

field of study.	

## 7. TRADE SYLLABUS

SYLLABUS FOR WIREMAN TRADE			
FIRST YEAR			
Duration	Reference Learning Outcome	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 110 Hrs;  Professional Knowledge 20 Hrs	Apply safety precautions and prepare profile with an appropriate accuracy as per drawing using basic jobs of marking components, filing, drilling, riveting, fitting, joining etc. (Mapped NOS: PSS/N1707)	<ol style="list-style-type: none"> <li>1. Visit various sections of the institutes and identify locations of different installations. (03 hrs)</li> <li>2. Identify safety symbols and hazards. (04 hrs)</li> <li>3. Practice elementary first aid. (04 hrs)</li> <li>4. Practice safe methods of fire fighting in case of electrical fire. (04 hrs)</li> <li>5. Demonstrate by visual aids to isolate electric supplies and rescue a person safely in contact with electricity. (7 hrs)</li> <li>6. Demonstrate artificial respiration through visual aids. (04 hrs)</li> <li>7. Identify trade tools and equipment. (03 hrs)</li> </ol>	<b>Occupational Safety &amp; Health:</b> Scope of the Wireman trade and career progression. Power sector scenario in India. Safety rules and safety signs for Danger, Warning, caution & personal safety messages. Basic injury prevention, Basic first aid, Hazard identification, avoidance and PPEs. Personal safety and factory safety. Effects of electric current on human being. Reasons for shock. Disposal procedure of waste materials. Response to emergencies e.g. power failure, fire, and system failure.

		<p>8. Disposal procedure of waste materials. (03 hrs)</p> <p>9. Use of personal protective equipment. (03 hrs)</p> <p>10. Practice on filing and hacksawing and prepare T-joints, straight joints and dovetail joints on wooden blocks. (15 hrs)</p> <p>11. Practice sawing, planing, drilling and assembling for making a wooden switchboard. (15 hrs)</p> <p>12. Practice in marking and cutting of straight and curved pieces in metal sheets, making holes, securing by screw and riveting etc. (15 hrs)</p> <p>13. Prepare a closed cabinet from metal sheet with holes for cables and various fittings. (15 hrs)</p> <p>14. Workshop practice on drilling, chipping, internal and external threading of different sizes. (15 hrs)</p>	<p>Concept of Standards and advantages of BIS/ISI.</p> <p>Familiarization with signs and symbols of electrical accessories</p> <p>Introduction to 5S concept.</p> <p>Introduction to fitting tools, safety precautions. Description of files, hammers, chisels hacksaw frames, blades, their specification and grades.</p> <p>Marking tools description and use.</p> <p>Types of drills, description &amp; drilling machines.</p> <p>Various wooden joints.</p> <p>Marking tools; calipers</p> <p>Dividers, Surface plates, angle plates, scribes, punches, surface gauges, Types, Uses, Care and maintenance.</p> <p>Sheet metal tools: Description of marking &amp; cutting tools.</p> <p>Types of rivets and riveted joints. Use of thread gauge.</p> <p>Description of carpenter's tools</p> <p>Care and maintenance of tools. (20 hrs)</p>
<p>Professional Skill 60 Hrs;</p> <p>Professional Knowledge 10 Hrs</p>	<p>Prepare terminations, make good quality of electrical wire joints for single and multi-strand conductors and carry out crimping, soldering and brazing. (Mapped NOS: PSS/N2512, PSS/N1331)</p>	<p>15. Demonstrate and identify various types of cables used in domestic, commercial and industrial wiring systems. (9 hrs)</p> <p>16. Practice stripping and skinning of different cables. Measure thickness of wire using SWG and micrometer. (9 hrs)</p>	<p><b>Wire Joints:</b></p> <p>Trade tools specifications.</p> <p>Properties of conductors, Fundamental of electricity.</p> <p>Electron theory; free electron, fundamental terms, definitions, units &amp; effects of electric current.</p> <p>Types of wires &amp; cables, standard wire gauge.</p>

		<p>17. Demonstrate and Practice bare conductor joints, viz. Rat tail, Duplex cross, Knotted type, Britannia, straight, Tee, Western union, fixture Joints, split bolt connector. (21 hrs)</p> <p>18. Practice in soldering. (7 hrs)</p> <p>19. Practice in brazing. (07 hrs)</p> <p>20. Practice on crimping thimbles, lugs and fitting of a push fit co-axial plug and socket. (7 hrs)</p>	<p>Current carrying capacity of different conductors.</p> <p>Specification of wires &amp; Cables- insulation &amp; voltage grades -Low, medium &amp; high voltage</p> <p>Precautions in using various types of cables / Ferrules.</p> <p>Types of Wire joints &amp; their application.</p> <p>Insulators, semi-conductors and resistors.</p> <p>Voltage grading of different types of Insulators, permissible temperature rise.</p> <p>Solders, flux and soldering techniques. (10 hrs)</p>
<p>Professional Skill 130 Hrs;</p> <p>Professional Knowledge 30 Hrs</p>	<p>Draw and set up DC and AC circuits, involving R-L-C components, perform measurement of various electrical parameters with due care and safety. Carry out Sealing of energy meters and Monitor meter readings using MRI. (Mapped NOS: PSS/N1707)</p>	<p>21. Measure resistance using voltage drop method. (05 hrs)</p> <p>22. Measure resistance using wheatstone bridge method. (06 hrs)</p> <p>23. Verify thermal effect of electric current and change in resistance due to temperature. (06 hrs)</p> <p>24. Verify Ohm's law in electrical circuit. (05 hrs)</p> <p>25. Measure current and voltage in electrical circuits to verify Kirchhoff's Law. (9 hrs)</p> <p>26. Verify the characteristics of series-parallel combination of resistors. (05 hrs)</p> <p>27. Determine the poles and plot the field of a magnet bar. (05 hrs)</p>	<p><b>Basic Electricity:</b></p> <p>Introduction of National Electrical Code 2011.</p> <p>Ohm's Law, Kirchoff's Laws Series and parallel circuits.</p> <p>Open and short circuits in series and parallel networks.</p> <p>Laws of Resistance and various types of resistors. Series and parallel combinations of resistors.</p> <p>Wheatstone bridge; principle and its applications.</p> <p>Different methods of measuring the values of resistance.</p> <p><b>Magnetism;</b> Magnetic terms, magnetic materials and properties of magnet.</p> <p>Principles and laws of electro-magnetism.</p>

