precautions. (Mapped NOS: PSS/N2001)	 Visit various sections of the institutes and location of electrical installations. (01hrs.) Identify safety symbols and hazards. (02Hrs.) Preventive measures for electrical accidents and practice steps to be taken in such accidents. (03hrs.) Practice safe methods of fire fighting in case of 	Scope of the electrician trade. Safety rules and safety signs. Types and working of fire extinguishers. (03 hrs.)	



		 electrical fire. (02hrs.) 5. Use of fire extinguishers. (03Hrs.) 6. Practice elementary first aid. (02hrs.) 7. Rescue a person and practice artificial respiration. (01Hrs.) 8. Disposal procedure of waste materials. (01Hrs.) 9. Use of personal protective equipment. (01hrs.) 10. Practice on cleanliness and procedure to maintain it. (02 hrs.) 	First aid safety practice. Hazard identification and prevention. Personal safety and factory safety. Response to emergencies e.g. power failure, system failure and fire etc. (03 hrs.)
		 Identify trade tools and machineries. (03Hrs.) Practice safe methods of lifting and handling of tools & equipment. (03Hrs.) Select proper tools for operation and precautions in operation. (03Hrs.) Care & maintenance of trade tools. (03Hrs.) 	Concept of Standards and advantages of BIS/ISI. Trade tools specifications. Introduction to National Electrical Code-2011. (02 hrs.)
		 15. Operations of allied trade tools. (05 Hrs.) 16. Workshop practice on filing and hacksawing. (05Hrs.) 	Allied trades: Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades. Types of drills, description & drilling machines. (02 hrs.)
Professional Skill 95 Hrs.; Professional Knowledge	Prepare electrical wire joints, carry out soldering, crimping and measure insulation resistance	 17. Prepare terminations of cable ends (03 hrs.) 18. Practice on skinning, twisting and crimping. (08 Hrs.) 	Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and



20 Hrs.	of underground cable. (Mapped NOS: PSS/N0108)	19. Identify various types of cables and measure conductor size using SWG and micrometer. (06Hrs.)	their comparison. (06 hrs.)
		 20. Make simple twist, married, Tee and western union joints. (15 Hrs.) 21. Make britannia straight, britannia Tee and rat tail joints. (15Hrs.) 22. Practice in Soldering of joints / lugs. (12 Hrs.) 	Joints in electrical conductors. Techniques of soldering. Types of solders and flux. (07 hrs.)
		 23. Identify various parts, skinning and dressing of underground cable. (10Hrs.) 24. Make straight joint of different types of underground cable. (10Hrs.) 25. Test insulation resistance of underground cable using megger. (06 hrs.) 26. Test underground cables for faults and remove the fault. (10Hrs.) 	Underground cables: Description, types, various joints and testing procedure. Cable insulation & voltage grades Precautions in using various types of cables. (07 hrs.)
Professional Skill 160 Hrs.; Professional Knowledge 36 Hrs.	Verify characteristics of electrical and magnetic circuits. (Mapped NOS: PSS/N6001, PSS/N6003)	 27. Practice on measurement of parameters in combinational electrical circuit by applying Ohm's Law for different resistor values and voltage sources and analyse by drawing graphs. (08 Hrs.) 28. Measure current and voltage in electrical circuits to verify Kirchhoff's Law (08Hrs.) 29. Verify laws of series and 	Ohm's Law; Simple electrical circuits and problems. Kirchoff's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks. (04 hrs.)



 parallel circuits with voltage source in different combinations. (05Hrs.) 30. Measure voltage and current against individual resistance in electrical circuit (05hrs.) 31. Measure current and voltage and analyse the effects of shorts and opens 	
32. Measure current and voltage and analyse the effects of shorts and opens in parallel circuit. (05 Hrs.)	
 33. Measure resistance using voltage drop method. (03Hrs.) 34. Measure resistance using wheatstone bridge. (02 Hrs.) 35. Determine the thermal effect of electric current. (03Hrs.) 36. Determine the change in resistance due to temperature. (02Hrs.) 37. Verify the characteristics of series parallel combination of resistors. (03Hrs.) 	Laws of Resistance and various types of resistors. Wheatstone bridge; principle and its applications. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance. Series and parallel combinations of resistors. (04 hrs.)
 38. Determine the poles and plot the field of a magnet bar. (05Hrs.) 39. Wind a solenoid and determine the magnetic effect of electric current. (05Hrs.) 40. Determine direction of induced emf and current. 	Magnetic terms, magnetic materials and properties of magnet. Principles and laws of electro-magnetism. Self and mutually induced EMFs. Electrostatics: Capacitor- Different types, functions, grouping and uses. (08 hrs.)



