

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)	1. Visit various sections of the institutes and location of electrical installations. (01hrs.) 2. Identify safety symbols and hazards. (02Hrs.) 3. Preventive measures for electrical accidents and practice steps to be taken in such accidents. (03hrs.) 4. 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.)
		11. Identify trade tools and machineries. (03Hrs.) 12. Practice safe methods of lifting and handling of tools & equipment. (03Hrs.) 13. Select proper tools for operation and precautions in operation. (03Hrs.) 14. 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.;	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. Kirchhoff's Laws and applications. Series and parallel circuits. Open and short circuits in series and parallel networks. (04 hrs.)
Professional Knowledge 36 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 in series circuit. (05 Hrs.) 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 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,	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. (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 identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter. (07Hrs.) 53. Determine effect of broken neutral wire in three phase four wire system.(04hrs.) 54. Determine the relationship 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.)	Advantages of AC poly-phase system. Concept of three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. Phase sequence meter. (10 hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	Install, test and maintenance of batteries and solar cell. (Mapped NOS: PSS/N6001)	57. Use of various types of cells. (08 Hrs.) 58. Practice on grouping of cells for specified voltage and current under different conditions and care. (12 Hrs.) 59. Prepare and practice on battery charging and details of charging circuit. (12 Hrs.) 60. Practice on routine, care/ maintenance and testing of batteries. (08 Hrs.) 61. Determine the number of solar cells in series / parallel	Chemical effect of electric current and Laws of electrolysis. Explanation of Anodes and cathodes. Types of cells, advantages / disadvantages and their applications. Lead acid cell; Principle of operation and components. Types of battery charging, Safety precautions, test equipment and maintenance. Basic principles of Electro-plating and cathodic

		for given power requirement. (10 Hrs.)	protection Grouping of cells for specified voltage and current. Principle and operation of solar cell. (10 Hrs.)
Professional Skill 200 Hrs.; Professional Knowledge 42 Hrs.	Estimate, Assemble, install and test wiring system. (Mapped NOS: PSS/N6001)	62. Identify various conduits and different electrical accessories. (8 Hrs.) 63. Practice cutting, threading of different sizes & laying Installations. (17 Hrs.) 64. Prepare test boards / extension boards and mount accessories like lamp holders, various switches, sockets, fuses, relays, MCB, ELCB, MCCB etc. (25 Hrs.)	I.E. rules on electrical wiring. Types of domestic and industrial wirings. Study of wiring accessories e.g. switches, fuses, relays, MCB, ELCB, MCCB etc. Grading of cables and current ratings. Principle of laying out of domestic wiring. Voltage drop concept. (14 Hrs.)
		65. Draw layouts and practice in PVC Casing-capping, Conduit wiring with minimum to more number of points of minimum 15 mtr length. (15 Hrs.) 66. Wire up PVC conduit wiring to control one lamp from two different places. (15 Hrs.) 67. Wire up PVC conduit wiring 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.)	PVC conduit and Casing-capping wiring system. Different types of wiring - Power, control, Communication and entertainment wiring. Wiring circuits planning, permissible load in sub-circuit and main circuit. (14 Hrs.)
		69. Wire up the consumers main board with MCB & DB's switch and distribution fuse box. (15 Hrs.) 70. Prepare and mount the energy meter board. (15 Hrs.)	Estimation of load, cable size, bill of material and cost. Inspection and testing of wiring installations. Special wiring circuit e.g. godown, tunnel and 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. (15Hrs.)	(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. (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 Skill 50 Hrs.; Professional Knowledge 08 Hrs.	Select and perform measurements using analog / digital instruments and install/ diagnose smart meters. (Mapped NOS: PSS/N1707)	83. Practice on various analog and digital measuring Instruments. (5 Hrs.) 84. Practice on measuring instruments in single and three phase circuits e.g. multi-meter, Wattmeter, Energy meter, Phase sequence meter and Frequency meter etc. (12Hrs.) 85. Measure power in three phase circuit using two wattmeter methods. (8 Hrs.) 86. Measure power factor in three phase circuit by using power factor meter and verify the same with voltmeter, ammeter and wattmeter readings. (10Hrs.) 87. Measure electrical parameters using tong tester in three phase 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.)	Classification of electrical instruments and essential forces required in indicating instruments. PMMC and Moving iron instruments. Measurement of various electrical parameters using different analog and digital instruments. Measurement of energy in three phase circuit. Automatic meter reading infrastructures and Smart meter. Concept of Prosumer and distributed generation. Electrical supply requirements of smart meter, Detecting/clearing the tamper notifications of meter. (08 hrs.)
Professional Skill 25 Hrs.; Professional Knowledge 05Hrs.	Perform testing, verify errors and calibrate instruments.	90. Practice for range extension and calibration of various measuring instruments. (10 Hrs.) 91. Determine errors in resistance measurement by voltage drop method. (8 Hrs.) 92. Test single phase energy meter for its errors. (7 Hrs.)	Errors and corrections in measurement. Loading effect of voltmeter and voltage drop effect of ammeter in circuits. Extension of range and calibration of measuring instruments. (05 hrs.)
Professional Skill 75 Hrs.;	Plan and carry out installation, fault detection and	93. Dismantle and assemble electrical parts of various electrical appliances e.g.	Working principles and circuits of common domestic equipment and appliances.

Professional Knowledge 10 Hrs.	repairing of domestic appliances. (Mapped NOS: PSS/N6003)	cooking range, geyser, washing machine and pump set. (25 Hrs.) 94. Service and repair of electric iron, electric kettle, cooking range and geyser. (12 Hrs.) 95. Service and repair of induction heater and oven. (10 Hrs.) 96. Service and repair of mixer and grinder. (10 Hrs.) 97. Service and repair of washing machine. (13Hrs.)	Concept of Neutral and Earth. (10 hrs.)
Professional Skill 75 Hrs.; Professional Knowledge 12 Hrs.	Execute testing, evaluate performance and maintenance of transformer. (Mapped NOS: PSS/N2406, PSS/N2407)	98. Verify terminals, identify components and calculate transformation ratio of single-phase transformers. (8 Hrs.) 99. Perform OC and SC test to determine and efficiency of single-phase transformer. (12Hrs.) 100. Determine voltage regulation of single-phase transformer at different loads and power factors. (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.)	Working principle, construction and classification of transformer. Single phase and three phase transformers. Turn ratio and e.m.f. equation. Series and parallel operation of transformer. Voltage Regulation and efficiency. Auto Transformer and instrument transformers (CT & PT). (12 Hrs.)
		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.) 105. Practice on winding of small transformer. (8 Hrs.) 106. Practice of general maintenance of transformer. (5 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 transformer. (06 Hrs.)
ENGINEERING DRAWING: 40 Hrs.			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work.	ENGINEERING DRAWING Introduction to Engineering Drawing and Drawing Instruments – ● Conventions ● Sizes and layout of drawing sheets ● Title Block, its position and content ● Drawing Instrument Free hand drawing of – ● Geometrical figures and blocks with dimension ● Transferring measurement from the given object to the free hand sketches. ● Free hand drawing of hand tools. 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	
WORKSHOP CALCULATION & SCIENCE: 30 Hrs			
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations.	WORKSHOP CALCULATION & SCIENCE Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems	

	Understand and explain basic science in the field of study.	Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division Solving problems by using calculator Square root, Ratio and Proportions, Percentage Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction Material Science Types of metals, types of ferrous and non ferrous metals Introduction of iron and cast iron Mass, Weight, Volume and Density Mass, volume, density, weight Related problems for mass, volume, density, weight Work, power, energy, HP, IHP, BHP and efficiency Potential energy, kinetic energy and related problems with assignment Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Scales of temperature, Celsius, Fahrenheit, Kelvin and conversion between scales of temperature Heat & Temperature - Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation. Mensuration Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder Trigonometry Measurement of angles Trigonometrical ratios Trigonometrical tables
Project work / Industrial visit Broad Areas: - Overload protection of electrical equipment - Automatic control of streetlight/night lamp		

- c) Fuse and power failure indicator using relays
- d) Door alarm/indicator
- e) Decorative light with electrical flasher

SYLLABUS FOR ELECTRICIAN TRADE			
SECOND YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 35 Hrs.; Professional Knowledge 09 Hrs.	Plan, execute commissioning and evaluate performance of DC machines. (Mapped NOS: PSS/N4402)	107. Identify terminals, parts and connections of different types of DC machines. (05 Hrs.) 108. Measure field and armature resistance of DC machines. (05 Hrs.) 109. Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load. (10 Hrs.) 110. Test for continuity and insulation resistance of DC machine. (5 Hrs.) 111. Start, run and reverse direction of rotation of DC series, shunt and	General concept of rotating electrical machines. Principle of DC generator. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring and Brushes, Laminated core etc. E.M.F. equation Separately excited and self-excited generators. Series, shunt and compound generators. (09 Hrs.)

		compound motors. (10 Hrs.)	
Professional Skill 77 Hrs.; Professional Knowledge 24 Hrs.	Execute testing, and maintenance of DC machines and motor starters. (Mapped NOS: PSS/N4402)	112. Perform no load and load test and determine characteristics of series and shunt generators. (08 Hrs.) 113. Perform no load and load test and determine characteristics of compound generators (cumulative and differential). (07 Hrs.) 114. Practice dismantling and assembling in DC shunt motor. (10 Hrs.) 115. Practice dismantling and assembling in DC compound generator. (10 Hrs.)	Armature reaction, Commutation, inter poles and connection of inter poles. Parallel Operation of DC Generators. Load characteristics of DC generators. Application, losses & efficiency of DC Generators. Routine & maintenance. (12 Hrs.)
		116. Conduct performance analysis of DC series, shunt and compound motors. (14 Hrs.) 117. Dismantle and identify parts of three point and four-point DC motor starters. (06 Hrs.) 118. Assemble, Service and repair three point and four-point DC motor starters. (10 Hrs.) 119. Practice maintenance of carbon brushes, brush holders, Commutator and sliprings. (12 Hrs.)	Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors. Routine and maintenance. (12 Hrs.)

Professional Skill 35 Hrs.; Professional Knowledge 09 Hrs.	Distinguish, organise and perform motor winding. (Mapped NOS: PSS/N4402)	120. Perform speed control of DC motors - field and armature control method. (10 Hrs.) 121. Carry out overhauling of DC machines. (10 Hrs.) 122. Perform DC machine winding by developing connection diagram, test on growler and assemble. (15 Hrs.)	Methods of speed control of DC motors. Lap and wave winding and related terms. (09 Hrs.)
Professional Skill 80 Hrs.; Professional Knowledge 26 Hrs.	Plan, Execute commissioning and evaluate performance of AC motors. (Mapped NOS: PSS/N1709) Execute testing, and maintenance of AC motors and starters. (Mapped NOS: PSS/N1709)	123. Identify parts and terminals of three phase AC motors. (5 Hrs.) 124. Make an internal connection of automatic star-delta starter with three contactors. (10 Hrs.) 125. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters. (17 Hrs.) 126. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic. (13 Hrs.)	Working principle of three phase induction motor. Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque. Different types of starters for three phase induction motors, its necessity, basic contactor circuit, parts and their functions. (13 Hrs.)
		127. Determine the efficiency of squirrel cage induction motor by brake test. (05 Hrs.) 128. Determine the efficiency of three phase squirrel cage induction motor by no load test and blocked rotor test.	Single phasing prevention. No load test and blocked rotor test of induction motor. Losses & efficiency. Various methods of speed control. Braking system of motor. Maintenance and repair. (13 Hrs.)

		(05 Hrs.) 129. Measure slip and power factor to draw speed-torque (slip/torque) characteristics. (10 Hrs.) 130. Test for continuity and insulation resistance of three phase induction motors. (5 Hrs.) 131. Perform speed control of three phase induction motors by various methods like rheostatic control, autotransformer etc. (10 Hrs.)	
Professional Skill 23 Hrs.; Professional Knowledge 09 Hrs.	Distinguish, organise and perform motor winding. (Mapped NOS: PSS/N4402)	132. Perform winding of three phase AC motor by developing connection diagram, test and assemble. (18 Hrs.) 133. Maintain, service and troubleshoot the AC motor starter. (05 Hrs.)	Concentric/ distributed, single/double layer winding and related terms.
Professional Skill 39 Hrs.; Professional Knowledge 12 Hrs.	Plan, Execute commissioning and evaluate performance of AC motors. (Mapped NOS: PSS/N1709) Execute testing, and maintenance of AC motors and starters. (Mapped NOS: PSS/N1709)	134. Identify parts and terminals of different types of single-phase AC motors. (5 Hrs.) 135. Install, connect and determine performance of single-phase AC motors. (10 Hrs.) 136. Start, run and reverse the direction of rotation of single-phase AC motors. (08 Hrs.) 137. Practice on speed control of single-phase AC motors. (08 Hrs.)	Working principle, different method of starting and running of various single-phase AC motors. Domestic and industrial applications of different single-phase AC motors. Characteristics, losses and efficiency. (12 hrs.)