		<p>28. Wind a solenoid and determine the magnetic effect of electric current. (05 hrs)</p> <p>29. Demonstrate generation of mutually induced emf. (05 hrs)</p> <p>30. Identify various types of capacitors, charging / discharging and testing. Group the given capacitors to get the required capacity and voltage rating. (06 hrs)</p> <p>31. Measure power, energy for lagging and leading power factors in three phase circuits. Verify relationship between line and phase values in 3 phase star and delta connection. (12 hrs)</p> <p>32. Ascertain use of neutral by identifying wires of a 3-phase 4 wire system and find the phase sequence using phase sequence meter. (05 hrs)</p> <p>33. Practice on using analog and digital multi-meter for measurement of various parameters. (05 hrs)</p> <p>34. Determine the effect of broken neutral wire in three phase four wire system. (05 hrs)</p> <p>35. Measure the Power of three phase circuit for balanced and unbalanced loads. (05 hrs)</p> <p>36. Practice on measuring instruments in single and three phase circuits viz.,</p>	<p>Self and mutually induced EMFs.</p> <p><b>Electrostatics:</b> Capacitor- Different types, functions, grouping and uses. Inductive and capacitive reactance, their effect on AC circuit and related vector concepts.</p> <p>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. Advantages of AC poly-phase system. Problems on A.C. circuits. 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.</p> <p><b>Measuring instruments;</b> Classification of electrical instruments and essential forces required in indicating instruments. PMMC and Moving iron instruments.</p>
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<p>Professional Skill 50 Hrs;  Professional Knowledge 10 Hrs</p>	<p>Explain basic concepts of generation, transmission and distribution of electrical power including renewable energy. (Mapped NOS: PSS/N7001)</p>	<p>42. Demonstrate Thermal &amp; Nuclear power plants using visual aids. (05 hrs)</p> <p>43. Demonstrate different transmission and distribution systems using visual aids. (06 hrs.)</p> <p>44. Demonstrate different renewable energy power plants viz., Solar, wind, small, mini &amp; micro hydro power plants using visual aids. (06 hrs.)</p>	<p><b>Power system:</b></p> <p>Generation, transmission and distribution of electrical power</p> <p>General idea about overhead transmission, distribution (LV, MV &amp; HV) and their types and accessories used.</p> <p>Types of Distribution system</p> <p>Line protecting devices</p> <p>Types of substations - indoor, outdoor &amp; Pole mounted, etc.</p> <p><b>Substation Equipment</b></p> <p>Switchgear; CBs – ACB, VCB, SF6, OCB etc. protection schemes,</p>

		<p>45. Identify different types of insulators. (Video demonstration/ charts). (03 hrs)</p> <p>46. Visit to distribution sub-station to familiarize with equipment and various accessories. (08 Hrs)</p> <p>47. Demonstrate operation of various circuit breakers viz., ACB, VCB, SF6, OCB. using visual aids. (10 hrs.)</p> <p>48. Demonstrate different types of substations viz., outdoor, indoor, pole mounted. using visual aids. (06 hrs.)</p> <p>49. Prepare a line diagram of the institute/ ITI supply system. (06 hrs.)</p>	<p>current transformer, Potential transformer, Protective relays, lightning arrestors, Different types of switches and switch gears, multi Range switches, rotary switches, cooker control panels, power circuit switches, thermostat, mercury switches etc. (10 hrs)</p>
<p>Professional Skill 40 Hrs; Professional Knowledge 7 Hrs</p>	<p>Plan and prepare Plate and Pipe earthing installations and ensure safe and effective earthing. (Mapped NOS: PSS/N6002)</p>	<p>50. Demonstrate and identify various components of earthing installation. (05 hrs)</p> <p>51. Prepare pipe earthing and measure earth resistance by earth tester/ megger. (9 Hrs)</p> <p>52. Prepare plate earthing and measure earth resistance by earth tester/ megger. (9 Hrs)</p> <p>53. Demonstrate grid/ mesh earthing. (06 Hrs)</p> <p>54. Practice grounding of equipment and systems. (06 Hrs)</p> <p>55. Test earth leakage by ELCB and relay. (05 Hrs)</p>	<p><b>Earthing:</b> Importance of Earthing. I. E. Rules for earthing conduits using earth clips and earth wire as per IS 732-1863. Plate earthing, pipe earthing grid/mesh earthing. Earth resistance, earth leakage current and circuit breaker.  Difference between grounding and earthing. Awareness of circuit main earth (CME) and portable earth. (07 hrs)</p>