 (03hrs.) 41. Practice on generation of mutually induced emf. (03hrs.) 42. Measure the resistance, impedance and determine inductance of choke coils in different combinations. (05Hrs.) 43. Identify various types of capacitors, charging / discharging and testing. (05 Hrs.) 44. Group the given capacitors 	
to get the required capacity and voltage rating. (05 Hrs.)	
 45. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC series circuits. (06Hrs.) 46. Measure the resonance frequency in AC series circuit and determine its effect on the circuit. (05hrs.) 47. Measure current, voltage and PF and determine the characteristics of RL, RC and RLC in AC parallel circuits. (06Hrs.) 48. Measure the resonance frequency in AC parallel circuit and determine its 	Inductive and capacitive reactance, their effect on AC circuit and related vector concepts. Comparison and Advantages of DC and AC systems. Related terms frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, power factor and Impedance etc. Sine wave, phase and phase difference. Active and Reactive power. Single Phase and three-phase system. Problems on A.C. circuits.
circuit and determine its effects on the circuit. (05hrs.) 49. Measure power, energy for lagging and leading power factors in single phase circuits and compare characteristic graphically. (06Hrs.) 50. Measure Current, voltage,	(10 hrs.)



		power, energy and power	
		factor in three phase	
		circuits. (05hrs.)	
		51. Practice improvement of	
		PF by use of capacitor in	
		three phase circuit.(03Hrs.)	
		52. Ascertain use of neutral by	Advantages of AC poly-phase
		identifying wires of a 3-	system.
		phase 4 wire system and	Concept of three-phase Star
		find the phase sequence	and Delta connection.
		using phase sequence	Line and phase voltage,
		meter. (07Hrs.)	current and power in a 3
		53. Determine effect of broken	phase circuits with balanced
		neutral wire in three phase	and unbalanced load.
		four wire system.(04hrs.)	Phase sequence meter.
		54. Determine the relationship	(10 hrs.)
		between Line and Phase	
		values for star and delta	
		connections. (07Hrs.)	
		55. Measure the Power of	
		three phase circuit for	
		balanced and unbalanced	
		loads. (10Hrs.)	
		56. Measure current and	
		voltage of two phases in	
		case of one phase is short-	
		circuited in three phase four	
		wire system and compare	
		with healthy system.	
		(07hrs.)	
Protessional	Install, test and	57. Use of various types of	Chemical effect of electric
Skill 50 Hrs.;	maintenance of	cells. (U8 Hrs.)	current and Laws of
	batteries and solar	58. Practice on grouping of	electrolysis.
Professional	cell.	cells for specified voltage	Explanation of Anodes and
Knowledge	(Mapped NOS:	and current under different	cathodes.
10 Hrs.	PSS/N6001)	conditions and care. (12	Types of cells, advantages /
		Hrs.)	disadvantages and their
		59. Prepare and practice on	applications.
		battery charging and details	Lead acid cell; Principle of
		OF CHARGING CITCUIT. (12 Hrs.)	Tupos of bottomy oborging
		bu. Practice on routine, care/	Safety processions test
		hattorios (08 Hrs.)	salety precautions, test
		61 Determine the number of	Rasic principles of Electro
		colar colls in corios / norsel	plating and esthedia
		solar cells in series / parallel	plating and cathodic