		138. Compare starting and running winding currents of a capacitor run motor at various loads and measure the speed. (08 Hrs.)	
Professional Skill 50 Hrs.; Professional Knowledge 12 Hrs.	Distinguish, organise and perform motor winding. (Mapped NOS: PSS/N4402)	139. Carry out maintenance, service and repair of single-phase AC motors. (10 Hrs.) 140. Practice on single/double layer and concentric winding for AC motors, testing and assembling. (25 Hrs.) 141. Connect, start, run and reverse the direction of rotation of universal motor. (10 Hrs.) 142. Carry out maintenance and servicing of universal motor. (05 Hrs.)	Concentric/ distributed, single/double layer winding and related terms. Troubleshooting of single-phase AC induction motors and universal motor. (12 hrs.)
Professional Skill 75 Hrs.; Professional Knowledge 22 Hrs.	Plan, execute testing, evaluate performance and carry out maintenance of Alternator / MG set. Execute parallel operation of alternators.	143. Install an alternator, identify parts and terminals of alternator. (5 Hrs.) 144. Test for continuity and insulation resistance of alternator. (5 Hrs.) 145. Connect, start and run an alternator and build up the voltage. (5 Hrs.) 146. Determine the load performance and voltage regulation of three phase alternator. (5 Hrs.) 147. Parallel operation and synchronization of three	Principle of alternator, e.m.f. equation, relation between poles, speed and frequency. Types and construction. Efficiency, characteristics, regulation, phase sequence and parallel operation. Effect of changing the field excitation and power factor correction. (10 Hrs.)

		phase alternators. (15 Hrs.)	
		148. Install a synchronous motor, identify its parts and terminals. (10 Hrs.) 149. Connect, start and plot V-curves for synchronous motor under different excitation and load conditions. (10 Hrs.)	Working principle of synchronous motor. Effect of change of excitation and load. V and anti V curve. Power factor improvement. (06 Hrs.)
		150. Identify parts and terminals of MG set. (5 Hrs.) 151. Start and load MG set with 3 phase induction motor coupled to DC shunt generator. (15 Hrs.)	Rotary Converter, MG Set description and Maintenance. (06 Hrs.)
Professional Skill 99 Hrs.; Professional Knowledge 31 Hrs.	Assemble simple electronic circuits and test for functioning.	152. Determine the value of resistance by colour code and identify types. (03 Hrs.) 153. Test active and passive electronic components and its applications. (05 Hrs.)	Resistors – colour code, types and characteristics. Active and passive components. Atomic structure and semiconductor theory. (04 Hrs.)
		154. Determine V-I characteristics of semiconductor diode. (05 Hrs.) 155. Construct half wave, full wave and bridge rectifiers using semiconductor diode. (08 Hrs.) 156. Check transistors for their functioning by identifying its type and terminals. (10 Hrs.)	P-N junction, classification, specifications, biasing and characteristics of diodes. Rectifier circuit - half wave, full wave, bridge rectifiers and filters. Principle of operation, types, characteristics and various configuration of transistor. Application of transistor as a switch, voltage regulator and amplifier. (12 Hrs.)

		157. Bias the transistor and determine its characteristics. (05Hrs.) 158. Use transistor as an electronic switch and series voltage regulator. (05Hrs.)	
		159. Operate and set the required frequency using function generator. (05Hrs.) 160. Make a printed circuit board for power supply. (09 Hrs.) 161. Construct simple circuits containing UJT for triggering and FET as an amplifier. (05 Hrs.) 162. Troubleshoot defects in simple power supplies. (09 Hrs.)	Basic concept of power electronics devices. IC voltage regulators Digital Electronics - Binary numbers, logic gates and combinational circuits. (06 hrs.)
		163. Construct power control circuit by SCR, Diac, Triac and IGBT. (12 Hrs.) 164. Construct variable DC stabilized power supply using IC. (08 Hrs.) 165. Practice on various logics by use of logic gates and circuits. (05 Hrs.) 166. Generate and demonstrate wave shapes for voltage and current of rectifier, single stage amplifier and oscillator using CRO. (05 Hrs.)	Working principle and uses of oscilloscope. Construction and working of SCR, DIAC, TRIAC and IGBT. (09 Hrs.)
Professional Skill 82 Hrs.;	Assemble accessories and	167. Design layout of control	Study and understand Layout drawing of control cabinet,

Professional Knowledge 24 Hrs.	carry out wiring of control cabinets and equipment.	cabinet, assemble control elements and wiring accessories for: (i) Local and remote control of induction motor. (09 Hrs.) (ii) Forward and reverse operation of induction motor. (09 Hrs.) (iii) Automatic star-delta starter with change of direction of rotation. (12 Hrs.) (iv) Sequential control of three motors. (09 Hrs.)	power and control circuits. Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc. (12 Hrs.)
		168. Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc. (13 Hrs.) 169. Mount various control elements e.g. circuit breakers, relays, contactors and timers etc. (09 Hrs.) 170. Identify and install required measuring instruments and sensors in control panel. (09 Hrs.) 171. Test the control panel for its performance. (12 Hrs.)	Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, gromats and clips etc. Testing of various control elements and circuits. (12 Hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 11 Hrs.	Perform speed control of AC and DC motors by using solid state devices.	172. Perform speed control of DC motor using thyristors / DC drive. (18 Hrs.) 173. Perform speed control and reversing the direction of rotation of AC motors by using thyristors / AC drive.	Working, parameters and applications of AC / DC drive. Speed control of 3 phase induction motor by using VVVF/AC Drive. (11 Hrs.)

		(18 Hrs.) 174. Construct and test a universal motor speed controller using SCR. (14 Hrs.)	
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	Detect the faults and troubleshoot inverter, stabilizer, battery charger, emergency light and UPS etc. (Mapped NOS: PSS/N6002)	175. Assemble circuits of voltage stabilizer and UPS. (10 Hrs.) 176. Prepare an emergency light. (10 Hrs.) 177. Assemble circuits of battery charger and inverter. (10Hrs.) 178. Test, analyze defects and repair voltage stabilizer, emergency light and UPS. (05Hrs.) 179. Maintain, service and troubleshoot battery charger and inverter. (07Hrs.) 180. Install an Inverter with battery and connect it in domestic wiring for operation. (08Hrs.)	Basic concept, block diagram and working of voltage stabilizer, battery charger, emergency light, inverter and UPS. Preventive and breakdown maintenance. (10 Hrs.)
Professional Skill 23 Hrs.; Professional Knowledge 04 Hrs.	Erect overhead domestic service line, outline various power plant layout and explain smart distribution grid and its components. (Mapped NOS: PSS/N0106)	181. Draw layout of thermal power plant and identify function of different layout elements. (5 Hrs.) 182. Draw layout of hydel power plant and identify functions of different layout elements. (5 Hrs.) 183. Visit to transmission / distribution substation. (08 Hrs.) 184. Draw actual circuit diagram of substation visited and	Conventional and non-conventional sources of energy and their comparison. Power generation by thermal and hydel power plants. (04 Hrs.)

		indicate various components. (5 Hrs.)	
Professional Skill 25 Hrs.; Professional Knowledge 07 Hrs.	Plan, assemble and install solar panel.	185. Prepare layout plan and Identify different elements of solar power system. (05 Hrs.) 186. Prepare layout plan and Identify different elements of wind power system. (05 Hrs.) 187. Assemble and connect solar panel for illumination. (15 Hrs.)	Various ways of electrical power generation by non-conventional methods. Power generation by solar and wind energy. Principle and operation of solar panel. (07 Hrs.)
Professional Skill 50 Hrs.; Professional Knowledge 10 Hrs.	Erect overhead domestic service line, outline various power plant layout and explain smart distribution grid and its components. (Mapped NOS: PSS/N0106)	188. Practice installation of insulators used in HT/LT line for a given voltage range. (04hrs.) 189. Draw single line diagram of transmission and distribution system. (04Hrs.) 190. Measure current carrying capacity of conductor for given power supply. (04hrs.) 191. Fasten jumper in pin, shackle and suspension type insulators. (07Hrs.)	Transmission and distribution networks. Line insulators, overhead poles and method of joining aluminum conductors. (05 Hrs.)
		192. Erect an overhead service line pole for single phase 230V distribution system in open space. (10 Hrs.) 193. Practice on laying of domestic service line. (10 Hrs.) 194. Install bus bar and bus coupler on LT line. (5 Hrs.)	Safety precautions and IE rules pertaining to domestic service connections. Various substations. Various terms like – maximum demand, average demand, load factor, diversity factor, plant utility factor etc. (05 Hrs.)

Professional Skill 25 Hrs.; Professional Knowledge 04 Hrs.	Examine the faults and carry out repairing of circuit breakers. (Mapped NOS: PSS/N7001)	195. Identify various parts of relay and ascertain the operation. (5 Hrs.) 196. Practice setting of pick up current and time setting multiplier for relay operation. (5 hrs.) 197. Identify the parts of circuit breaker, check its operation. (5Hrs.) 198. Test tripping characteristic of circuit breaker for over current and short circuit current. (5 hrs.) 199. Practice on repair and maintenance of circuit breaker. (5 hrs.)	Types of relays and its operation. Types of circuit breakers, their applications and functioning. Production of arc and quenching. (04 Hrs)
Professional Skill 22 Hrs.; Professional Knowledge 04 Hrs.	Install and troubleshoot Electric Vehicle charging stations.	200. Demonstrate different charger specifications. (05 hrs) 201. Perform installation of EV charging Station for Public places. (10 hrs) 202. Perform installation of Home EV charging stations. (10 hrs)	EV scenario in India and EV Charging basic theory. EV Charging safety requirements. (04 Hrs)
ENGINEERING DRAWING: 40 Hrs.			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work.	ENGINEERING DRAWING: Reading of Electrical Sign and Symbols. Sketches of Electrical components. Reading of Electrical wiring diagram and Layout diagram. Reading of Electrical earthing diagram. Drawing the schematic diagram of plate and pipe earthing. Drawing of Electrical circuit diagram. Drawing of Block diagram of Instruments & equipment of trades.	
WORKSHOP CALCULATION & SCIENCE: 32 Hrs			
Professional Knowledge WCS- 32 Hrs.	Demonstrate basic mathematical concept and principles to	WORKSHOP CALCULATION & SCIENCE: Friction Friction - Lubrication Algebra	

	perform practical operations. Understand and explain basic science in the field of study.	Algebra - Addition , subtraction, multiplication & division Algebra - Theory of indices, algebraic formula, related problems Elasticity Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Profit and Loss Profit and loss - Simple problems on profit & loss Profit and loss - Simple and compound interest Estimation and Costing Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade. Estimation and costing - Problems on estimation and costing
Project work / Industrial visit: a) Battery charger/Emergency light b) Control of motor pump with tank level c) DC voltage converter using SCRs d) Logic control circuits using relays e) Alarm/indicator circuits using sensors		

7. TRADE SYLLABUS

SYLLABUS FOR FITTER TRADE			
FIRST YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) with Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 212 Hrs; Professional Knowledge 37Hrs	Plan and organize the work to make job as per specification applying different types of basic fitting operation and Check for dimensional accuracy following safety precautions. <i>[Basic fitting operation – marking, Hacks awing, Chiseling, Filing, Drilling, Taping and Grinding etc. Accuracy: $\pm 0.25\text{mm}$]</i> (Mapped NOS: CSC/N0304)	1. Importance of trade training, List of tools & Machinery used in the trade. (1 hr.) 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). (5 hrs.) 3. First Aid Method and basic training. (2 hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. (2 hrs.) 5. Hazard identification and avoidance. (2 hrs.) 6. Safety signs for Danger, Warning, caution & personal safety message. (1 hrs.) 7. Preventive measures for electrical accidents & steps to be taken in such accidents. (2 hrs.) 8. Use of Fire extinguishers. (7 hrs.) 9. Practice and understand precautions to be followed while working in fitting jobs. (2 hrs.) 10. Safe use of tools and equipments used in the trade. (1 hrs.)	All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Soft Skills, its importance and Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. Basic understanding on Hot work, confined space work and material handling equipment. (04 hrs.)

		11. Identification of tools & equipment as per desired specifications for marking & sawing. (4 hrs.) 12. Selection of material as per application. (1 hrs.) 13. Visual inspection of raw material for rusting, scaling, corrosion etc. (1 hrs.) 14. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions. (9 hrs.) 15. Sawing different types of metals of different sections. (6 hrs.)	Linear measurements- its units, dividers, calipers, hermaphrodite, centre punch, dot punch, prick punch their description and uses of different types of hammers. Description, use and care of 'V' Blocks, marking off table. Measuring standards (English, Metric Units), angular measurements. (04 hrs.)
		16. Filing Channel, Parallel. (5 hrs.) 17. Filing- Flat and square (Rough finish), (08 hrs.) 18. Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule. (5 hrs.) 19. Marking practice with dividers, odd leg calipers and steel rule (circles, ARCs, parallel lines). (4 hrs.)	Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification, description, types and their uses, method of using hacksaws. Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Measuring standards (English, Metric Units), angular measurements. (04 hrs.)
		20. Marking off straight lines and ARCs using scribing block and dividers. (4 hrs.) 21. Chipping flat surfaces along a marked line. (9 hrs.) 22. Marking, filing, filing square and check using tri square. (9 hrs.)	Marking off and layout tools, dividers, scribing block, - description, classification, material, care & maintenance. Try square, ordinary depth gauge, protractor- description, uses and cares. Uses, care & maintenance of cold chisels- materials, types, cutting angles. (04 hrs.)
		23. Marking according to simple blueprints for locating, position of holes,	Marking media, marking blue, Prussian blue, red lead, chalk and their special application,

		scribing lines on chalked surfaces with marking tools. (8 hrs.) 24. Finding centre of round bar with the help of 'V' block and marking block. (2 hrs.) 25. Joining straight line to an ARC. (08 hrs.)	description. Use, care and maintenance of scribing block. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses, accuracy, care and maintenance. (03 hrs.)
		26. Chipping, Chamfering, Chip slots & oils grooves (Straight). (08 hrs.) 27. Filing flat, square, and parallel to an accuracy of 0.5mm. (07 hrs.) 28. Chip curve along a line-mark out, keyways at various angles & cut keyways. (1 hrs.) 29. Sharpening of Chisel. (2 hrs.) 30. File thin metal to an accuracy of 0.5 mm. (3 hrs.)	Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability, hardness, brittleness, toughness, tenacity, and elasticity. (04 hrs.)
		31. Saw along a straight line, curved line, on different sections of metal. (12 hrs.) 32. Straight saw on thick section, M.S. angle and pipes. (8 hrs.)	Power Saw, band saw, Circular saw machines used for metal cutting. (03 hrs.)
		33. File steps and finish with smooth file to accuracy of ± 0.25 mm. (12 hrs.) 34. File and saw on M.S. Square and pipe. (10 hrs.)	Micrometer- outside and inside – principle, constructional features, parts graduation, reading, use and care. Micrometer depth gauge, parts, graduation, reading, use and care. Digital micrometer. (03 hrs.)
		35. File radius along a marked line (Convex & concave) & match. (12 hrs.) 36. Chip sheet metal (shearing). (3 hrs.) 37. Chip step and file. (3 hrs.)	Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital Vernier caliper.

			Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance. (03 hrs.)
		38. Mark off and drill through holes. (5 hrs.) 39. Drill and tap on M.S. flat. (8 hrs.) 40. Punch letter and number (letter punch and number punch) (3 hrs.) 41. Practice use of different punches. (5 hrs.)	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Determination of tap drill size. (03 hrs.)
Professional Skill 97Hrs; Professional Knowledge 21Hrs	Manufacture simple sheet metal items as per drawing and join them by soldering, brazing and riveting. (Mapped NOS: CSC/N0301)	42. Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. (12 hrs.) 43. Marking out of simple development (5 hrs.) 44. Marking out for flaps for soldering and sweating. (4 hrs.)	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Shearing machine- description, parts and uses. (05 hrs.)
		45. Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming. (22 hrs.) 46. Punch holes-using hollow and solid punches. (5 hrs.) 47. Do lap and butt joints. (12 hrs.)	Marking and measuring tools, wing compass, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools, types, specifications, uses. Trammel- description, parts, uses. Hand grooves- specifications and uses. Sheet and wire gauge. (07 hrs.)
		48. Bend sheet metal into various curvature form, wired edges- straight and curves. Fold sheet metal at angle using stakes. (6 hrs.) 49. Make simple Square container with wired edge and fix handle. (13 hrs.)	Stakes-bench types, parts, their uses. Various types of metal joints, their selection and application, tolerance for various joints, their selection& application. Wired edges. (04 hrs.)

		50. Make square tray with square soldered corner. (11 hrs.) 51. Practice in soft soldering and silver soldering. (7 hrs.)	Solder and soldering: Introduction-types of solder and flux. Composition of various types of solders and their heating media of soldering iron. Method of soldering, selection and application-joints. Hard solder-Introduction, types and method of brazing. (05 hrs.)
Professional Skill 19Hrs; Professional Knowledge 03Hrs	Join metal components by riveting observing standard procedure. (Mapped NOS: CSC/N0304)	52. Make riveted lap and butt joint. (6 hrs.) 53. Make funnel as per development and solder joints. (8 hrs.) 54. Drill for riveting. (1 hr.) 55. Riveting with as many types of rivet as available, use of counter sunk head rivets. (4 hrs.)	Various rivets shape and form of heads, importance of correct head size. Rivets-Tin man's rivets types, sizes, and selection for various works. Riveting tools, dolly snaps description and uses. Method of riveting, The spacing of rivets. Flash riveting, use of correct tools, compare hot and cold riveting. (03 hrs.)
Professional Skill 21Hrs; Professional Knowledge 04Hrs	Join metal component by arc welding observing standard procedure. (Mapped NOS: CSC/N0304)	56. Welding - Striking and maintaining ARC, laying Straight-line bead. (21 hrs.)	Safety-importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Introduction to safety equipment and their uses. Machines and accessories, welding transformer, welding generators. (04 hrs.)
Professional Skill 64Hrs; Professional Knowledge 16Hrs	Cut and join metal component by gas (oxy-acetylene) (Mapped NOS: CSC/N0304)	57. Making butt joint and joint-gas and ARC. (12 hrs.) 58. Do setting up of flames, fusion runs with and without filler rod, and gas. (8 hrs.)	Welding hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-

			Butt and fillet <u>as per BIS SP: 46-1988</u> specifications. Gases and gas cylinder description, kinds, main difference and uses. (05 hrs.)
		59. Make butt weld and corner, fillet in ARC welding (22 hrs.)	Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode. (05 hrs.)
		60. Gas cutting of MS plates (22 hrs.)	Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses. (06 hrs.)
Professional Skill 143Hrs; Professional Knowledge 26Hrs	Produce components by different operations and check accuracy using appropriate measuring instruments. <i>[Different Operations - Drilling, Reaming, Taping, Dieing; Appropriate Measuring Instrument – Vernier, Screw Gauge, Micrometer]</i> (Mapped NOS: CSC/N0304)	61. Mark off and drill through holes. (04 hrs.) 62. Drill on M.S. flat. (1 hrs.) 63. File radius and profile to suit gauge. (10 hrs.) 64. Sharpening of Drills. (1 hrs.) 65. Practice use of angular measuring instrument. (04 hrs.)	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses. (04 hrs.)
		66. Counter sink, counter bore and ream split fit (three piece fitting). (04 hrs.) 67. Drill through hole and blind holes. (2 hrs.) 68. Form internal threads with taps to standard size (through holes and blind holes). (3 hrs.) 69. Prepare studs and bolt. (13 hrs.)	Counter sink, counter bore and spot facing-tools and nomenclature, Reamer-material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Screw threads: terminology, parts, types and their uses. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (coarse and fine) material, parts (shank body, flute, cutting edge). (03 hrs.)

		70. Form external threads with dies to standard size. (08 hrs.) 71. Prepare nuts and match with bolts. (15 hrs.)	Tap wrench: material, parts, types (solid & adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses. (06 hrs.)
		72. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree). (12 hrs.) 73. Make simple open and sliding fits. (08 hrs.)	Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Drill kinds: Fraction, metric, letters and numbers, grinding of drill. (04 hrs.)
		74. Enlarge hole and increase internal dia. (2 hrs.) 75. File cylindrical surfaces. (5 hrs.) 76. Make open fitting of curved profiles. (15 hrs.)	Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use. (04 hrs.)
		77. Correction of drill location by binding previously drilled hole. (04 hrs.) 78. Make inside square fit. (16 hrs.)	Gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge-types (feeler, screw, pitch, radius, wire gauge). (05 hrs.)
		79. Make sliding 'T' fit. (21 hrs.)	Interchange ability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system. (05 hrs.)
Professional Skill 126Hrs; Professional Knowledge 28Hrs	Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality. <i>[Different Fit – Sliding, Angular, Step fit, 'T' fit, Square fit</i>	80. File fit- combined, open	Method of expressing

	and Profile fit; Required tolerance: ± 0.04 mm, angular tolerance: 30 min.] (Mapped NOS: CSC/N0304)	angular and sliding sides. (08 hrs.) 81. File internal angles 30minutes accuracy open, angular fit. (12 hrs.)	tolerance as per BIS Fits: Definition, types, description of each with sketch. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance. (04 hrs.)
		82. Make sliding fit with angles other than 90° (21 hrs.)	Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and uses Wrought iron:- properties and uses. Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminium, tin, lead, zinc) properties and uses. (05 hrs.)
		83. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. (04 hrs.) 84. Make & assemble, sliding flats, plain surfaces. (12 hrs.) 85. Check for blue match of bearing surfaces- both flat and curved surfaces by wit worth method. (5 hrs.)	Simple scraper- flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces). Testing scraped surfaces: ordinary surfaces without a master plate. (04 hrs.)
		86. File and fit combined radius and angular surface (accuracy ± 0.5 mm), angular and radius fit. (15 hrs.) 87. Locate accurate holes & make accurate hole for stud fit. (2 hrs.) 88. Fasten mechanical components / sub- assemblies together using screws, bolts and collars using hand tools. (5 hrs.)	Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Screw thread micrometer: Construction, graduation and use. (05 hrs.)

		89. Make sliding fits assembly with parallel and angular mating surface. (± 0.04 mm)(21 hrs.)	Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores. (05 hrs.)
Professional Skill 95 Hrs; Professional Knowledge 15 Hrs	Produce components involving different operations on lathe observing standard procedure and check for accuracy. <i>[Different Operations – facing, plain turning, step turning, parting, chamfering, shoulder turn, grooving, knurling, boring, taper turning, threading (external 'V' only)]</i> (Mapped NOS: CSC/N0110)	90. Lathe operations- 91. True job on four jaw chuck using knife tool. (5 hrs.) 92. Face both the ends for holding between centres. (06 hrs.) 93. Using roughing tool parallel turn ± 0.1 mm. (06 hrs.) 94. Measure the diameter using outside caliper and steel rule.(1 hr.)	Safely precautions to be observed while working on a lathe, Lathe specifications, and constructional features. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centres, works with catch plate, dog, simple description of a facing and roughing tool and their applications. (04 hrs.)
		95. Holding job in three jaw chuck. (2 hrs.) 96. Perform the facing, plain turn, step turn, parting, deburr, chamfer-corner, round the ends, and use form tools. (08 hrs.) 97. Shoulder turn: square, filleted, beveled undercut shoulder, turning-filleted under cut, square beveled. (08 hrs.) 98. Sharpening of -Single point Tools. (1 hr.)	Lathe cutting tools- Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants. (03 hrs.)
		99. Cut grooves- square, round, 'V' groove. (08 hrs.) 100. Knurl the job. (1 hr.) 101. Bore holes –spot face, pilot drill, enlarge hole using boring tools. (9 hrs.)	Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and

			enlargement of holes. (02 hrs.)
		102. Turn taper (internal and external). (10 hrs.) 103. Turn taper pins. (5 hrs.) 104. Turn standard tapers to suit with gauge. (5 hrs.)	General turning operations-parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations. Appropriate method of holding the tool on tool post or tool rest, Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations Morse taper. (03 hrs.)
		105. Practice threading using taps, dies on lathe by hand. (2 hrs.) 106. Make external 'V' thread. (8 hrs.) 107. Prepare a nut and match with the bolt. (10 hrs.)	Screw thread definition – uses and application. Square, worm, buttress, acme (nonstandard-screw threads), Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread. (03 hrs.)
Professional Skill 63 Hrs; Professional Knowledge 12Hrs	Plan & perform simple repair, overhauling of different machines and check for functionality. <i>[Different Machines – Drill Machine, Power Saw, Bench Grinder and Lathe]</i>	108. Simple repair work: Simple assembly of machine parts from blueprints. (10 hrs.) 109. Rectify possible assembly faults during assembly. (14 hrs.) 110. Perform the routine maintenance with check list (08 hrs.) 111. Monitor machine as per routine checklist (3 hrs.) 112. Read pressure gauge, temperature gauge, oil level (1 hr.)	Maintenance -Total productive maintenance -Autonomous maintenance -Routine maintenance -Maintenance schedule -Retrieval of data from machine manuals Preventive maintenance-objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of

		113. Set pressure in pneumatic system (2 hrs.)	handbooks and reference table. Possible causes for assembly failures and remedies. Installation, maintenance and overhaul of machinery and engineering equipment (10 hrs.)
		114. Assemble simple fitting using dowel pins and tap screw assembly using torque wrench. (15 hrs.)	Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torqueing. Dowel pins: material, construction, types, accuracy and uses. (02 hrs.)
Engineering Drawing: 40 Hrs.			
<u>Professional Knowledge</u> <u>ED- 40 Hrs.</u>	Read and apply engineering drawing for different application in the field of work.	<u>Engineering Drawing:</u> Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the freehand sketches. • Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke. Dimensioning • Types of arrowhead • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation – • Different symbols used in the related trades. Concept and reading of Drawing in • Concept of axes plane and quadrant • Concept of Orthographic and Isometric projections • Method of first angle and third angle projections (definition and difference) Reading of Job drawing of related trades.	
WORKSHOP CALCULATION & SCIENCE: 38 Hrs.			

Professional Knowledge WCS- 38 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	<u>WORKSHOP CALCULATION & SCIENCE:</u> Unit, Fractions Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, subtraction, multiplication & division Decimal fractions - Addition, subtraction, multiplication & division Solving problems by using calculator Square root, Ratio and Proportions, Percentage Square and square root Simple problems using calculator Applications of Pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Percentage - Changing percentage to decimal and fraction Mass, Weight, Volume and Density Mass, volume, density, weight and specific gravity Related problems for mass, volume, density, weight and specific gravity Speed and Velocity, Work, Power and Energy Work, power, energy, HP, IHP, BHP and efficiency Heat & Temperature and Pressure Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure Basic Electricity Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC their comparison, voltage, resistance and their units Mensuration Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels
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		Levers and Simple machines Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage Trigonometry Measurement of angles Trigonometrical ratios Trigonometrical tables
In-plant training / Project work		

SYLLABUS FOR FITTER TRADE

SECOND YEAR

Duration	Reference Learning Outcome	Professional Skills (Trade Practical) with Indicative hrs.	Professional Knowledge (Trade Theory)
Professional Skill 255Hrs; Professional Knowledge 70Hrs	Make & assemble components of different mating surfaces as per required tolerance by different surface finishing operations using different fastening components, tools and check functionality. <i>[Different Mating Surfaces – Dovetail fitting, Radius fitting, Combined fitting; Different surface finishing operations – Scraping, Lapping and Honing; Different fastening components – Dowel pins, screws, bolts, keys and cotters; Different fastening tools-hand operated & power tools, Required tolerance - $\pm 0.02\text{mm}$, angular tolerance $\pm 10\text{ min.}$]</i> (Mapped NOS: CSC/N0304)	115. Make 'H' fitting. (13 hrs.)	Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its constructional features, uses & maintenance. (06 hrs.)
		116. Power tools: Practice operation of power tool for fastening. (5 hrs.)	
		117. Tightening of bolt/ screw with specified torque. (2 hrs.)	Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) Description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers. (06 hrs.)
		118. Selection of right tool as for Tightening or loosening of screw/bolt as per accessibility. (1 hr.)	
		119. Assembly sliding for using keys, dowel pin and screw, $\pm 0.02\text{ mm}$ accuracy on plain surface and testing of sliding fitting job. (13 hrs.)	Special files: types (pillar, Dread naught, Barrow, warding) description & their uses. (07 hrs.)
		120. File & fit angular mating surface within an accuracy of $\pm 0.02\text{ mm}$ & 10 minutes angular fitting. (12 hrs.)	
		121. Drill through and blind holes at an angle using swivel table of drilling machine. (09 hrs.)	Templates and Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance. (05 hrs.)
		122. Precision drilling, reaming and tapping and Test-Job. (12 hrs.)	
		123. Make Dovetailed fitting and radius fitting. (18hrs.)	

		124. File and fit, combined fit with straight, angular surface with ± 0.02 mm accuracy and check adherence to specification and quality standards using equipment like Vernier-calipers, micrometres etc. (18 hrs.)	Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. (06 hrs.)
		125. Drilling and reaming, small dia. holes to accuracy & correct location for fitting. (4 hrs.) 126. Perform drilling using 'V' block and a clamp. (1 hrs.) 127. Make male and female fitting parts, drill and ream holes not less than 12.7 mm. (18 hrs.)	Application of slip gauges for measuring, Sine Bar-Principle, application & specification. Procedure to check adherence to specification and quality standards. (05 hrs.)
		128. Make Sliding Diamond fitting. (22 hrs.) 129. Lap flat surfaces using lapping plate. (5 hrs.)	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for testing surfaces quality – dimensional tolerances of surface finish. (06 hrs.)
		130. Prepare Stepped keyed fitting and test job. (16 hrs.) 131. Lapping holes and cylindrical surfaces. (5 hrs.)	Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance. (05 hrs.)