<p>Professional Skill 50 Hrs;  Professional Knowledge 10 Hrs</p>	<p>Carry out wiring, testing, and maintenance of DC machines including DC motor starters.</p>	<p>56. Identify parts of DC machines and their terminals. (04 Hrs.) 57. Carry out wiring of different DC motors and generators. (8 Hrs.) 58. Dismantle and identify parts of three point and four-point DC motor starters. (05 Hrs.) 59. Assemble, Service and repair three point and four-point DC motor starters. (9 Hrs.) 60. Practice maintenance of carbon brushes, brush holders, Commutator and slip-rings. (9 Hrs.) 61. Perform speed control of DC motors - field and armature control method. (06 Hrs.) 62. Demonstrate overhauling/ routine maintenance of DC machines. (9 Hrs.)</p>	<p><b>DC Machines;</b> 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. Armature reaction, Commutation, interpoles and connection of interpoles. Parallel Operation of DC Generators. Application, losses &amp; efficiency of DC Generators. Principle and types of DC motors. Changing the direction of rotation. Methods of speed control of DC motors. (10 hrs)</p>
<p>Professional Skill 60 Hrs;  Professional Knowledge 10 Hrs</p>	<p>Carry out wiring, testing, and maintenance of small transformers, 1<math>\phi</math>&amp; 3<math>\phi</math> AC motors and Alternators including AC motor starters.</p>	<p>63. Verify terminals, identify components of various single phase and three phase transformers and carry out wiring. (05 hrs) 64. Carry out polarity, insulation, open circuit, short circuit test and voltage regulation of a transformer. (10 hrs) 65. Identify parts and terminals of three phase AC motors, test for continuity and</p>	<p><b>Transformers, AC motors, starters and Alternators:</b> Working principle, construction and classification of transformers. Single phase and three phase transformers. Testing of transformers. General concept of rotating electrical machines. Principle of operation of AC motors and generators,</p>

		<p>insulation resistance. (10 hrs)</p> <p>66. Identify parts and terminals of different types of single-phase AC motors. (10 hrs)</p> <p>67. Identify parts and terminals of MG set, make connections and demonstrate conversion of electrical power to a different form. (10 Hrs)</p> <p>68. Identify parts, service and troubleshoot/ repair &amp; maintenance of AC motor starters viz., DOL, star-delta auto-transformer and rotor resistance starter. (15 Hrs)</p>	<p>components and various types.</p> <p><b>Motor Starters:</b> Different types of starters for AC motors, its necessity, basic contactor circuit, parts and their functions.</p> <p>Basic knowledge of soft starter. (10 hrs)</p>
<p>Professional Skill 50 Hrs; Professional Knowledge 10 Hrs</p>	<p>Read, understand and draw electrical Schematic drawings of power and control circuits using industry standard symbols.</p>	<p>69. Identify and draw symbols used in the electrical circuit drawings. (08 hrs)</p> <p>70. Interpret control and power circuits of various panel wiring drawings in simple to complex manner. (10 hrs)</p> <p>71. Practice drawing of simple circuits viz. control of lamps, tube lights, fans and single - phase motors. (10 hrs)</p> <p>72. Practice drawing of circuits using various control elements viz. timers, relays Circuit breakers, sensors, and sequential control of motors. (17 hrs)</p> <p>73. Draw a circuit of fully automatic star-delta starter for starting a 3-<math>\phi</math> induction motor. (05 hrs)</p>	<p>Different control elements and equipment, their symbols.</p> <p>Power and control schematic drawings with interlocks.</p> <p>Relay ladder logic. Relay and control panel wiring.</p> <p>Circuits of various electrical appliances and controls.</p> <p>Power Distribution network drawings. (10 hrs)</p>
<p>Professional Skill 175</p>	<p>Plan, draw, assemble and perform various</p>	<p>74. Wire up simple circuits and practice control of lamps in</p>	<p><b>Domestic Wiring:</b> Introduction and explanation of</p>

