DIPLOMA IN ELECTRICAL TECHNICIAN

Course Name: Diploma in Electrical Technician

Duration: 1 Year

Eligibility: Class 10 or equivalent from recognized board

DETAILED SYLLABUS

Semester I	Semester II
Trade Theory	Engineering Drawing
Trade Practical	Workshop Calculation & Science

SEMESTER I

PAPER 1: TRADE THEORY

CONTENT:

Unit 1: Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard

Unit 2: Identification of Trade-Hand tools, Specifications.

Unit 3: Fundamental of electricity. Electron theory, free electron. Fundamental terms, definitions, units & effects of electric current.

Unit 4: Solders, flux and soldering technique. Resistors types of resistors & properties of resistors.

Unit 5: Explanation, Definition and properties of conductors, insulators and semi-conductors. Voltage grading of different types of Insulators, Temp. Rise permissible Types of wires & cables standard wire gauge Specification of wires & Cables insulation & voltage grades -Low, medium & high voltage Precautions in using various types of cables.

Unit 6: Ohm's Law - Simple electrical circuits and problems. Resistors, Law of Resistance. Series and parallel circuits. Kirchhoff's Laws and applications. Wheatstone bridge principle and its applications.

Unit 7: Common Electrical Accessories, their Specifications Explanation of switches lamp holders, plugs and sockets. Developments of domestic ckts, Alarm & switches, lamp, fan with individual switches, Two way switch.

Unit 8: Chemical effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis. Basic principles of Electro-plating and Electro chemical equivalents. Explanation of Anodes and cathodes. Lead acid cell-description, methods of Charging, Precautions to be taken & testing equipment, Ni-cadmium & Lithium cell, Cathodic protection. Electroplating, Anodising.

Unit 9: Rechargeable dry cell, description advantages and disadvantages. Care and maintenance of cells Grouping of cells of specified voltage & current, Sealed Maintenance Free Batteries, Solar cell.

Unit 10: Lead Acid cell, general defects & remedies. Nickel Alkali Cell-description charging. Power & capacity of cells. Efficiency of cells.

Unit 11: Allied Trades- Marking use of chisels and hacksaw on flats, sheet metal filing practice, filing true to line.

Unit 12: Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint.

Unit 13: Drilling practice in hand drilling & power drilling machines. Grinding of drill bits.

Unit 14: Practice in using taps & dies, threading hexagonal & square nuts etc. cutting external threads on stud and on pipes, riveting practice.

Unit 15: Practice in using snips, marking & cutting of straight & curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making different joints in sheet metal in soldering the joints.

Unit 16: Magnetism - classification of magnets, methods of magnetising, magnetic materials. Properties, care & maintenance, methods of magnetising magnetic materials. Para & Diamagnetism and Ferro magnetic materials. Principle of electro-magnetism, Maxwell's corkscrew rule, Fleming's left & right hand rules, Magnetic field of current carrying conductors, loop & solenoid. MMF, Flux density, reluctance. B.H. curve, Hysteresis, Eddy current. Principle of electromagnetic Induction, Faraday's Law, Lenz's Law. Electrostatics Capacitor, Different types, functions & uses.

Unit 17: Resistance- Different Types of resistors used in electrical ckts. Specification of resistance and tolerance. Effect of variation of temperature on resistance. Different methods of measuring the values of resistance.

Unit 18: Working principles and circuits of common domestic equipments & appliances.

Unit 19: D.C. Machines - General concept of Electrical Machines. Principle of D.C. generator. Use of Armature, Field Coil, Yoke, and Commutator, slip ring Brushes, Laminated core. Explanation of D.C. Generators types, parts. E.M.F. equation, self excitation and separately excited Generators-Practical uses. Brief description of series, shunt and compound generators.

Unit 20: Expl. Of Armature reaction, interpoles and their uses, connection of interpoles, commutation.

Unit 21: DC Motors - Terms used in D.C. motor- Torque, speed, Back, e.m.f. etc. their relations practical application. Related problems. Types, characteristics and practical application of D.C. motors. Special precaution to be taken in DC Series motors. Starters used in D.C. motors.

Unit 22: Types of speed control of DC motors in industry Word Leonard control, Thyristor/electronic controls. Insulting materials, properties common insulting materials, classifications.

Unit 23: Electric wirings, importance, I.E.E. rules. Types of wirings both domestic & industrial - Specifications for wiring, Grading of cables and current ratings. Principle of laying out in domestic wiring-testing by meggar Wiring system, using casing capping, P.V.C., concealed system. -Maintenance & Repairing data sheet preparation. Specifications, standards for conduits & accessories.