		132. Dovetail and Dowel pin assembly. (16 hrs.) 133. Scrape cylindrical bore. (5 hrs.)	Metallurgical and metal working processes such as Heat treatment, various heat treatment methods - normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart. (06 hrs.)
		134. Scrapping cylindrical bore and to make a fit-(12 hrs.) 135. Scrapping cylindrical taper bore and check taper angle with sine bar. (08 hrs.)	Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas). (07 hrs.)
		136. Make a cotter jib assembly. (20 hrs.)	Tapers on keys and cotters permissible by various standards. (06 hrs.)
		137. Hand reams and fit taper pin. (12 hrs.) 138. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts. (08 hrs.)	The various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments to provide a pleasing finish such as chromium silver plating, nickel plating and galvanizing. (05hrs.)
Professional Skill 113Hrs; Professional Knowledge 30Hrs	Make different gauges by using standard tools & equipment and checks for specified accuracy. <i>[Different Gauges – Snap gauge, Gap gauge; Specified Accuracy - $\pm 0.02\text{mm}$]</i> (Mapped NOS:CSC/N0304)	139. Making a snap gauge for checking a dia. of 10 ± 0.02 mm. (20 hrs.)	Gauges and types of gauge commonly used in gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization. (06 hrs.)
		140. Scrape external angular mating surface and check angle with sine bar. (15 hrs.) 141. Scrape on internal surface and check. (10 hrs.)	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row. (06 hrs.)
		142. Practice in dovetail fitting assembly and dowel pins	Roller and needle bearings: Types of roller bearing.

		and cap screws assembly. (16 hrs.) 143. Industrial visit. (5 hrs.)	Description & use of each. Method of fitting ball and roller bearings (06 hrs.)
		144. Preparation of gap gauges. (12 hrs.) 145. Perform lapping of gauges (hand lapping only) (10 hrs.)	Bearing metals – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, Teflon polyamide (nylon). (06hrs.)
		146. Preparation of drill gauges. (10 hrs.) 147. File and fit straight and angular surfaces internally. (13 hrs.) 148. Identify different ferrous metals by spark test (2 hrs.)	The importance of keeping the work free from rust and corrosion. (06 hrs.)
Professional Skill 62 Hrs.; Professional Knowledge 18Hrs	Apply a range of skills to execute pipe joints, dismantle and assemble valves & fittings with pipes and test for leakages. <i>[Range of skills – Cutting, Threading, Flaring, Bending and Joining]</i> (Mapped NOS:CSC/N0304)	149. Flaring of pipes and pipe joints. (02 hrs.) 150. Cutting & Threading of pipe length. (3 hrs.) 151. Fitting of pipes as per sketch observing conditions used for pipe work. (10 hrs.) 152. Bending of pipes- cold and hot. (06 hrs.)	Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads- Std. Pipe threads Die and Tap, pipe vices. (06 hrs.)
		153. Dismantling & assembling – globe valves, sluice valves, stop cocks, seat valves and non-return valve. (20 hrs.)	Use of tools such as pipe cutters, pipe wrenches, pipe dies, and tap, pipe bending machine etc. (06 hrs.)
		154. Fit & assemble pipes, valves and test for leakage & functionality of valves. (18 hrs.) 155. Visual inspection for visual defects e.g. dents, surface finish. (1 hr.) 156. Measuring, checking and	Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection on rainwater drainage pipes and household taps and pipe work. Inspection & Quality control

		recording in control chart. (2 hrs.)	-Basic SPC -Visual Inspection. (06 hrs.)
Professional Skill 24 Hrs.; Professional Knowledge 06 Hrs.	Make drill jig & produce components on drill machine by using jigs and check for correctness. (Mapped NOS:CSC/N0304)	157. Make a simple drilling jig. (20 hrs.) 158. Use simple jigs and fixtures for drilling. (04 hrs.)	Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses. (06 hrs.)
Professional Skill 152Hrs. Professional Knowledge 43 Hrs.	Plan, dismantle, repair and assemble different damaged mechanical components used for power transmission & check functionality. <i>[Different Damage Mechanical Components – Pulley, Gear, Keys, Jibs and Shafts.]</i> (Mapped NOS:CSC/N0304)	159. Marking out for angular outlines, filing and fitting the inserts into gaps. (06 hrs.) 160. Exercises on finished material such as aluminium/ brass/ copper / stainless steel, marking out, cutting to size, drilling, tapping etc. without damage to surface of finished articles. (09 hrs.)	Aluminum and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such as brass, phosphor bronze, gunmetal, copper, aluminum etc. Their composition and purposes, where and why used, advantages for specific purposes, surface wearing properties of bronze and brass. (04 hrs.)
		161. Making an adjustable spanner: - Marking out as per Blueprint, drilling, cutting, straight and curve filing, threading, cutting slot and cutting internal threads with taps. (16 hrs.)	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. (04 hrs.)
		162. Dismantling and mounting of pulleys. (12 hrs.) 163. Making & replacing damaged keys. (12 hrs.) 164. Dismounting, repairing damaged gears and mounting and check for workability. (16 hrs.) 165. Repair & replacement of belts and check for workability. (12 hrs.)	Vee belts and their advantages and disadvantages, use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions-coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses. Pulleys-types-solid, split and

			'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drives. The geometrical explanation of the belt drivers at an angle. Clutch: Type, positive clutch (straight tooth type, angular tooth type). Chains, wire ropes and clutches for power transmission. Their types and brief description. (15 hrs.)
		166. Making of template/gauge to check involute profile. (17 hrs.)	Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set. (05 hrs.)
		167. Repair of broken gear tooth by stud and repair broken gear teeth by dovetail. (17 hrs.)	Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method. (05 hrs.)
		168. Make hexagonal slide fitting. (16 hrs.) 169. Prepare different types of documentation as per industrial need by different methods of recording information. (04 hrs.)	Method of fixing geared wheels for various purpose drives. General cause of the wear and tear of the toothed wheels and their remedies, method of fitting spiral gears, helical gears, bevel gears, worm and worm wheels in relation to required drive. Care and maintenance of gears. (05 hrs.)
		170. Marking out on the round sections for geometrical	Fluid power, Pneumatics, Hydraulics, and their

		shaped fittings such as spline with 3 or 4 teeth. Finishing and fitting to size, checking up the faces for universality. (15 hrs.)	comparison, Overview of a pneumatic system, Boyle's law. Overview of an industrial hydraulic system, Applications, Pascal's Law. (05 hrs.)
Professional Skill 21Hrs; Professional Knowledge 07Hrs	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. <i>[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]</i>	171. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. (2 hrs.) 172. Dismantle, replace, and assemble FRL unit. (5 hrs.) 173. Demonstrate knowledge of safety procedures in pneumatic systems and personal Protective Equipment (PPE). (2 hrs.) 174. Identify the parts of a pneumatic cylinder.(1 hrs.) 175. Dismantle and assemble a pneumatic cylinder.(6 hrs.) 176. Construct a circuit for the direction & speed control of a small-bore single-acting (s/a) pneumatic cylinder. (5 hrs.)	Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems. Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. (07 hrs.)
Professional Skill 20Hrs; Professional Knowledge 07Hrs	Construct circuit of pneumatics and hydraulics observing standard operating procedure& safety aspect.	177. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input signals. (4 hrs.) 178. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve. (08 hrs.)	Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2-way valves (NO & NC types) (manually-actuated & pneumatically-actuated) & 5/2-way valves, Check valves, Flow control valves, One-way flow control valve Pneumatic valves: Roller

		179. Dismantling & assembling of solenoid valves. (08hrs.)	valve, Shuttle valve, Two-pressure valve Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components - Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls. (07 hrs.)
Professional Skill 20Hrs; Professional Knowledge 07Hrs	Identify, dismantle, replace and assemble different pneumatics and hydraulics components. <i>[Different components – Compressor, Pressure Gauge, Filter Regulator Lubricator, Valves and Actuators.]</i>	180. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video) (04 hrs.) 181. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses (04 hrs.) 182. Inspect fluid levels, service reservoirs, clean/replace filters (04 hrs.) 183. Inspect hose for twist, kinks, and minimum bend radius, Inspect hose/tube fittings (04 hrs.) 184. Identify internal parts of hydraulic cylinders, pumps/motors (04 hrs.)	- Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems - Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/piston types, Pressure relief valves – Direct acting and pilot-operated types - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses. (07 hrs.)
Professional Skill 18 Hrs.; Professional Knowledge 05Hrs	Construct circuit of pneumatics and hydraulics observing standard operating procedure & safety aspect.	185. Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2-way valve (Weight loaded d/a cylinder may be used as a s/a cylinder), 4/2- & 4/3-way valves. (8 hrs.) 186. Maintenance, troubleshooting, and safety aspects of	- Hydraulic cylinders –Types - Hydraulic motors –Types - Hydraulic valves: Classification, Directional Control valves – 2/2- and 3/2-way valves - Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves - Hydraulic valves: Check

		pneumatic and hydraulic systems (The practical for this component may demonstrated by video). (10 hrs.)	valves and Pilot-operated check valves, Load holding function - Flow control valves: Types, Speed control methods – meter-in and meter-out - Preventive maintenance & troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils. (05 hrs.)
Professional Skill 80Hrs; Professional Knowledge 23Hrs	Plan & perform basic day to day preventive maintenance, repairing and check functionality. [<i>Simple Machines – Drill Machine, Power Saw and Lathe</i>] (Mapped NOS:CSC/N0304)	187. Dismantle, overhauling & assemble cross-slide & hand-slide of lathe carriage. (20 hrs.)	Importance of Technical English terms used in industry –(in simple definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards. (05 hrs.)
		188. Simple repair of machinery: - Making of packing gaskets. (04 hrs.) 189. Check washers, gasket, clutch, keys, jibs, cotter, Circlip, etc. and replace/repair if needed. (04 hrs.) 190. Use hollow punches, extractor, drifts, various types of hammers and spanners, etc. for repair work. (16 hrs.) 191. Dismantling, assembling of different types of bearing and check for functionality. (20 hrs.) 192. Perform routine check of machine and do replenish	Method of lubrication-gravity feed, force (pressure) feed, splash lubrication. Cutting lubricants and coolants: Soluble off soaps, suds-paraffin, soda water, common lubricating oils and their commercial names, selection of lubricants. Washers-Types and calculation of washer sizes. The making of joints and fitting packing. (18 hrs.)

		as per requirement. (15 hrs.)	
Professional Skill 75 Hrs; Professional Knowledge 16Hrs	Plan, erect simple machine and test machine tool accuracy. [<i>Simple Machines – Drill Machine, Power Saw and Lathe</i>]	193. Inspection of Machine tools such as alignment, levelling. (10 hrs.) 194. Accuracy testing of Machine tools such as geometrical parameters. (15 hrs.)	Lubrication and lubricants-purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. How a film of oil is formed in journal Bearings. (04 hrs.)
		195. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. (5 hrs.) 196. Erect simple machines. (45 hrs.)	Foundation bolt: types (Lewis cotter bolt) description of each erection tools, pulley block, crowbar, spirit level, Plumb bob, wire rope, manila rope, wooden block. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts. (12 hrs.)
Engineering Drawing: 40 Hrs.			
Professional Knowledge ED- 40 Hrs.	Read and apply engineering drawing for different application in the field of work.	<u>Engineering Drawing:</u> • Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Double nut, Castle nut, Pin, etc. • Reading of foundation drawing • Reading of Rivets and rivetted joints, welded joints • Reading of drawing of pipes and pipe joints Reading of Job Drawing, Sectional View & Assembly view	
WORKSHOP CALCULATION & SCIENCE: 28 Hrs.			
Professional Knowledge WCS- 28 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	<u>WORKSHOP CALCULATION & SCIENCE:</u> Friction Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction Friction - Lubrication Friction - Co-efficient of friction, application and effects of friction in workshop practice	

		Centre of Gravity Centre of gravity - Centre of gravity and its practical application Area of cut out regular surfaces and area of irregular surfaces Area of cut out regular surfaces - circle, segment and sector of circle Related problems of area of cut out regular surfaces - circle, segment and sector of circle Area of irregular surfaces and application related to shop problems Elasticity Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus Elasticity - Ultimate stress and working stress Heat Treatment Heat treatment and advantages Heat treatment - Different heat treatment process – Hardening, tempering, annealing, normalising and case hardening Estimation and Costing Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing
In-plant training/ Project work		

SYLLABUS FOR HEALTH SANITARY INSPECTOR TRADE			
DURATION: ONE YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 50Hrs; Professional Knowledge 24 Hrs	Make a nutrition plan for all age groups under given conditions following safety precautions. Design a balanced diet as per the requirement under given conditions. Calculate and suggest the calorie and nutrition requirements as per the specific requirements of the person. Identify diseases that occur due to various deficiencies. Assess disease symptoms. Inspect and report various food adulterations. Suggest different food preservation techniques for various types of food.	1. Point out the requirement of nutrition. 2. Demonstrate on charts of various deficiency diseases. 3. Nutrient requirement of infant, wearing pregnancy, location, preschool child, school going child. 4. Survey of nutrition education & its importance. 5. Preparation of diet menu for hypertensive, diabetic nephritis & heart patients. 6. Images of patients suffering from diseases. 7. Audio-video aids. 8. Tabular differentiation of types of malnutrition. 9. Importance of health education to overcome the problem of malnutrition. 10. Display videos (Audio-video) on malnutrition. 11. Demonstration of sources of Hb by pictorial chart. 12. Demonstration of spoilage of some food items. 13. Application of common salt & sugar to increase shelf life of many food	Food (definition) & function of food & introduction of nutrition & nutrients. Classification of food, their sources, nutrient diets proteins, fat, vitamins & minerals – sources, function, deficiency excess & daily requirement. Balanced diet- definition & importance – Factors to be considered on planning meals. – Nutrient requirement of different age group – Diet survey Family assessment – clinical examination of all members – height & weight BMI [Body mass index], Head circumference, -Blood test for Hb. Nutrition education malnutrition- causes prevention, low birth weight (LBW), causes of LBW, prevention of LBW, special care to be given to malnourished children. Therapeutic Diet: Introduction for balanced diet, weight reducing diet- low fat diet, bland diet, cirrhosis of liver, renal stone

		items. 14. Cleanliness of Kitchen equipment and cooking utensils. 15. Operation and usage procedures of storage Equipment like Refrigerators.	Food Preservation: definition & methods, household & industrial method of preservation, self-line, Pasteurization: methods, types & importance. Refrigeration: Prevents spoilage.
Professional Skill 50Hrs; Professional Knowledge 12Hrs	Identify and understand water and its properties and causes of water pollution. Summarize water supply system with water treatment in the city/ country etc. Assemble plumbing system for Conservation of water. Develop rain water harvesting technique. Identify and understand the water purification process.	16. Draw a chart showing various environmental factors. 17. Tabulate various types of water with their properties. 18. Classify water resources (surface water and ground water). 19. Prepare a pie chart of total availability of water on the earth (Fresh water, saltwater, potable water etc.) 20. Tabulate the per capital water demand for domestic purpose. 21. Prepare a chart of water demand in different areas such as hospitals, hotels, industries, schools etc. 22. Prepare a chart for impact of polluted water on human health, animals, plants etc. 23. Tabulate the different methods for conservation of water in different areas. 24. Draw and sketch a picture of rainwater harvesting. 25. Identify the difference between portable water, safe and wholesome water.	WHO's definition for environmental sanitation. Safe and wholesome water. Sources of water. Various uses of water and its needs. Water borne diseases. Conservation sources of water. Quality of water. Physical, chemical and biological standard for portable water. Public health aspect of very hard water. Steps of disinfection of well. Sources and nature of pollution of water. Purification of water: i) Large Scale ii) Small Scale Prepare of a sanitary well and tube well. Plumbing system and its maintenance. Water supply and storage system at the community and domestic. Pot method of chlorination. Swimming pool. Water testing labs.