<p>Hrs; Professional Knowledge 35 Hrs</p>	<p>domestic wiring. Carry out Testing, maintenance and repair/ replacement of domestic wiring.</p>	<p>different combinations using switching concept. (10 Hrs)</p> <p>75. Calculate maximum connected load in a section of the institute. (10 hrs)</p> <p>76. Demonstrate and draw electrical supply system from pole to main switch board including different components. (05 hrs.)</p> <p>77. Prepare a list of typical energy consumption of electrical appliances. (05 hrs)</p> <p>78. Identify various accessories used in domestic wiring of different ratings/sizes and list out their approximate cost. (10 hrs.)</p> <p>79. Prepare test boards/ extension boards and mount accessories like lamp holders, switches, sockets, fuses, relays, MCB, ELCB, MCCB. (18 Hrs)</p> <p>80. Graphical representation (Current Vs time) of MCB &amp; ELCB. (05 hrs)</p> <p>81. Demonstrate method of working with plum bob, spirit level, water level and wall chasing. (10 hrs)</p> <p>82. Draw layouts and practice PVC Casing-capping wiring of minimum 20 meter length with minimum to more number of points. (12 Hrs)</p> <p>83. Wire up PVC Casing-capping wiring to control one lamp</p>	<p>electrical wiring systems, cleat wiring, Casing-capping, CTS, Conduit and concealed etc.</p> <p>IE Rules related to wiring, National Building codes for house wiring, specification and types, rating &amp; material. Minimum load capacities (W/m<sup>2</sup>) of various buildings. Electrical load categories. Terms; Maximum demand, Load factor and Diversity factor, etc.</p> <p>Various wiring accessories/ electrical fittings e.g. switches, fuses, lamp holders, plugs, brackets, ceiling rose, cut out relays, sensors, voltage regulators, MCB, ELCB, MCCB etc.</p> <p>Grading of cables and current ratings.</p> <p>Principle of laying out of domestic wiring. Selection of switchgear. Voltage drop concept. IS 732-1863.</p> <p>Wiring materials used for PVC cables, Indian standards regarding the above wiring such as clip distance fixing of screws, cable bending etc. Introduction to estimation procedure, PVC casing and capping materials, sizes and</p>
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		<p>from two different places (Staircase wiring). (12 Hrs)</p> <p>84. Draw layouts and practice PVC Conduit wiring of minimum 20 mtr length with minimum to more number of points. (15 hrs)</p> <p>85. Wire up PVC conduit wiring to control one lamp from three different places. (12 hrs)</p> <p>86. Demonstrate process of concealed conduit wiring system using visual aids. (05 hrs)</p> <p>87. Prepare main distribution board, mount the energy meter board. (10 hrs)</p> <p>88. Wire up the consumers main board with ICDP switch and distribution fuse box. (05 Hrs)</p> <p>89. Carry out polarity test and ensure correct connections of switches, fuses and accessories. (05 hrs)</p> <p>90. Carry out earth continuity test and ensure resistance of earth conductor as per IE rule. (05 hrs)</p> <p>91. Check line-earth and neutral-earth loop impedance and ensure effectiveness of earthing. (06 hrs)</p> <p>92. Simulate faults and practice tracing of faults in different circuits. (10 Hrs)</p>	<p>grades etc.</p> <p>Conduit pipe wiring materials and accessories, types and sizes of conduit.</p> <p>Branching of circuits with respect to loads such as lighting and power.</p> <p>Layout of Light points, fan points, heating loads etc., their controls, main switches, distribution boards as per IE rules.</p> <p>Difference between MCCB, MCB, ELCB, RCCB, MPCB.</p> <p>Different types of wiring; PVC conduit; Surface and concealed (PVC Conduit;/ metal conduit)</p> <p>Casing-capping wiring system. Power, control, Communication and entertainment wiring.</p> <p>Wiring circuits planning, permissible load in sub-circuit and main circuit. (35 hrs)</p>
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		93. Video demonstration of various wiring accessories/ electrical fittings available in the market viz., switches, panels, fuses, plugs, brackets, cut out relays, sensors, voltage regulators, circuit breakers etc. (05 hrs)	
Professional Skill 80 Hrs; Professional Knowledge 18 Hrs	Carry out wiring of control panels, assemble accessories and equipment. (Mapped NOS: PSS/N1709)	<p>94. Demonstrate various components of a control panel viz. DIN rails, plastic trunking, connector blocks, screw terminals, transformers/ toroidal inductors, resistors, capacitors, fuses, fuse holders, switches, push buttons, lamps their specifications and labelling. (05 hrs)</p> <p>95. Demonstrate various components of different relays and contactors, their specifications, fittings in the control panel and labelling. (05 hrs)</p> <p>96. Practice cable forming including template, binding, lacing, loop tie, lock stitch, breakouts, twisted pair. (10 hrs)</p> <p>97. Practice use of sleeves, bootlace ferrule, passing cables through strain relief plate, correct method of connections in terminal blocks and routing of cables. (10 hrs)</p>	<p><b>Control Panel Wiring;</b> Control panel components; DIN rails, trunking, connector blocks, screw terminals, relays, contactors, protective units, fuses, fuse holders; chassis mounted, fuse-links, resistors; fixed, variable, capacitors, switches, lamps, labelling grommets and clips etc. Cable forming; template, wiring schedule, run out sheet, binding, continuous lacing, loop tie, lock stitch, finish knot, breakouts, lacing breakouts, spot ties, laying of wires, twisted pair, Cable markers and colour codes etc. Connections and routing of cables. Consideration of EMI/EMC Conductors of different circuits. Symbols and use of relay contacts: NO, NC, changeover, make/break after delay. Testing of various control elements and circuits. (18 hrs)</p>