		for given power	protection
		requirement. (10 Hrs.)	Grouping of cells for
			specified voltage and
			current.
			Principle and operation of
			solar cell. (10 Hrs.)
Professional	Estimate, Assemble,	62. Identify various conduits	I.E. rules on electrical wiring.
Skill 200 Hrs.;	install and test	and different electrical	Types of domestic and
	wiring system.	accessories. (8 Hrs.)	industrial wirings.
Professional	(Mapped NOS:	63. Practice cutting, threading	Study of wiring accessories
Knowledge	PSS/N6001)	of different sizes & laying	e.g. switches, fuses, relays,
42 Hrs.		Installations. (17 Hrs.)	MCB, ELCB, MCCB etc.
		64. Prepare test boards /	Grading of cables and current
		extension boards and	ratings.
		mount accessories like lamp	Principle of laying out of
		holders, various switches,	domestic wiring.
		sockets, fuses, relays, MCB,	Voltage drop concept.
		ELCB, MCCB etc. (25 Hrs.)	(14 Hrs.)
		65. Draw layouts and practice	PVC conduit and Casing-
		in PVC Casing-capping,	capping wiring system.
		Conduit wiring with	Different types of wiring -
		minimum to more number	Power, control,
		of points of minimum 15	Communication and
		mtr length. (15 Hrs.)	entertainment wiring.
		66. Wire up PVC conduit wiring	wiring circuits planning,
		to control one lamp from	permissible load in sub-
		two different places. (15	(14 Line)
		FIS.)	(14 115.)
		to control one lamp from	
		three different places (15	
		Hrs)	
		68 Wire up PVC conduit wiring	
		and practice control of	
		sockets and lamps in	
		different combinations	
		using switching concepts	
		(15 Hrs.)	
		69. Wire up the consumers	Estimation of load, cable size.
		main board with MCB &	bill of material and cost.
		DB's switch and distribution	Inspection and testing of
		fuse box. (15 Hrs.)	wiring installations.
		70. Prepare and mount the	Special wiring circuit e.g.
		energy meter board. (15	godown, tunnel and
		Hrs.)	workshop etc.



		 71. Estimate the cost/bill of material for wiring of hostel/ residential building and workshop. (15 Hrs.) 72. Practice wiring of hostel and residential building as per IE rules. (15 Hrs.) 73. Practice wiring of institute and workshop as per IE rules. (15 Hrs.) 74. Practice testing / fault detection of domestic and industrial wiring installation and repair. (15 Hrs.) 	(14 Hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 07 Hrs.	Plan and prepare Earthing installation. (Mapped NOS: PSS/N6002)	 75. Prepare pipe earthing and measure earth resistance by earth tester / megger. (10 Hrs.) 76. Prepare plate earthing and measure earth resistance by earth tester / megger. (10 Hrs.) 77. Test earth leakage by ELCB and relay. (5 Hrs.) 	Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker. (5 Hrs.)
Professional Skill 45Hrs.; Professional Knowledge 10Hrs.	Plan and execute electrical illumination system and test.	 78. Install light fitting with reflectors for direct and indirect lighting. (10 Hrs.) 79. Group different wattage of lamps in series for specified voltage. (5 Hrs.) 80. Practice installation of various lamps e.g. fluorescent tube, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, metal halide etc. (18 Hrs.) 81. Prepare decorative lamp circuit to produce rotating light effect/running light effect/running light effect. (6 Hrs.) 82. Install light fitting for show case lighting. (6 Hrs.) 	Laws of Illuminations. Types of illumination system. Illumination factors, intensity of light. Type of lamps, advantages/ disadvantages and their applications. Calculations of lumens and efficiency. (10 hrs.)



Professional	Select and perform	83. Practice on various analog	Classification of electrical
Skill 50 Hrs.;	measurements	and digital measuring	instruments and essential
	using analog /	Instruments. (5 Hrs.)	forces required in indicating
Professional	digital instruments	84. Practice on measuring	instruments.
Knowledge	and install/	instruments in single and	PMMC and Moving iron
08 Hrs.	diagnose smart	three phase circuits e.g.	instruments.
	meters.	multi-meter, Wattmeter,	Measurement of various
	(Mapped NOS:	Energy meter, Phase	electrical parameters using
	PSS/N1707)	sequence meter and	different analog and digital
		Frequency meter etc.	instruments.
		(12Hrs.)	Measurement of energy in
		85. Measure power in three	three phase circuit.
		phase circuit using two	Automatic meter reading
		wattmeter methods. (8 Hrs.)	infrastructures and Smart
		86. Measure power factor in	meter.
		three phase circuit by using	Concept of Prosumer and
		power factor meter and	distributed generation.
		verify the same with	Electrical supply
		voltmeter, ammeter and	requirements of smart
		(10Urc.)	the temper notifications of
		(10115.) 87 Massura alactrical	motor (08 brs)
		narameters using tong	
		tester in three nhase	
		circuits (08Hrs)	
		88 Demonstrate Smart Meter	
		its physical components and	
		Communication	
		components. (03 Hrs.)	
		89. Perform meter readings.	
		install and diagnose smart	
		meters. (04 Hrs.)	
Professional	Perform testing,	90. Practice for range	Errors and corrections in
Skill 25 Hrs.;	verify errors and	extension and calibration of	measurement.
	calibrate	various measuring	Loading effect of voltmeter
Professional	instruments.	instruments. (10 Hrs.)	and voltage drop effect of
Knowledge		91. Determine errors in	ammeter in circuits.
05Hrs.		resistance measurement by	Extension of range and
		voltage drop method. (8	calibration of measuring
		Hrs.)	instruments. (05 hrs.)
		92. Test single phase energy	
		meter for its errors. (7 Hrs.)	
Professional	Plan and carry out	93. Dismantle and assemble	Working principles and
Skill 75 Hrs.;	installation, fault	electrical parts of various	circuits of common domestic
	detection and	electrical appliances e.g.	equipment and appliances.