		26. Prepare a chart for physical, chemical and bacteriological quality of water. 27. Explain the disinfection with various disinfectant for well disinfection 28. Prepare the list of sources of water pollution with their different characteristics. 29. Visit to a water treatment plant. 30. Make a diagram of water treatment plant with different process of water purification. 31. Collection and dispatch of water sample for chemical and bacteriological examination. 32. Prepare and construct a purification system in the rural areas. 33. Calculate the chlorine demand and prepare the graph also for residual chlorine in water. 34. Collect the water sample from the domestic taps, surface and ground water resources. 35. Perform the practical for physical and chemical parameters of given water sample in testing labs - pH - Turbidity - Chlorine - Hardness - TDS - Acidity - Alkalinity etc.	
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Professional Skill 40Hrs; Professional Knowledge 12Hrs	Handle the night soil of a city/ town with protection of environment and human being.	36. Show the difference between water and sewage with given samples in the bottles in the testing labs. 37. Categorises the numerous impacts of night soil on the water bodies, atmosphere, soil etc. 38. Tabulate numerous impacts of food chain and impact of food contamination on human bodies. 39. Prepare a chart for various diseases due to unsanitary disposal of night soil. 40. Describe the construction and maintenance of service and non-service type latrines bore hole, dug well, RCA, septic tank, sulabh souchalaya. 41. Visit to sulabh souchalaya. 42. Demonstrating the construction and maintenance of trenching ground.	<u>Night soil disposal</u> Sewage in liquid waste containing human excreta. Numerous impacts of night soil on the environmental factors. Faucal borne disease due to unsanitary disposal of night soil. Different types of latrines in use principal of construction of sanitary latrines and their uses. i) Bore hole ii) Dug well iii) RCA iv) Septic tank latrines.
Professional Skill 46Hrs; Professional Knowledge 12Hrs	Plan solid waste management system in an area or a small town.	43. Identify resources of increasing solid waste. 44. Tabulate the category of solid waste based on sources. 45. Classify solid waste according to their different properties such as medical, municipal, commercial, construction. 46. Demonstration of collection methods of	<u>Solid waste disposal</u> – Source, generation, storage, collection and disposal methods of solid waste. – Classification of solid waste in community. – Polluting effects of different types of solid waste. – System of collection of solid waste from the

		solid waste. 47. Prepare a plan chart of solid waste management in a city. 48. Prepare pie chart composition of MSW. 49. Explain the disposal methods of solid waste in sanitary methods. 50. Illustrate the bad effects of solid waste disposal in a chart. 51. Compare the different methods of collection and transportation of solid waste with diagrams. 52. Visit disposal site. i. Sanitary landfills ii. Composting iii. Incineration iv. Biogas plant	houses & streets. – Sanitary transportation of solid waste. – Sanitary process of disposal of solid waste such as composting, sanitary land filling, incineration etc.
Professional Skill 80 Hrs; Professional Knowledge 20Hrs	Practice Bio Medical and E- waste management system.	Bio Medical Waste Management 53. Techniques of segregation, packaging, storage transport of infectious waste. 54. Techniques of Biomedical waste management. 55. Treatment method- Autoclave, Hydro clave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, 56. Accumulation and storage of hazardous waste, 57. Land disposal of hazardous waste	Bio Medical Waste Management – Definition of Bio Medical Waste - Sources of Bio Medical Waste - Waste minimisation - BMW – segregation, collection, transportation, treatment and disposal (including color coding) - Liquid BMW, Radioactive waste, Metals/Chemicals/Drug waste - BMW management and method of disinfection - Modern technology for handling BMW - Use of personal protective equipment (PPE) - Monitoring and controlling of cross infection

			(protective devices) - Identifying the risk of Bio Medical Waste – E-waste: Introduction, toxicity due to hazardous substances in e-waste and their impacts, domestic e-waste disposal, e-waste management, technologies for recovery of resource from electronic waste, guidelines for environmentally sound management of e-waste, occupational and environmental health perspectives of recycling e-waste in India.
Professional Skill 35Hrs; Professional Knowledge 14Hrs	Identify air pollution sources and suggest the suitable remedies. Interpret the effects of global warming and identify the remedial measures. (Mapped NOS: MIN/N9432) Suggest the measures to minimize the noise pollution. Plan and suggest the ventilation requirements of a particular area.	58. Demonstration of humidity and temperature. 59. Point out sources of air pollution. 60. Prepare charts or posters of Global warming. 61. Prepare posture on prevention techniques for Air pollution. 62. Demonstration of an AC plant for thermal comfort. 63. Point out types of ventilation. 64. Measurement of noise level. 65. Process to control noise pollution	<u>Air pollution</u> – Introduction of air pollution. – Composition of air. – Sources and nature of air pollution. – Effect of air pollution on health. – Prevention and controlling methods for air pollution. – Explain global warming and its impact. – Concept of temperature, humidity, radiation, thermal comfort, evaporation etc. – Methods of air purification. – Air disinfection. – Definition of ventilation. – Concept and importance of adequate ventilation. – Types of ventilation <u>Noise pollution</u> – Introduction. – Sources.

			– Health Impacts. – Preventive measures for controlling Noise pollution.
Professional Skill 45Hrs; Professional Knowledge 14Hrs	Illustrate concept of liquid waste and disposal. Know the types of sewer Health hazards due to liquid waste. Plan and help in construction and maintenance of sewers, traps, plumbing tools etc.	66. Point out the sewage treatment plant. 67. Inspection of flushing tank, manholes etc. 68. Demonstration of various traps ‘p’ trap, ‘s’ trap, ‘q’ trap etc. 69. Demonstration of manholes by video calls. 70. Demonstration of various plumbing tools like hacksaw, pipe cutter, pipe vice, pipe wrench set of spanners etc. 71. Inspection and maintenance of sewage treatment plant. 72. Identify various equipment of sewage disposal. 73. Identify pollution of water from sewage.	<u>Liquid waste disposal</u> – Definition of liquid waste and its sources. – Human waste management system. – Various methods for liquid waste disposal. – Pollution of water due to sewage. – Health hazard associated with liquid waste. – Sewers and its types. – Methods of laying sewers. – Construction and maintenance of sewers. – Sewer appurtenances. – Traps introductions. – Types of traps. – Definition of plumbing. – Plumbing tools and operations. <u>Sewage disposal</u> – Definition and types of sewage system. – Sewage farming and land treatment. – Sewage disposal by biogas plant. – Methods of disinfecting sewage. – Sewage farming.
Professional Skill 43Hrs; Professional Knowledge 12Hrs	Suggest disposal methods for dead animals and humans. Identify different types of soil, its importance in relation to public	74. Visit to burial ground, proper process of disposal of dead bodies and maintenance of records as per legal provisions. 75. Identify soil sample equipment. 76. Sampling for assessment	<u>Burial and Cremation</u> – Introduction – Disposal of dead. – Types of disposal methods. – Methods of preservation of dead. – Commonly and less

	health and reclamation of land.	of soil pollution. 77. Treatment of soil after the PH and disinfection.	commonly used methods for disposal of dead. – Basic requirements for burial and cremation grounds. – Health hazards associated with unsanitary disposal of dead bodies. <u>Soil sanitation</u> – Introduction and importance of soil. – Classification of soil. – Classification from the view point of importance in public health. – Reason of excessive moisture in the soil. – Reclamation of land. – Soil health.
Professional Skill 43 Hrs; Professional Knowledge 12Hrs	Plan and suggest sanitary prescription of medical measures in housing and fairs & festivals.	78. Visit of housing for assessing sanitary standards and prescription of remedial measures. 79. Classify the overcrowding. 80. Inspection and preparation of fairs and festivals. 81. Preparation of sanitary arrangements associated with natural calamities.	<u>Housing</u> – General principle of healthy housing. – Home sanitation. – Utility services of house. – Sanitary standards for construction of house. – Food hygiene at home. – Specification for healthy housing. <u>Sanitation in fairs and festivals</u> – Sanitation management at fairs and festivals. – Sanitary problems associated with human gatherings and temporary settlements. – Alternative emergency sanitary provisions to prevent sanitation crisis for food, housing, water supply, lighting. – Disposal of community waste and prevention of

Health Sanitary Inspector

			outbreak of epidemics.
Professional Skill 35Hrs; Professional Knowledge 12Hrs	Identify occupational health hazards. Follow safety rules. Prevent occupational diseases.	82. Visit various trade premises (diary, bakery etc.) 83. Visit to a factory for survey of sanitation problems of workplace. 84. Identification of danger zones and adequacy of safety arrangements.	<u>Occupational health</u> – Introduction – Occupational environment measures. – Occupational diseases. – State the importance of safety and health at work place. – State the role of employer, trade union and employees for health and safety program. – Measures for health protection workers. – Prevention of occupational diseases. – Provision- benefit to employees. – Occupational health in India.
Professional Skill 24 Hrs; Professional Knowledge 06Hrs	Prepare and control of biological environment and different parts of spraying equipment.	85. Identification and use of insecticides, pesticides and disinfectants. 86. Application of techniques of sterilisation and disinfection of various articles. 87. Identification of different part of spraying equipment. 88. Identify and use of larvicides. 89. Operation and maintenance of spraying equipment. 90. Identify and use of rodenticides.	<u>Control of biological environment</u> – Introduction – Study on insecticides, pesticides and disinfections. – Sterilisation and disinfection of different articles. – Various spraying equipment. – Uses of rodenticides and larvaecidals. – Principal of arthropod control.
Professional Skill 60 Hrs; Professional Knowledge	Generate awareness programmes for masses on health education.	91. Designing of posters on Malaria. 92. Designing of posters on roles and responsibilities of a	– Definition of health – Content of health education. – Principal of health education.

16 Hrs		health inspector. 93. Demonstration of health awareness program as a class activity. 94. Designing environmental sanitation posters. 95. Designing posters on balanced diet. 96. Designing poster on basic hygiene practices. 97. Preparing power point presentation on health awareness. 98. Demonstration of preparation of ORS.	– Health education opportunities for health inspector in his work place. – Use of audio-visual aids and media. – Health education approach. – Planning health education activities, education in relation to environmental sanitation. – Awareness on need of sanitation amenities. – Health education material. – Contribution of public health centres in health education. – Utilising community resources for health education. – Benefits of personal contract group meetings to provide health education.
Professional Skill 51Hrs; Professional Knowledge 16Hrs	Illustrate importance of right behavior and personal hygiene, learn its direct impact on their personal life & society.	99. Preparing charts on personal hygiene habits. 100. Designing posters on Do's and Don'ts in a social behaviour. 101. Demonstration of hand washing and caring. 102. Demonstration on oral hygiene.	<u>Behavioral Science</u> – Definition of behavioural science. – Importance of behavioural science. – Impact of behaviour on personal hygiene. – Basic hygiene practices. – Habits and customs affecting personal hygiene. – Caring sense organs. – Oral hygiene. – Factors influencing human behaviour, change of behavioural pattern in different age groups. – Interpersonal relations and defence mechanism.
Professional Skill 95 Hrs;	Perform first- aid treatment to tackle medical emergency	103. Dressing of wounds, bandages. 104. Management of bone	<u>First-Aid</u> – Aim of first-aid. – Principles and practice of