		<p>98. Pass cables through strain relief plate in an Electrical cabinet and secure the cables properly using cable tie/clamp. (05 hrs)</p> <p>99. Mount various control elements e.g. circuit breakers, relays, contactors, measuring instruments, sensors and timers. (10 hrs)</p> <p>100. Practice earthing and screening of cabinets as per IE rules and ensure proper earth continuity. (10 hrs)</p> <p>101. Demonstrate electro-magnetic interference and electro-magnetic compatibility. (05 hrs)</p> <p>102. Practice wiring of control panel for different operations/controls of motor using various accessories and test for its performance. (20 hrs)</p>	
<p>Professional Skill 35 Hrs;</p> <p>Professional Knowledge 10 Hrs</p>	<p>Install, test and carry out maintenance of batteries and solar cell with due care and safety. (Mapped NOS: PSS/N6003)</p>	<p>103. Demonstrate use of various types of cells and practice on grouping of cells for specified voltage/current under different conditions. (03 Hrs)</p> <p>104. Prepare and practice on battery charging. (03 Hrs)</p> <p>105. Practice on routine, care/maintenance and testing of batteries. (07 Hrs)</p> <p>106. Practice charging of a Lead acid cell, filling of electrolytes, testing of</p>	<p><b>Battery and solar cell:</b> Chemical effects of electric current and Laws of electrolysis. Explanation of Anodes and cathodes.</p> <p>Types of cells, advantages/disadvantages and their applications.</p> <p>Lead acid cell; Principle of operation and components. Types of battery charging, Safety precautions, test equipment and</p>

		<p>charging, checking of discharged and fully charged battery. (12 hrs)</p> <p>107. Demonstrate different types of solar cell viz., a-Si, Cd-Te, c-Si, Cl(G)S, CVP and HCVP. (05 hrs)</p> <p>108. Determine the number of solar cells in series/ parallel for given power requirement. (05 Hrs)</p>	<p>maintenance.</p> <p>Grouping of cells for specified voltage and current.</p> <p>Principle and operation of solar cell, Types of solar cell. (10 Hrs)</p>
<b>Engineering Drawing: 40 Hrs.</b>			
Professional Knowledge ED-40 Hrs.	Read and apply engineering drawing for different application in the field of work.	<p><b>Engineering Drawing:</b></p> <p>Introduction to Engineering Drawing and Drawing Instruments–</p> <ul style="list-style-type: none"> <li>• Conventions</li> <li>• Sizes and layout of drawing sheets</li> <li>• Title Block, its position and content</li> <li>• Drawing Instrument</li> </ul> <p>Freehand drawing of–</p> <ul style="list-style-type: none"> <li>• Geometrical figures and blocks with dimension</li> <li>• Transferring measurement from the given object to the free hand sketches.</li> <li>• Free hand drawing of hand tools.</li> </ul> <p>Drawing of Geometrical figures:</p> <ul style="list-style-type: none"> <li>• Angle, Triangle, Circle, Rectangle, Square, Parallelogram.</li> <li>• Lettering &amp; Numbering – Single Stroke</li> </ul> <p>Dimensioning Practice</p> <ul style="list-style-type: none"> <li>• Types of arrowhead</li> </ul> <p>Symbolic representation–</p> <ul style="list-style-type: none"> <li>• Different electrical symbols used in the related trades</li> </ul>	

		Reading of Electrical Circuit Diagram Reading of Electrical Layout drawing	
<b>Workshop Calculation &amp; Science: 30 Hrs.</b>			
Professional Knowledge WCS-30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	<p><b><u>Workshop Calculation &amp; Science:</u></b></p> <p><b>Unit, Fractions</b> 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 &amp; division Decimal fractions - Addition, subtraction, multiplication &amp; division Solving problems by using calculator</p> <p><b>Square root, Ratio and Proportions, Percentage</b> 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</p> <p><b>Material Science</b> Types metals, types of ferrous and non-ferrous metals Introduction of iron and cast iron</p> <p><b>Mass, Weight, Volume and Density</b> 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</p> <p><b>Heat &amp; Temperature and Pressure</b> Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point &amp; melting point of different metals and non-metals Scales of temperature, Celsius, Fahrenheit, kelvin and conversion between scales of temperature Heat &amp; Temperature - Temperature measuring instruments, types of thermometer, pyrometer and transmission of heat - Conduction, convection and radiation.</p> <p><b>Mensuration</b> Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles</p>	

		<p>Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse</p> <p>Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder</p> <p><b>Trigonometry</b></p> <p>Measurement of angles</p> <p>Trigonometrical ratios</p> <p>Trigonometrical tables</p>
<b>Project Work / Industrial Visit</b>		

SYLLABUS FOR WIREMAN TRADE			
SECOND YEAR			
Duration	Reference Learning Outcomes	Professional Skills (Trade Practical) With Indicative Hours	Professional Knowledge (Trade Theory)
Professional Skill 115 Hrs;  Professional Knowledge 30 Hrs	Plan, draw, install and test different types of Commercial wiring including advanced systems. Install temporary electrical wiring at construction site.  (Mapped NOS: PSS/N1707)	<p>109. Practice wiring for communication circuits and computer networks using UTP, STP, Co-axial and optical fibre cables. (11 hrs)</p> <p>110. Wire-up lighting system for control using motion detector. (12 hrs)</p> <p>111. Wire-up panel board for control of lights and fans from wireless remote. (12</p>	<p><b>Commercial Wiring:</b></p> <p>Wiring in commercial building- their special precautions as per I.E. rules.</p> <p>Different types of wiring - Power, control, Communication and entertainment wiring.</p> <p>Wiring circuits planning, Cabling in healthcare facilities;</p>