Professional Knowledge 10 Hrs.	repairing of domestic appliances. (Mapped NOS: PSS/N6003)	94.	cooking range, geyser, washing machine and pump set. (25 Hrs.) Service and repair of electric iron, electric kettle, cooking range and geyser. (12 Hrs.) Service and repair of	Concept of Neutral and Earth. (10 hrs.)
		96.	induction heater and oven. (10 Hrs.) Service and repair of	
		97.	mixer and grinder. (10 Hrs.) Service and repair of washing machine. (13Hrs.)	
Professional Skill 75 Hrs.; Professional Knowledge	Execute testing, evaluate performance and maintenance of transformer.	98.	Verify terminals, identify components and calculate transformation ratio of single-phase transformers.	Workingprinciple,constructionandclassification of transformer.Single phase and three phasetransformers.
12 Hrs.	(Mapped NOS: PSS/N2406, PSS/N2407)	99.	Perform OC and SC test to determine and efficiency of single-phase transformer. (12Hrs.)	Turn ratio and e.m.f. equation. Series and parallel operation of transformer. Voltage Regulation and
		100.	Determine voltage regulation of single-phase transformer at different loads and power factors. (12 Hrs.)	efficiency. Auto Transformer and instrument transformers (CT & PT). (12 Hrs.)
		101.	Perform series and parallel operation of two single phase transformers. (12 Hrs.)	
		102.	Verify the terminals and accessories of three phase transformer HT and LT side. (6Hrs.)	
		103.	Perform 3 phase	Method of connecting three



		 operation (i) delta-delta, (ii) delta-star, (iii) star-star, (iv) star-delta by use of three single phase transformers. (6 Hrs.) 104. Perform testing of transformer oil. (6 Hrs.) single phase transformers for three phase operation. Types of Cooling, protective devices, bushings and termination etc. Testing of transformer oil. Materials used for winding and winding wires in small 		
		105. Practice on winding of transformer.		
		small transformer. (8 Hrs.) (06 Hrs.)		
		106. Practice of general		
		maintenance of		
		transformer. (5 Hrs.)		
	EN	GINEERING DRAWING: 40 Hrs.		
Professional	Read and apply	ENGINEERING DRAWING		
Knowledge	engineering drawing	Introduction to Engineering Drawing and Drawing		
ED- 40 Hrs.	for different	Instruments –		
	field of work	 Conventions Sizes and layout of drawing shoets 		
		 Sizes and layout of drawing sheets Title Block its position and content 		
		 Title Block, its position and content Description and content 		
		Drawing Instrument Erect hand drawing of		
		Free nand drawing of –		
		 Geometrical figures and blocks with dimension Transferring measurement from the given object to the free band sketches 		
		Free hand drawing of hand tools.		
		Drawing of Geometrical figures:		
		Angle, Triangle, Circle, Rectangle, Square, Parallelogram.		
		Lettering & Numbering – Single Stroke		
		Dimensioning Practice		
		 Types of arrowhead 		
		Symbolic representation		
		 Different electrical symbols used in the related trades 		
		Reading of Electrical Circuit Diagram		
		Reading of Electrical Layout drawing		
	WORKSH	IOP CALCULATION & SCIENCE: 30 Hrs		
Protessional	Demonstrate basic	WORKSHOP CALCULATION & SCIENCE		
Knowledge	mathematical	Unit, Fractions		
WCS- 30 Hrs.	concept and	Classification of unit system		
	principles to	Measurement units and conversion		
	operations	Factors, HCF, I CM and problems		
	operations.			