Professional Knowledge 16 Hrs	situation.	injuries with splints, slings. 105. Transportation of injured and unconscious cases and their management. 106. Diagnosis and treatment of minor ailments, cough, fever, bleeding, toothache etc. 107. Poisoning case managements 108. Management in case of heat attack, sun stroke, haemorrhage, burns, electrical injuries etc. 109. Training on artificial respiration. 110. Arranging first-aid treatment in various emergency cases.	first-aid. – Contents of a basic first-aid box. – CPR – Types of dressing and bandages. – Types of wounds. – Miscellaneous conditions. – Approach to a casualty. – Psychological first-aid. – Handling multiple casualties. – Types of injuries like road accidents, factories accidents and disaster injuries. – Transportation of victims and proper care provided.
Professional Skill 71Hrs; Professional Knowledge 20Hrs	Assess intensity of any disease, recognize the disease and provide first-aid treatment on time to contain the disease. Follow the given immunization schedule and understand its importance. Identify disinfection and its importance to control diseases. Carry out sterilization.	111. Demonstration on communicable and non-communicable diseases symptoms and their control measures. 112. Preparation of immunisation programme 113. Conducting health and general survey and report making. 114. Videos on disinfection and sterilisation techniques. 115. Various chemicals use with safety for disinfection through videos.	<u>Communicable diseases</u> – Definition and introduction on communicable disease. – Air-borne and transmission of diseases through contact. – Symptoms of diseases. – Explain in detail various communicable diseases like Swine Flu, T.B., AIDS, Diphtheria, Polio, measles, diarrhoea etc. – General measures for prevention and control of communicable diseases. <u>Non-communicable diseases</u> – Introduction of non-communicable disease. – Explain in detail diseases like cancer, hypertension, cardiac disease, diabetes etc. – In detail symptoms, prevention and control of

			non-communicable diseases. <u>Immunity and immunization</u> – Importance of immunity and immunisation – Types, purpose and effect of immunisation. – National immunisation schedule. – Measles, typhoid vaccines and pentavalent vaccine. <u>Disinfection and sterilisation</u> – Need of disinfection and sterilisation. – Importance of disinfection and sterilisation in hospitals. – Introduction and uses of various disinfection agents like Halogen, KMnO₂ solution, solid and liquid agents. – Effective disinfectants like formaldehyde, sulphur, chlorine gases etc. – Use of UV radiation and ozone as disinfectant.
Professional Skill 20Hrs; Professional Knowledge 10 Hrs	Perform basic personal hygiene and interpret its impact on a person's health and personality.	116. Making posters on dental care. 117. Making posters on skin and hair hygiene. 118. Making posters on basic hygiene habits. 119. Demonstration on right method for hand washing. 120. Demonstration on oral health.	<u>Personal hygiene</u> – Need and importance of personal hygiene in daily life. – Factors influencing health and hygiene habits. – Maintaining basic hygiene habits of skin, hair, oral, nails etc. – Developing dental care, care of hands, washing etc. – Importance of regular exercise and nutritious food.
Professional Skill 52Hrs; Professional Knowledge 12Hrs	Recognize various factors like death rate, birth rate, morbidity, MMR, IMR etc., analyze importance of	121. Data collection from hospitals for Malaria cases. 122. Data collection from hospitals for Dengue cases.	<u>Demography and health survey</u> – Definition and introduction of demography. – Factors of demography. – Various stage of demo.

	census survey and data collection. Categories health survey. Familiarize with vocabulary and terminology of different acts.	123. Health survey of people of a locality. 124. Vaccination survey in a locality. 125. Design and prepare population control measures on chart. 126. Collection and dispatch of food samples for analysis preparation of papers for legal proceeding. 127. Performance of simple household tests to identify adulteration in milk, ghee, oil, sugar, tea etc. 128. Acquaintance with registration of acts. 129. Prepare reporting of different acts. 130. Documentation process for implementation of different acts. 131. Prepare a chart of pollution levels of toxins of different industries in an area.	1. High stationary 2. Early expending 3. Late expending 4. Low stationary – Health survey includes birth rate, death rate, morbidity, IMR, MMR etc. – Population control measures. Public Health Act – Definition, introduction and importance of acts. – Indian Epidemic Disease Act. – Explain endemic, pandemic with examples. – Define epidemiology. – Air and Water Pollution Control Act. – Prevention of Food Adulteration Act. – Birth and Death Registration Act. – M.T.P. Act. – Suppression of Immoral Traffic Act (SITA). – Municipal and Local Body Acts related to Housing Sanitation Act. – Factory Act and ESI Acts.
Project work/ Hospital visit Broad Areas: a) Arranging first-aid treatment in various emergency cases. b) Design and prepare population control measures on chart. c) Various chemical uses with safety for disinfection through video. d) Preparing charts on personal hygiene habits. e) Data collection from hospitals for malaria cases. f) Prepare a chart of pollution levels of toxins of different industries in an area.			

7. TRADE SYLLABUS

SYLLABUS FOR PHYSIOTHERAPY TECHNICIAN TRADE			
DURATION: ONE YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Operate using suitable tools and equipment with basic outline of physiotherapy and develop a vocabulary of appropriate terminology following safety precautions.	1. Identify electrotherapy modalities 2. Cataloguing of exercise tools and equipment. 3. Draw human body and label its parts. 4. Demonstrate planes, axis, anatomical and fundamental positions. 5. Sketch planes, anatomical and fundamental positions.	<u>Introduction</u> a) Definition of Physiotherapy, terms of Physiotherapy: Electrotherapy, Exercise-therapy, Massage-Therapy, Ergonomics, Rehabilitation. b) Definition of Electrotherapy, safety precautions in Electrotherapy. c) Name of modalities which are used in physiotherapy. <u>Introduction to Anatomy/Physiology</u> a) Definition and subdivisions of anatomy. b) Anatomical and fundamental position. c) Anatomical regions, section and planes. The descriptive anatomical terms.
Professional Skill 45Hrs; Professional Knowledge 1Hrs	Analyze and assemble the components of skeleton system.	6. Demonstrate skeleton system. 7. List the names, side determination and parts of all bones of upper limb and lower limb. 8. Identify side determination and	<u>Osteology</u> a) Skeleton system. b) Structure, functions and classification of bone and cartilage. c) Name of human bones. d) Side determination and parts of bones of upper limb, lower limb, skull,

		parts of bones of skull, vertebral column and thorax.	vertebral column and thorax.
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Analyze the joints by using X-Ray films.	9. Prepare presentation of joints formation by using bones. 10. Identify the major joints of human body. 11. Perform X-Ray practical by using X-Ray films- ➤ Recognize bones. ➤ Identify of joints. ➤ Demonstration of some normal and abnormal X-ray plates.	<u>Orth ology</u> a) Definition and classification of joints. b) The terms related to the movements of joints. c) Description of joints of upper and lower extremities with their ligaments.
Professional Skill 45Hrs; Professional Knowledge 12Hrs	Differentiate various muscles.	12. Show muscles structure with proper labelling. 13. Demonstrate major muscles of upper limb. 14. Demonstrate major muscles of lower limb. 15. Identify major muscles of abdomen trunk, thorax, neck and face with diagram.	<u>Myology</u> a) Macroscopic and microscopic structure of muscle. b) Classification of muscles. c) Parts of muscle. d) Neuromuscular junction. e) Sliding contraction theory. f) Description of all major muscles with their origin, insertion, nerve supply and action.
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Recognize basic cell structure and its organelles.	16. Sketch labelled picture of cell. 17. Prepare Microscopic diagram of different tissues e.g. Connective tissues, muscular tissues, nervous tissues etc. 18. Prepare postures of skin. 19. Identify cell structure.	a) Cell- definition, structure and function, cellular organelles. b) Tissue- Structure and function. <u>Skin and temperature regulation</u> a) Structure of skin. b) Function of skin. c) Temperature regulation system.

Professional Skill 45Hrs; Professional Knowledge 12Hrs	Identify the major neural tissues.	20. Idea of reflexes and their examination. 21. Demonstrate and A.V. display. 22. Prepare Display charts of Nervous system 23. Represent neuron, brain, spinal cord, reflex arc, and plexus. 24. Perform Pain assessment	<u>Neurology</u> a) Parts of nervous system. b) Structure and function of Nervous, types of neurological cells. c) Structure and function of Brain and spinal cord. d) Reflex Arc, blood-brain barrier. e) Structure of a nerve, Cranial nerves (names and functions) and spinal nerves (Introduction). f) Nerve plexus of the body with their distributions (cervical plexus, brachial plexus, lumbosacral plexus). g) About the nerve fibers, motor and sensory. h) Blood circulation of brain and spinal cord.
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Relate the anatomical position of circulatory system on mannequin.	25. Prepare of charts of heart structure and circulation. 26. Identify heart location and position by using mannequin. 27. Identify A.V. display of blood circulation. 28. Prepare for Pulse and blood pressure examination.	<u>Circulatory system</u> a) Structure and function of heart. b) Nodes of heart, heart rates and heart sound. c) Physiology of heart circulation. d) Blood pressure and the influencing factors. e) Composition and function of blood. f) Circulatory system of body.
Professional Skill 20Hrs; Professional	Categorize foods according to nutrients and assemble organs	29. Prepare balance diet chart for different age graphs. 30. Display the organs of	<u>Food and nutrition</u> a) Definition of food and nutrition. b) Carbohydrate, protein, fat,

Knowledge 06Hrs	of digestive system.	digestive system on mannequin. 31. Demonstrate A.V. display. 32. Recognise Figuration of main and accessory organs of digestive system.	minerals, vitamins, water with example and brief description. c) Balanced diet. <u>Digestive system</u> a) Structure and functions of digestive organs. b) Absorption and metabolism (in brief)
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Illustrate respiratory system.	33. Demonstrate the organs of respiratory system on mannequin. 34. Prepare Display respiratory mechanism by using videos. 35. Measure chest inspiration and expiration with inch tape. 36. Check Respiratory rate examination. 37. Check Portrait charts of organs of respiratory system.	<u>Respiratory system</u> a) Structure and function. b) Process of respiration. c) Cardio-respiratory relation. d) Artificial respiration. e) Neurological control. f) Volumes and capacities values of respiration. <u>Endocrinology</u> a) Definition, character and function of Hormones. b) About the hormone secreting glands (in brief).
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Arrange organs on dummy of excretory and reproductive system.	38. Identify parts of excretory and reproductive system on mannequin. 39. Perform the Presentation and A.V. videos of excretory system. 40. Identify Micturition reflex by showing charts.	<u>Excretory system</u> a) Structure and function of kidney. b) Organs of excretory system. c) Structure of nephron. d) Formation of Urine e) Micturition <u>Gynaecology and obstetrics</u> a) Pelvic floor muscles(names) b) Introduction of human reproductive system (in brief). c) Physiology of pregnancy.
Professional Skill 20Hrs;	Design a treatment plan for	41. Prepare hot packs. 42. Preparation of patient.	<u>Thermotherapy</u> <u>Superficial heating agents</u>

Professional Knowledge 06Hrs	stiff parts of body.	43. Apply hot packs at different regions of body. 44. Plan precautions while giving treatment to patient. 45. Assessment of the affected part before applying wax bath. 46. Perform Techniques of wax bath for instance with brush, bowl etc. 47. Apply wax bath with precautions and proper layering and thickness, removal of wax.	a) Hot packs: Physiological effects, indications and contraindications. Types of hot packs (hydro collators, hot water bag, electrical heating pads) with their techniques of application b) Wax bath: Description of a wax bath unit, composition and method of preparation of wax bath, physiological effects, techniques of application, indications and contra indications.
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Illustrate the effects of IRR.	48. Apply IRR with precautions. 49. Demonstrate different positions of patient during treatment. 50. Placement of IRR at proper distance from skin.	a) Infra-Red Radiation: About the infra-red rays, sources of infra-red rays, technical data, physiological effects, techniques of application, termination of IRR, Indications and contra indications.
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Execute remedial effects of cryotherapy.	51. Practice on preparation and application of ice pack, cold pack, ice towels, ice bath, ice cube massage according to the contour of the body. 52. Practice of preparation of patient. 53. Plan precautions while giving treatment.	Cryotherapy a) Physiological effects. b) Methods of application (Ice pack, cold pack, ice towels, ice bath, ice cube massage, vapor coolant sprays) c) Cry kinetics. d) Indications and contraindications.
Professional Skill 20Hrs;	Enumerate the benefits of SWD.	54. Explain all parts of SWD. 55. Testing of SWD. 56. Positioning of patient	Deep heating agents A) S.W.D.: meanings of Short-wave & Diathermy, Effects of

Professional Knowledge 06Hrs		and placement of electrodes. 57. Draw Flow chart of SWD circuit. 58. SWD cable methods. 59. Precautions.	S.W.D. Technical data, Descriptions of a S.W.D Instrument, Method of application, Positioning of Electrode Pads During, Treatment, Dose & Duration of treatment, Indications & Contraindications.
Professional Skill 20Hrs; Professional Knowledge 06Hrs	Test and lay out therapeutic uses of UST.	60. Methods of testing. 61. Methods of application. 62. Handling and operating of UST modality with precautions. 63. Precaution of patient.	B) M.W.D- Introduction. C)U.S.T- About the Ultra sound, Effects of U.S.T in Human body, Technical data, Descriptions of an U.S.T. Instrument, Description about different types of Coupling medium, Method of application of U.S.T, Dose & Duration of treatment, Indications & Contraindications.
Professional Skill 65Hrs; Professional Knowledge 18Hrs	Plan a regimen to stimulate muscles.	64. Practice on muscle stimulator for major muscles of upper limb and lower limb. 65. Preparation of patient 66. Demonstration of muscles stimulator on face. 67. Plan precautions during treatment. 68. Practice on placement of electrodes with using proper gel. 69. Create difference between TENS and IFT for pain producing conditions. 70. Demonstrate on placement of TENS and	Stimulators- a) Faradic - About the Faradic type of current, Technical data's, Description of a Faradic Stimulator& Electrodes, Physiological effects, Method of application, Application of continuous & Surged Faradic, Dose & Duration of treatment, Indications & Contraindications. b) Galvanic- About the Galvanic type of current, Technical data, Descriptions of a Galvanic Stimulator, Physiological

		IFT pads for radiating and local pain respectively. 71. Methods of treatment. 72. Testing methods of all modalities.	effects, Method of application, application of continuous & Interrupted Galvanic, Dose & duration of treatment, Indications & Contraindications. c) T.E.N.S- Meaning of 'Transcutaneous', Description of a T.E.N.S., Physiological effects (along with pain gate Theory), Method of application (Trigger point stimulation method, Acupuncture point stimulation method etc.), Placements of T.E.N.S electrodes, Application of continuous, surged & burst mode. Dose & Duration of treatment, Indications & contraindications. d) I.F.T- Introduction, application, Indications & Contraindications.
Professional Skill 45Hrs; Professional Knowledge 12Hrs	Asses and create a massage therapy.	73. Positioning of patient and therapist. 74. Techniques used in massage for upper and lower limb. 75. Illustrate a practical of massage on face. 76. Elaborate methods of trunk massage. 77. Precautions while giving massage. 78. Rules and direction of	MASSAGE THERAPY & REHABILITATION a) Definition of Massage b) Aim of Massage c) Physiological effects of Massage d) Therapeutic uses of Massage. e) Contraindications of Massage f) Materials used in Massage (oil, powder, ice etc.)