		<p>hrs)</p> <p>112. Demonstrate wiring and components of fire alarm system, interior siren, control &amp; signalling using visual aids. (12 hrs)</p> <p>113. Practice installation of 1 <math>\phi</math> &amp; 3 <math>\phi</math> online/ offline UPS wiring and test. (12 hrs)</p> <p>114. Install and wire up CCTV camera. (08 hrs)</p> <p>115. Install inverter and carry out wiring. (12 hrs)</p> <p>116. Demonstrate wiring plan, lighting fixtures, receptacles and sensors for bathing area. (12 hrs)</p> <p>117. Demonstrate multi-storeyed building wiring. (12 hrs)</p> <p>118. Install temporary LV electrical panels and lighting arrangements for construction site. (12 hrs)</p>	<p>importance of grounding, shielding and routing in accordance with life safety codes to minimize interference with medical equipment.</p> <p>GFCI (Ground-fault circuit interrupter) receptacles. (30 hrs)</p>
<p>Professional Skill 110 Hrs;</p> <p>Professional Knowledge 28 Hrs</p>	<p>Plan, draw, estimate material/ cost, install and test different types of industrial wiring system as per IE rules. Layout cables for various purposes including cable management. (Mapped NOS: PSS/N1707)</p>	<p>119. Identify accessories and tools required for industrial wiring. Demonstrate various switchboards, switchgears, industrial control panels and accessories. (06 hrs)</p> <p>120. Demonstrate cable tray, raceways, auxiliary gutter, cable bus assembly, trench for passing of cables. (06 hrs)</p> <p>121. Determine minimum ampacity and size of conductors for continuous</p>	<p><b>Industrial Wiring:</b></p> <p>Adverse conditions likely to affect the installation.</p> <p>Degree of mechanical and electrical protection necessary.</p> <p>Peak-Non-peak Loads in Office Buildings</p> <p>Lighting Design; lighting power density,</p> <p>Estimation of load, cable size,</p>

		<p>and non-continuous loads. (06 hrs)</p> <p>122. Practice installing cables in conduit as per IE rules. (06 hrs)</p> <p>123. Practice cutting, threading and bending of metallic conduit. (08 hrs)</p> <p>124. Identify different bus bars, practice joining and installation including overhead bus bar system as per IE rules. (10 hrs)</p> <p>125. Prepare bill of material, plan and practice wiring of an institute and workshop as per IE rules. (16 hrs)</p> <p>126. Demonstrate Hospital, Tunnel and Godown wiring using visual aids. (06 hrs)</p> <p>127. Practice testing / fault detection of industrial wiring installations and repair. (14 hrs)</p> <p>128. Practice laying of cables in raceways and trenches. (05 hrs)</p> <p>129. Demonstrate various cable glands. Practice cable entry on a switch cabinet wall. (05 hrs)</p> <p>130. Practice passing of cables through cable entry plate for standard cables without connectors, up to IP 68 rated protection. (05 hrs)</p> <p>131. Practice split cable entry for multiple pre-terminated</p>	<p>bill of material and cost.</p> <p>Inspection and testing of wiring installations.</p> <p>Special wiring circuit e.g. hospital, godown, tunnel and workshop, etc.</p> <p>Danger notice as per IE rules</p> <p><b>Cable Management:</b></p> <p>Types of cables, their use,</p> <p>Various cable glands</p> <p>Introduction to IP ratings (Ingress protection) and IP Codes format.</p> <p>Importance of Bonding and grounding, various types.</p> <p>Testing of cables, locating faults, open circuit, short circuit and leakage in cables. (28 hrs)</p>
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		<p>cables, up to IP 65 rated protection. (05 hrs)</p> <p>132. Demonstrate bonding and grounding of raceways, cable assembly and panels. (04 hrs)</p> <p>133. Demonstrate use of earth rods. Test underground cables for faults and remove the fault. (08 hrs)</p>	
<p>Professional Skill 60 Hrs;</p> <p>Professional Knowledge 20 Hrs</p>	<p>Plan, install and test illumination system including domestic, commercial and industrial requirements.</p> <p>Connect, program and operate PAR light on DMX controller (Stage light control). (NOS: PSS/N1707)</p>	<p>134. Group different wattage of lamps in series for specified voltage. (03 Hrs)</p> <p>135. Practice on low voltage track system, mains voltage track system and LED battery powered lighting. (07 hrs)</p> <p>136. Prepare decorative lamp circuit to produce rotating/running light effect. (08 Hrs)</p> <p>137. Install different display spotlights and LED downlights. (08 Hrs)</p> <p>138. Demonstrate kitchen under-cabinet lighting, shelf lighting, closet lighting and cove lighting. (05 hrs)</p> <p>139. Practice installation of various lamps e.g. fluorescent tube, HP mercury vapour, LP mercury vapour, HP sodium vapour, LP sodium vapour, metal halide, LED lights, pendant lighting. (15 hrs)</p> <p>140. Assemble, program and Practice on DMX controller for operation of PAR lights.</p>	<p><b>Illumination &amp; Stage Light Control:</b></p> <p>Laws of Illuminations.</p> <p>Types of illumination system.</p> <p>Illumination factors, intensity of light.</p> <p>Type of lamps, advantages/disadvantages and their applications.</p> <p>Calculations of lumens and efficiency.</p> <p>Spotlights, downlights, Strip lights</p> <p>Various reflectors; PAR (Parabolic aluminized reflector), MR (Multi-faceted reflector)</p> <p>LED video wall panel applications.</p> <p>(20 hrs)</p>

		(10 hrs) 141. Visual demonstration of LED video wall panel installation, hardware & software setup. (04 hrs)	
Professional Skill 65 Hrs; Professional Knowledge 20 Hrs	Assemble simple electronic circuits, repair CFL, LED lamps and DC regulated power supply. (Mapped NOS: PSS/N6002)	142. Determine the value of resistance by colour code and identify types. (05 hrs) 143. Determine V-I characteristics of semiconductor diode. (05 hrs) 144. Identify circuit components and their terminals viz, diode, transistor, capacitors, regulator. (06 hrs) 145. Construct half wave, full wave and bridge rectifiers. (15 hrs) 146. Practice soldering on basic electrical and electronic circuits. (06 hrs) 147. Troubleshoot defects in simple power supplies. (05 hrs) 148. Identify different components and circuits of CFL & LED lamps. (08 hrs) 149. Check faulty section/ components of LED & CFL and practice for repairing. (15 hrs)	<b>CFL/LED Lamps &amp; DC regulated power supply;</b>  Resistors; colour code, types and characteristics.  Diode; P-N junction, classification, specifications, biasing and characteristics.  Rectifier circuit; half wave, full wave, bridge rectifiers and filters.  Active and passive components.  Functioning of components used in CFL and LED circuits. CFL and LED lamp's circuit.  Safety and disposal procedure (20 hrs)
Professional Skill 80 Hrs; Professional Knowledge	Assist in Installation and commissioning of small solar plant, solar pumps and construct	150. Construct a solar lantern using Solar PV panel (15W), Charge controller (6V, 5A), output control circuit for variable illumination,	<b>Solar Power Plant:</b> Solar energy fundamentals. Study of Sun path (east to west, North to south and south to north movement).

<p>20 Hrs</p>	<p>Solar DC appliances.  (Mapped NOS: PSS/N6003)</p>	<p>Rechargeable battery (6V, 7Ah) and DC LED lamp (5W). (15 hrs)</p> <p>151. Construct a Solar Day lighting using manual charge controller (12V, 10A), Solar battery (12V, 100Ah), Solar panel (75 W) and 4X LED light (12V DC, 5W). (10 hrs)</p> <p>152. Construct a Solar Street light using dusk to dawn charge controller (12V, 10 A), Solar battery (12V, 100 Ah), Solar panel (75 W) and 4X LED light (12V DC, 5W). (10 hrs)</p> <p>153. Construct a Solar water pump using a DC pump (24 V), Solar Panel (250 W), Charge controller (24 V, 10 A). (12 hrs)</p> <p>154. Connect a Solar panel (10W), Solar charge controller (12V, 10A), Solar battery (12V, 100 Ah) and a normal inverter and convert to a solar inverter. (10 hrs)</p> <p>155. Prepare bill of material for a 1 KW solar PV installation. (10 hrs)</p> <p>156. Demonstrate through audio visual aids; automatic manufacturing of solar panels, installation of solar street light, solar fertilizer sprayer, solar water pump and solar traffic light. (09</p>	<p>Study of daily and seasonal changes of sunlight. Angle of inclination of radiant light and its relation with latitude and longitude of different locations on Earth.</p> <p>Solar DC domestic application: Making of solar lantern. Solar Day lighting. Solar Garden Lights. Safety in DC system. Quality standards List out the inventory list of equipments.</p> <p>Solar DC industrial application: Solar street light. Solar home lighting system. Solar Security system. Solar DC water pump.</p> <p>Differentiate AC and DC solar pumps and their PV requirements for various HP capacities.</p> <p>Solar PV e-learning software. (20 hrs)</p>
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		hrs) 157. Demonstrate synchronization between Solar Panel & AC grid supply using visual aids. (04 hrs)	
Professional Skill 85 Hrs; Professional Knowledge 20 Hrs	Plan, prepare and carry out jointing of LT/HT underground cables with due care and safety. (Mapped NOS: PSS/N2512)	158. Identify different parts of various underground cables. (05 hrs) 159. Practice preparation of cables for termination and joining. (12 hrs) 160. Demonstrate termination kits and practice on terminations of LT/HT cables. (15 hrs) 161. Practice discharging procedure of underground cables. (08 hrs) 162. Make straight joint of different types of underground cable. (25 hrs) 163. Demonstrate jointing of XLPE cables using audio-visual aids. (12 hrs) 164. Demonstrate various tests on underground cables. (08 hrs)	<b>Underground cable joints:</b> Need of cables, advantages and disadvantages, various types viz., PVC, XLPE, PILC, oil filled, etc. Cable insulation & voltage grades. Joints and terminations; pre-moulded, heat shrinkable, extrusion molded joints Slip on, cold shrink terminations. Types of connectors used in the cable, current path. Methods of conductor connection, contact resistance. Galvanic corrosion and use of bimetals. Connectivity for cable screen and armour, mechanical protection Kits for joints and terminations. Cable termination to equipment Standards and testing; type, routine, field test, Stress control (20 hrs)
Professional Skill 20 Hrs; Professional Knowledge 05 Hrs	Install Electric Vehicle charging stations and carry out preventive/breakdown maintenance.	165. Demonstrate different charger specifications. (04hrs) 166. Perform installation of EV charging Station for Public places. (08 hrs) 167. Perform installation of Home EV charging stations.	EV scenario in India and EV Charging basic theory.  EV Charging safety requirements.  (05 hrs)