		massage. 79. Direction of using materials (oil, powder etc.) during massage. 80. Therapeutic application of massage.	g) Rules & direction of Massage h) Types of Massage
Professional Skill 155Hrs; Professional Knowledge 42Hrs	Carry out physiotherapy assessment and develop exercise regimen.	81. Show positioning of patient and therapist. 82. Perform Practical of different exercises. 83. Rules and directions of exercises. 84. Demonstrate exercise to increase ROM by using continuous passive movement equipment. 85. Presentation of passive movements (manually). 86. Assessment of range of motion of major joints by using goniometer scales. 87. Perform measurement of spine ROM by using inch tape. 88. Exhibit active and active-assisted movements. 89. Illustrate strengthening exercises by using weight-cuffs for upper and lower limb joints. 90. Perform strengthening exercises by utilizing Thera bands/Thera tubes. 91. Demonstrate resisted exercises (manually).	<u>EXERCISE THERAPY AND YOGA</u> 1. <u>Fundamental of exercise:</u> a. Definition of therapeutic exercise. b. Benefits of exercise. c. Classification of exercise-active, passive, resistive, isometric, functional, stretching, isokinetic, closed-chain, open-chain etc. 2. <u>Applied exercise therapy</u> a. Passive movements. b. Goniometry. c. Exercise with instrument. d. Active movements, active-assisted movements. e. Resistive exercise. f. Co-ordination and balance. g. Stretching exercise. h. Techniques for chest physiotherapy. i. Manual muscle testing. j. Techniques of PNF (brief). k. Indications and contraindications of passive movements. l. Indications and contraindications of

		92. Representation of quadriceps and hamstring resisted exercises on quadriceps chair and multipurpose chair. 93. Practical use of different exercise equipment (e.g. Shoulder wheel, shoulder pulley, Swiss ball etc.) 94. Assessment of coordination and balance. 95. Describe equilibrium and non-equilibrium tests. 96. Schedule exercise programs for stretching of major muscles (Manually). 97. Elaborate methods of stretching (Static, mechanical etc.) 98. Explain positioning of patient during postural drainage. 99. Collaborate massage techniques with postural drainage. 100. Prepare a chart of measurements of chest inspiration and expiration by using hands and inch tape at different chest levels. 101. Perform resistive exercises for thorax	breathing exercise. m. Grades of MMT. n. Precautions while performing these exercises on patient.
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		muscles. 102. Practical based on breathing exercises. 103. Illustrate a practical on PNF techniques for upper and lower limbs. (brief) 104. Presentation of PNF techniques for trunk, face and neck. (brief) 105. Explanation of D₁ and D₂ patterns of PNF (brief) 106. Determination of grades of MMT for upper and lower limb. 107. Practical based on grading of MMT for trunk and abdominals. 108. Identify MMT exercises for face.	
Professional Skill 130Hrs; Professional Knowledge 36Hrs	Develop remedial measures for back pain and abnormal gaits.	109. Proper demo of relaxation techniques by using pillows. 110. Execute testing of traction. 111. Demonstrate positioning of patient while giving traction. 112. Teach how to calculate patient's weight to be used in treatment. 113. Develop different methods of application of traction. 114. Impart skills of manual cervical and lumbar traction. 115. Instruct normal gait	<u>Exercise Physiology</u> 1. <u>Thermoregulation and exercise organs:</u> a. Conduction, convection & evaporation. b. Homeostasis c. Physiological thermoregulation 2. <u>Respiration:</u> a. Muscles for inspiration and expiration. b. Static and Dynamic Lung volume. c. Gaseous exchange. 3. <u>Cardiovascular adaptations:</u>

		patterns. 116.Presentation of gate phases on floor. 117.Perform abnormal gaits. 118.Demonstrate a practical on walking aids (e.g. Crutches, walker). 119.Give a brief idea of parts of wheelchair. 120.Give guidelines for walking aids' usage for patients (e.g. Two step, three step etc.). 121.Design gait pattern for weight bearing and non-weight bearing. 122.Performance of gait training.	a. Sub maximal exercise. b. At maximal exercise. 4. <u>Fatigue</u>: Types, symptoms, recovery. 5. <u>Endurance</u>: Definition, endurance training. 6. <u>Kinesiology & Biomechanics</u>: Basic terminologies. 7. Relaxation exercises. 8. <u>TRACTION</u>: Introductions, contraindications, therapeutic uses and effects. 9. Activities of daily living (in brief). 10. <u>Gait</u>: Definition, phases, abnormal gait patterns (in brief). 11. <u>Walking aids</u>: Types, indications, precautions.
Professional Skill 70Hrs; Professional Knowledge 24Hrs	Prepare assessment chart and rehabilitation protocol.	123.Display videos showing causes of clinical conditions. 124.Perform observational assessment in various conditions. 125.Perform clinical examination. 126.Demonstrate various orthopedically tests. 127.Demonstrate various neurological tests. 128.Prepare a chart of orthopedic, neurology	<u>Applied Anatomy</u>: Causes, Deformity, loss of functions in following conditions: a. Carpal tunnel syndrome. b. Erb's and kulmpke palsy c. De Quervain's disease. d. Rotator cuff syndrome. e. Wrist drop. f. Trendelenburg's sign. g. Tarsal tunnel syndrome. h. Genu valgum/varum.

		assessment. 129. Make a cardiopulmonary assessment chart. 130. Make a diagnosis after assessment. 131. Plan a rehabilitation program for patients. 132. Develop home exercise programs. 133. Demonstrate precautions to be considered during and after treatment. 134. Develop ergonomics. 135. Evaluate the prognosis. 136. Make postures showing diagrammatical calculation of burn. 137. Calculate obesity according to BMI. 138. Illustrate precautions related to treatment. 139. Clinical presentation in hemiplegia, hemiparesis to differentiate it. 140. Plan antenatal and postnatal exercises.	i. Coxa valgus/ Varus. j. Foot drop. <u>ORTHO-NEURO-GENERAL</u> Orthopaedical condition: Etiology, C/F & physiotherapy management of the followings: (i) Kyphosis, Lordosis & Scoliosis (ii) Cervical & Lumbar Spondylosis (iii) Ankylosing Spondylosis (iv) Tennis Elbow (v) Golfer's Elbow (vi) Gout (vii) Osteoarthritis (viii) Rheumatoid Arthritis (ix) Frozen Shoulder (x) Fracture (brief) (xi) Dislocation & subluxation (xii) Sprain (xiii) Tendonitis (xiv) Rickets (xv) Osteomalacia (xvi) Osteomyelitis (xvii) Calcaneal Spur (xviii) Flatfoot. Neurological Condition: Etiology, C/F, & Physiotherapeutic Management of the following: i. Cerebral palsy ii. Hemiplegia iii. Paraplegia iv. Quadriplegia v. Myalgia
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			vi. Fibromyositis vii. Polio Myelitis viii. Parkinsonism ix. Bell's palsy x. C.V.A (brief) xi. Upper & Lower Motor Neuron diseases xii. Peripheral Nerve Injury xiii. Spinal Cord Injury xiv. Sciatica General Condition: Etiology, C/F, Investigations & Physiotherapeutic Management of the following: i. Obesity ii. Burns
Project work/ Case Study Broad Areas: - Perform practical of different exercises. - Assessment of range of motion of major joints by using goniometer scales. - Prepare a chart of measurements of chest inspiration and expiration by using hands and inch tape at different chest levels. - Execute testing of traction. - Prepare a chart of orthopaedic, neurology assessment. - Calculate obesity according to BMI.			

7. TRADE SYLLABUS

SYLLABUS - WELDER				
DURATION: ONE YEAR				
Duration	Reference Learning Outcome	Process code	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
Professional Skill 47Hrs; Professional Knowledge 11Hrs	Set the gas plant and join MS sheet in different position following safety precautions. [Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]		1. Demonstration of Machinery used in the trade. 2. Identification to safety equipment and their use etc. 3. Hack sawing, filing square to dimensions. 4. Marking out on MS plate and punching.	- Importance of trade Training. - General discipline in the Institute - Elementary First Aid. - Importance of in Industry - Safety precautions in Shielded Metal Arc , and Oxy-Acetylene and Cutting.
	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. [different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]	OAW-01 SMAW-01	5. Setting of oxy-acetylene equipment, Lighting and setting of flame. 6. Perform fusion run without filler rod on MS sheet 2mm thick in flat position. 7. Setting up of Arc machine & accessories and striking an arc. 8. Deposit straight line bead on MS plate in flat position.	- Introduction and definition of . - Arc and Gas Equipments, tools and accessories. - Various Processes and its applications. - Arc and Gas terms and definitions.
Professional Skill 21Hrs; Professional Knowledge 05Hrs	Set the gas plant and join MS sheet in different position following safety precautions. [Different position: - 1F, 2F, 3F,	OAW-02 OAW-03	9. Depositing bead with filler rod on M.S. sheet 2 mm thick in flat position. 10. Edge joint on MS sheet 2 mm thick in flat	- Different process of metal joining methods: Bolting, riveting, soldering, brazing, seaming etc. - Types of joints and its applications. Edge

	1G, 2G, 3G.]		position without filler rod.	preparation and fit up for different thickness. - Surface Cleaning
Professional Skill 20Hrs; Professional Knowledge 05Hrs	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. <i>[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]</i>	SMAW-02 SMAW-03	11. Straight line beads on M.S. plate 10 mm thick in flat position. 12. Weaved bead on M. S plate 10mm thick in flat position.	- Basic electricity applicable to arc and related electrical terms & definitions. - Heat and temperature and its terms related to - Principle of arc. And characteristics of arc.
Professional Skill 23Hrs; Professional Knowledge 05Hrs	Set the oxy- acetylene cutting plant and perform different cutting operations on MS plate. <i>[Different cutting operation – Straight, Bevel, circular]</i>	OAGC-01 OAGC-02 OAGC-03 OAGC-04 OAGC-05	13. Setting up of oxy-acetylene and make straight cuts (freehand) 14. Perform marking and straight line cutting of MS plate 10 mm thick by gas. Accuracy within ± 2 mm. 15. Beveling of MS plates 10 mm thick, cutting regular geometrical shapes and irregular shapes, cutting chamfers by gas cutting. 16. Marking and perform radial cuts, cutting out holes using oxy-acetylene gas cutting. 17. Identify cutting defects viz., distortion, grooved, fluted or ragged cuts; poor draglines; rounded	- Common gases used for & cutting, flame temperatures and uses. - Types of oxy-acetylene flames and uses. - Oxy-Acetylene Cutting Equipment principle, parameters and application.

		OAGC-06	edges; tightly adhering slag.	
Professional Skill 126Hrs; Professional Knowledge 31Hrs	Set the gas plant and join MS sheet in different position following safety precautions. <i>[Different position: - 1F, 2F, 3F, 1G, 2G, 3G.]</i> Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. <i>[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]</i>	OAW-04	18. Square butt joint on M.S. sheet 2 mm thick in flat Position. (1G)	- Arc power sources: Transformer, Rectifier and Inverter type machines and its care & maintenance. - Advantages and disadvantages of A.C. and D.C. machines
		SMAW-04	19. Fillet “T” joint on M.S. Plate 10 mm thick in flat position. (1F)	
		OAW-05	20. Open corner joint on MS sheet 2 mm thick in flat Position (1F)	- positions as per EN & ASME: flat, horizontal, vertical and over head position. - Weld slope and rotation. - symbols as per BIS & AWS.
		SMAW-05	21. Fillet lap joint on M.S. plate 10 mm thick in flat position. (1F)	
		OAW-06	22. Fillet “T” joint on MS sheet 2 mm thick in flat position. (1F)	
		SMAW-06	23. Open Corner joint on MS plate 10 mm thick in flat position. (1F)	
		OAW-07	24. Fillet Lap joint on MS sheet 2 mm thick in flat position. (1F)	- Arc length – types – effects of arc length. - Polarity: Types and applications. - Weld quality inspection, common mistakes and appearance of good and defective welds - Weld gauges & its uses.
		SMAW-07	25. Single “V” Butt joint on MS plate 12 mm thick in flat position (1G) .	
		I&T-01	26. Testing of weld joints by visual inspection. 27. Inspection of welds by using weld gauges.	
		OAW-08	28. Square Butt joint on M.S. sheet. 2 mm thick in Horizontal position. (2G)	- Calcium carbide uses and hazard. - Acetylene gas properties and flash back arrestor.
		SMAW-08	29. Straight line beads and multi layer practice on	

		SMAW-09	M.S. Plate 10 mm thick in Horizontal position. 30. Fillet “T” joint on M.S. plate 10 mm thick in Horizontal position. (2F)	
		OAW-09	31. Fillet Lap joint on M.S. sheet 2 mm thick in horizontal position (2F)	- Oxygen gas and its properties, uses in . - Charging process of oxygen and acetylene gases - Oxygen and Dissolved Acetylene gas cylinders and Color coding for different gas cylinders. - Uses of single and double stage Gas regulators.
		SMAW-10	32. Fillet Lap joint on M.S. plate 10 mm thick in horizontal position. (2F)	
		OAW-10	33. Fusion run with filler rod in vertical position on 2mm thick M.S sheet.	- Oxy acetylene gas Systems (Low pressure and High pressure). Difference between gas blow pipe(LP &HP) and gas cutting blow pipe - Gas techniques. Rightward and Leftward techniques.
		OAW-11	34. Square Butt joint on M.S. sheet. 2 mm thick in vertical position (3G)	
		SMAW-11	35. Single Vee Butt joint on M.S. plate 12 mm thick in horizontal position (2G).	
		SMAW- 12	36. Fillet “T” joint on M.S sheet 2 mm thick in vertical position. (3F)	- Arc blow – causes and methods of controlling. - Distortion in arc & gas and methods employed to minimize distortion - Arc defects, causes and Remedies.
		OAW-12	37. Fillet “T” joint on M.S. plate 10 mm thick in vertical position. (3F)	
		SMAW-13		
Professional Skill 80 Hrs; Professional Knowledge	Set the SMAW machine and perform different type of joints on MS in different	OAW-13	38. Structural pipe butt joint on MS pipe Ø 50 and 3mm WT in 1G position.	- Specification of pipes, various types of pipe joints, pipe all positions, and procedure.