		(08 hrs)	
Professional Skill 135 Hrs;  Professional Knowledge 40 Hrs	Install and repair domestic appliances viz., electric kettle, food processor, fan, washing machine, geyser, water pump etc. including repair of electrical faults in refrigerator, window and split AC. (Mapped NOS: PSS/N6003, PSS/N4402, PSS/N1711)	168. Service and repair of bell/buzzer. (06 hrs) 169. Service and repair of electric iron, electric kettle, cooking range and geyser. (15 hrs) 170. Service and repair of induction heater. (06 hrs) 171. Service and repair of mixer/grinder and food processor. (20 hrs) 172. Service and repair of fan, blower, cooler, etc. (15 hrs) 173. Service and repair of semi-automatic washing machine. Demonstrate components of fully automatic top & front load washing machine using visual aids. (15 hrs) 174. Service and repair of refrigerator. (15 hrs) 175. Demonstrate installation and repair of pump set and submersible pump. (15 hrs) 176. Carry out repair of electrical circuit of window and split AC. (20 hrs) 177. Demonstrate installation and maintenance of split AC using visual aids. (08 hrs)	<b>Domestic appliances:</b>  Working principles and circuits of common domestic electrical appliances; Bell, buzzer, electric iron, kettle, cooking range, geyser, induction heater, mixer, grinder, juicer, food processor, fan, pump set, washing machine, refrigerator and air conditioner etc.  Concept of Neutral and Earth.  (40 hrs)
Professional Skill 130 Hrs;  Professional Knowledge	Perform winding of small transformers and motors viz., ceiling fan, table fan, mixer/grinder, submersible pump,	178. Practice winding of single-phase transformer. (12 hrs) 179. Practice on ceiling fan and table fan motor winding. (12 hrs) 180. Carry out maintenance,	<b>Winding:</b>  Concentric/ distributed, single/ double layer winding and related terms.  Troubleshooting of single-phase

35 Hrs	etc. (Mapped NOS: PSS/N4402)	<p>service and repair of single-phase AC motors viz., mixer/grinder, table fan pumps etc. (25 hrs)</p> <p>181. Practice on single/double layer and concentric winding for AC motors and testing. (30 hrs)</p> <p>182. Carry out maintenance and servicing of universal motor. (12 hrs)</p> <p>183. Carry out winding of submersible pump. (15 hrs)</p> <p>184. Practice winding of small 3-<math>\phi</math> AC motor. (24 hrs)</p>	AC induction motors and universal motor.  (35 hrs)
Professional Skill 40 Hrs;  Professional Knowledge 10 Hrs	Carry out Estimation & costing for different wiring systems and ready to adopt structured / smart wiring concept for automation and IoT applications.	<p>185. Perform estimation and costing for different types/scheme of wiring for labour, materials and accessories as per layout. (25 hrs)</p> <p>186. Demonstrate structured wiring/ smart wiring for home &amp; office automation through visual aids. (05 hrs)</p> <p>187. Visual demonstration of IoT based home automation/ control of electrical appliances through smartphone. (05 hrs)</p> <p>188. Demonstrate software available for electrical wiring and circuits. (05 hrs)</p>	<p>Concept and Principles of estimation and costing. Different wiring layouts and Bill of material; domestic, commercial, and industrial wiring.</p> <p>Smart wiring concept</p> <p>Procedure for taking wireman permit and competency certificate. (10 hrs)</p>
<b>Engineering Drawing: 40 Hrs.</b>			
Professional Knowledge ED 40 Hrs.	Read and apply engineering drawing for different application in the field	<p><b>Engineering Drawing:</b> 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</p>	

	of work.	and pipe earthing. Drawing of Electrical circuit diagram. Drawing of Block diagram of Instruments & equipment of trades.
<b>Workshop Calculation &amp; Science: 32 Hrs.</b>		
Professional Knowledge WCS 32 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	<b>Workshop Calculation &amp; Science:</b> <b>Friction</b> Friction - Lubrication <b>Algebra</b> Algebra - Addition, subtraction, multiplication & division Algebra - Theory of indices, algebraic formula, related problems <b>Elasticity</b> Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus <b>Profit and Loss</b> Profit and loss - Simple problems on profit & loss Profit and loss - Simple and compound interest <b>Estimation and Costing</b> Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade. Estimation and costing - Problems on estimation and costing
<b>Project work / Industrial visit</b>		

<b>SYLLABUS FOR CORE SKILLS</b>
1. Employability Skills (Common for all CTS trades) (120 Hrs. + 60 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](http://www.bharatskills.gov.in) / dgt.gov.in