17Hrs	position observing standard procedure. <i>[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G] (Mapped NOS: CSC/N0204)</i> Perform in different types of MS pipe joints by Gas (OAW). <i>[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]</i>	SMAW-14	39. Fillet Lap joint on M.S. Plate 10 mm in vertical position. (3G)	- Difference between pipe and plate.
		SMAW-15	40. Open Corner joint on MS plate 10 mm thick in vertical position. (2F)	- Pipe development for Elbow joint, “T” joint, Y joint and branch joint
		OAW-14	41. Pipe - Elbow joint on MS pipe Ø 50 and 3mm WT. (1G)	- Brief use of Manifold system
		OAW-15	42. Pipe “T” joint on MS pipe Ø 50 and 3mm WT. (1G)	- Gas filler rods, specifications and sizes.
Professional Skill 61Hrs; Professional Knowledge 06Hrs	Set the SMAW machine and perform different type of joints on MS in different position observing standard procedure. <i>[different types of joints- Fillet (T-joint, lap & Corner), Butt (Square & V); different position - 1F, 2F, 3F,4F, 1G, 2G, 3G, 4G]</i> Set the SMAW	SMAW-16	43. Single “V” Butt joint on MS plate 12 mm thick in vertical position (3G).	- Gas fluxes – types and functions. - Gas Brazing & Soldering : principles, types fluxes & uses - Gas defects, causes and remedies
		OAW-16	44. Pipe 45 ° angle joint on MS pipe Ø 50 and 3mm WT. (1G)	- Electrode: types, functions of flux, coating factor, size specifications of electrode.
		SMAW-17	45. Straight line beads on M.S. plate 10mm thick in over head position.	- Effects of moisture pick up. - Storage and baking of electrodes.
		SMAW-18	46. Pipe Flange joint on M.S plate with MS pipe Ø 50 mm X 3mm WT (1F)	- Weldability of metals, importance of pre heating, post heating and maintenance of inter pass temperature.
		SMAW-19	47. Fillet “T” joint on M.S. plate 10 mm thick in over head position. (4F)	
		SMAW-20	48. Pipe butt joint on MS pipe Ø 50 and 5 mm WT. in 1G position.	- of low, medium and high carbon steel and alloy steels.
		SMAW-21	49. Fillet Lap joint on M.S. plate 10 mm thick in over head position. (4G).	

	machine and perform in different types of MS pipe joints by SMAW. <i>[Different types of MS pipe joints – Butt, Elbow, T-joint, angle (45°) joint, flange joint]</i>	SMAW-22 SMAW-23	50. Single “V” Butt joint on MS plate 10mm thick in over head position (4G) 51. Pipe butt joint on M. S. pipe Ø 50mm WT 6mm (1G) Rolled).	- Stainless steel types- weld decay and weldability.
Professional Skill 25 Hrs; Professional Knowledge 04Hrs	Choose appropriate process and perform joining of different types of metals and check its correctness. <i>[appropriate process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]</i>	OAW-17 SMAW -24 OAW-18	52. Butt joint of copper pipe ½ inch by brazing process by induction machine 53. Square Butt joint on S.S. Sheet 2 mm thick in flat position. (1G) 54. Corner/T joint of copper pipe of ½ inch and of length 75 mm	- Induction, brazing of copper tubes. - Brass – types – properties and methods. - Copper – types – properties and methods. - Brazing cutting tools.
Professional Skill 21Hrs; Professional Knowledge 04Hrs	Choose appropriate process and perform joining of different types of metals and check its correctness. <i>[appropriate process – OAW, SMAW; Different metal – SS, CI, Brass, Aluminium]</i> Demonstrate arc gauging operation to rectify the weld joints.	OAW-19 SMAW-25 AG-01	55. Square Butt & Lap joint on M.S. sheet 2 mm thick by brazing in flat position. 56. Single “V” butt joint C.I. plate 6mm thick in flat position. (1G) 57. Arc gouging on MS plate 10 mm thick.	- Aluminium properties and weldability, methods - Arc cutting & gouging,
Professional Skill 20Hrs; Professional Knowledge 04Hrs	Choose appropriate process and perform joining of different types of metals and check its correctness. <i>[appropriate process</i>	OAW-20 OAW-21	58. Square Butt joint on Aluminium sheet. 3 mm thick in flat position.(10hrs) 59. Bronze of cast iron (Single “V” butt joint)	- Cast iron and its properties types. - Methods of cast iron. (04hrs)

	– OAW, SMAW; Different metal – SS, Cl, Brass, Aluminium]		6mm thick plate (10hrs)	
Professional Skill 25 Hrs; Professional Knowledge 04Hrs	Test welded joints by different methods of testing. <i>[different methods of testing- Dye penetration test, Magnetic particle test, Nick break test, Free band test, Fillet fracture test]</i>	I&T-02 I&T-03 I&T-04 I&T-05 I&T-06	60. Dye penetrant test. 61. Magnetic particle test. 62. Nick- break test. 63. Free bend test. 64. Fillet fracture test.	- Types of Inspection methods - Classification of destructive and NDT methods - economics and Cost estimation.
Professional Skill 166Hrs; Professional Knowledge 32Hrs	Set GMAW machine and perform in different types of joints on MS sheet/plate by GMAW in various positions by dip mode of metal transfer. <i>[different types of joints- Fillet (T-joint, lap, Corner), Butt (Square & V); various positions- 1F, 2F, 3F,4F, 1G, 2G, 3G]</i>	GMAW- 01 GMAW - 02	65. Introduction to safety equipment and their use etc. 66. Setting up of GMAW machine & accessories and striking an arc. 67. Depositing straight line beads on M.S Plate. 68. Fillet weld – “T” joint on M.S plate 10mm thick in flat position by Dip transfer. (1F)	- Safety precautions in Gas Metal Arc and Gas Tungsten Arc. - Introduction to GMAW - equipment – accessories. - Various other names of the process. (MIG/MAG/CO ₂ .)
		GMAW -03 GMAW -04 GMAW -05	69. Fillet weld – Lap joint on M.S. sheet 3mm thick in flat position by Dip transfer. (1F) 70. Fillet weld – “T” joint on M.S. sheet 3mm thick in flat position by Dip transfer. (1F) 71. Fillet weld – corner joint on M.S. sheet 3mm thick in flat	- Advantages of GMAW over SMAW , limitations and applications - Process variables of GMAW.

			position by Dip transfer. (1F)	
		GMAW -06	72. Butt weld – Square butt joint on M.S sheet 3mm thick in flat position (1G)	- Wire feed system – types – care and maintenance. - wires used in GMAW, standard diameter and codification as per AWS.
		GMAW -07	73. Butt weld – Single “V” butt joint on M.S plate 10 mm thick by Dip transfer in flat position. (1G)	
		GMAW -08	74. Fillet weld – “T” joint on M.S plate 10mm thick in Horizontal position by Dip transfer. (2F)	- Name of shielding gases used in GMAW and its applications. - Flux cored arc – description, advantage, wires, coding as per AWS.
		GMAW -09	75. Fillet weld – corner joint on M.S plate 10mm thick in Horizontal position by Dip transfer. (2F)	
		GMAW -10	76. Fillet weld – “T” joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. (2F)	- Edge preparation of various thicknesses of metals for GMAW. - GMAW defects, causes and remedies
		GMAW -11	77. Fillet weld – corner joint on M.S. sheet 3mm thick in Horizontal position by Dip transfer. (2F)	
		GMAW -12	78. Fillet weld – “T” joint on M.S plate 10mm thick in vertical position by Dip transfer. (3F)	- Heat input and techniques of controlling heat input during. - Heat distribution and effect of faster cooling
		GMAW -13	79. Fillet weld – corner joint on M.S plate	

			10mm thick in vertical position by dip transfer. (3F)	
		GMAW -14	80. Fillet weld – Lap joint on M.S. sheet 3mm thick in vertical position by Dip transfer. (3F)	- Pre heating & Post Weld Heat Treatment - Use of temperature indicating crayons.
		GMAW -15	81. Fillet weld – corner joint on M.S. sheet 3mm thick in vertical position by Dip transfer. (3F)	
		GMAW -16	82. Fillet weld – Lap and “T” joint on M.S sheet 3mm thick in overhead position by Dip transfer. (4F)	- Submerged arc process – principles, equipment, advantages and limitations
		GMAW -17	83. Tee Joints on MS Pipe Ø 60 mm OD x 3 mm WT 1G position – Arc constant (Rolling)	
Professional Skill 80 Hrs; Professional Knowledge 14Hrs	Set the GTAW machine and perform by GTAW in different types of joints on different metals in different position and check correctness of the weld. <i>[different types of joints- Fillet (</i>	GMAW -18	84. Depositing bead on S.S sheet in flat position.	- Thermit process- types, principles, equipments, Thermit mixture types and applications. - Use of backing strips and backing bars
		GMAW -19	85. Butt joint on Stainless steel 2 mm thick sheet in flat position by Dip transfer.	
		GTAW -01	86. Depositing bead on Aluminium sheet 2 mm thick in flat position.	- GTAW process - brief description. Difference between AC and DC , equipments, polarities and applications. - Power sources for GTAW - AC & DC
		GTAW -02	87. Square butt joint on Aluminium sheet 1.6mm thick in flat position.	
		GTAW -03	88. Fillet weld – “T” joint	- Tungsten electrodes –

	<i>T-joint, lap, Corner), Butt (Square & V) ; different metals- Aluminium, Stainless Steel; different position- 1F & 1G]</i>	GTAW -04	89. Fillet weld – Outside corner joint on Aluminium sheet 2 mm thick in flat position. (1F)	types & uses, sizes and preparation - GTAW Torches- types, parts and their functions - GTAW fillerrods and selection criteria.
		GTAW -05	90. Butt weld - Square butt joint on Stainless steel sheet 1.6 mm thick in flat position with purging gas (1G)	- Edge preparation and fit up. - GTAW parameters for of different thickness of metals
		GTAW -06	91. Fillet weld – “T” joint on Stainless steel sheet 1.6 mm thick in flat position. (1F)	- Argon / Helium gas properties – uses. - GTAW Defects causes and remedy.
Professional Skill 20Hrs; Professional Knowledge 04Hrs	Perform Aluminium & MS pipe joint by GTAW in flat position.	GTAW -07	92. Pipe butt joint on Aluminium pipe Ø 50 mm x 3 mm WT in Flat position. (1G)	- Friction process- equipment and application - Laser beam (LBW).
Professional Skill 20Hrs; Professional Knowledge 03Hrs	Perform Aluminium & MS pipe joint by GTAW in flat position. Set the Plasma Arc cutting machine and cut ferrous & non-ferrous metals.	GTAW -08 PAC-01	93. “T” Joints on MS Pipe Ø 50 mm OD x 3 mm WT, position – Flat (1F) 94. Straight cutting on ferrous and non ferrous	- Plasma Arc (PAW) and cutting (PAC) process – equipments and principles of operation. - Types of Plasma arc, advantages and applications.
Professional Skill 20Hrs; Professional Knowledge 02Hrs	Set the resistance spot machine and join MS & SS sheet.	RW-01 RW-02	95. Lap joint on Stainless steel sheet by Resistance Spot. 96. MS sheets joining by Resistance Spot	- Resistance process -types, principles, power sources and parameters. - Applications and limitations.
Professional	Perform joining of	OAW-01	97. Square butt joint on	- Metalizing – types of

Skill 41Hrs; Professional Knowledge 10Hrs	different similar and dissimilar metals by brazing operation as per standard procedure. <i>[different similar and dissimilar metals- Copper, MS, SS]</i>	OAW-02	98. Copper sheet 2mm thick in flat position. (1G) “T” joint on Copper to MS sheet 2mm thick in flat position by Brazing (1F)	metalizing principles. - Manual Oxy – acetylene powder coating process- principles of operation and applications
		OAW-03	99. Silver brazing on S.S Sheet with copper sheet “T” joint.	- Reading of assembly drawing - Procedure Specification (WPS) and Procedure Qualification Record (PQR)
		OAW-04	100. Silver brazing on copper tube to tube.	
Professional Skill 24Hrs; Professional Knowledge 01Hrs	Repair Cast Iron machine parts by selecting appropriate welding process. (OAW, and SMAW] Hard facing of alloy steel components / MS rod by using hard facing electrode.	OAW - 05	101. Repair of broken C.I. machine parts by oxy-acetylene with C.I and bronze filler rod.	- Hard facing/ surfacing necessity, surface preparation, various hard facing alloys and advantages of hard facing. - Plastic machine with hot air gun and plastic material: Polypropylene (PP) Polyethylene (PE) Polyvinylchloride (PVC)
		SMAW-01	102. Repair of broken C.I machine parts by C.I. electrode.	
			SMAW-02	
			104. Make a plastic tank with plastic sheet of PVC. Dimensions 150*100*100	
Engineering Drawing: 40 Hrs.				
Professional Knowledge ED - 40 hrs.	Read and apply engineering drawing for different application in the field of work.	ENGINEERING DRAWING: - Introduction to Engineering Drawing and Drawing Instruments; Conventions Sizes and layout of drawing sheets Title Block, its position and content Drawing Instrument - Free hand drawing of; Geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches.		

		Free hand drawing of hand tools and measuring tools. - Lines Types and applications in drawing - Drawing of Geometrical figures; Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke, double stroke, inclined - Reading of dimension and Dimensioning Practice. - Reading of fabrication drawing, sectional view of different types of Joints. Sectional view of different pipe joints - Symbolic representation different symbols used in the related trades Reading of Job Drawing of related trades.
Workshop Calculation & Science: 38 Hrs.		
Professional Knowledge WC- 38 hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	<u>WORKSHOP CALCULATION & SCIENCE :</u> - Unit, Fractions - Square root, Ratio and Proportions, Percentage - Material Science - Mass, Weight, Volume and Density - Heat & Temperature and Pressure - Basic Electricity - Mensuration - Trigonometry

SYLLABUS FOR CORE SKILLS

1. Employability Skills (Common for all CTS trades) (120 hrs)

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