Unit 24: Earthing - Principle of different methods of earthing. Importance of Earthing. Earth Leakage Relay.

Unit 25: Alternating Current - Comparison D.C& A.C., Advantages of A.C. Alternating current & related terms frequency Instantaneous value, R.M.S. value Average value, Peak factor, form factor. Generation of sine wave, phase and phase difference. Inductive & Capacitative reactance XL & Xc, Impedance (Z), power factor, (P.f), Vector diagram. Active and Reactive power, Simple problems on A.C. circuits, single phase & three phase system etc. Problems on A.C. ckts. Both series

& parallel power consumption P.F. etc. Concept three-phase Star & Delta connection Line voltage & phase voltage, current & power in a 3 ph ckt, with balanced and unbalanced load.

Unit 26: Transformers- Working principle of Transformer, classification C.T., P.T. Instrument and Auto Transformer/Variac Construction, Single phase and Poly phase. E.M.F. equation, parallel operation of transformer, their connections. Regulation and efficiency, Cooling of transformer, protective devices. Specifications, simple problems on e.m.f. Equation, turn ratio, regulations and efficiency. Special transformers. Transformer, construction cores winding shielding, auxiliary parts breather, conservator buckholtz relay, other protective devices cooling of transformer oil testing and Tap changing off load and on load. Transformer bushings and termination.

Unit 27: Alternator – Explanation of alternator, prime mover, types, regulations, phase sequence, specification of alternators and brushless alternator. Automatic Voltage Regulator.

Unit 28: Electrical measuring Instruments- types Deflecting torque, controlling torque & Damping torque, moving coil permanent magnet, Moving iron, Range extension, Multimeter, Wattmeter, P.F. meter, Intergrading type, Digital Energy meter, megger. Energy meter, Frequency meter, Tri vector meter, Max Demand meter - Phase Sequence indicator Multimeter, Analog and Digital, C.R.O.

Unit 29: Explanation of light White light-illumination factors, intensity of light –importance of light, human eye factor units. Types illumination & lamps, Neon Sign Halogen, Mercury vapour, sodium vapour, Fluorescent tube CFL, Solar lamp applications, Concept of Energy, Characters watt ages, fixing places. Types of lighting. Decoration lighting Drum Switches, Direct & indirect lighting, efficiency in lumens per watt, colour available. Thumb rule calculations of lumens. Estimating placement of lights and fans and ratings.

PAPER 2: TRADE PRACTICAL

CONTENT:

1. Implementation in the shop floor of the various safety measures. Visit to the different sections of the Institute Demonstration on elementary first aid. Artificial Respiration
2. Demonstration of Trade hand tools. Identification of simple types screws, nuts & bolts, chassis, clamps, rivets etc. Use, care & maintenance of various hand tools.
3. Practice in using cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. Demonstration & Practice on bare conductors joints such as Britannia, straight, Tee, Western union. Joints.
4. Practice in soldering- Measurement of Resistant and Measurement of specific Resistant. Application of Wheatstone bridge in measurement of Resistance.
5. Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge. Practice on crimping thimbles, Lugs. Examination and checking of cables and conductors and verification of materials according to the span.
6. Verification of Ohm's Law, Verification of Kirchoff's Laws. Verification of laws of series and parallel circuits. Verification of open circuit and closed circuit network. Measuring unknown resistance using Wheatstone bridge.
7. Practice on installation and overhauling common electrical accessories. Fixing of switches, holder plugs etc. in T.W. boards, Identification and use of wiring accessories.
8. Assembly of a Dry Cell Electrodes-Electrolytes. Grouping of Dry cells for a specified voltage and current, Ni cadmium & Lithium cell. Practice on Battery Charging, Preparation of battery charging, testing of cells, Installation of batteries, Charging of batteries by different methods. Practice on Electroplating and anodising, Cathodic protection.
9. Routine care & maintenance of Batteries.
10. Charging of a Lead acid cell, filling of electrolytes, testing of charging checking of discharged and fully charged battery.
11. Introduction of fitting trade. Safety precautions to be observed Description of files, hammers, chisels, hacksaw frames & blades, their specification & grades. Care & maintenance of steel rule try square and files.
12. Marking tools description & use. Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing & holding tools, their care and maintenance.
13. Types of drills description & drilling machines, proper use, care and maintenance.
14. Description of taps & dies, types in rivets & riveted joints. Use of thread gauge.
15. Description of marking & cutting tools such as snubs shears punches & other tools like hammers, mallets etc. used by sheet metal workers. Types of soldering irons-their proper uses. Use of different bench tools used by sheet metal worker. Soldering materials, fluxes and process.
16. Demonstration on CRO – The magnetic flux produced by Electromagnet, Demonstration on Tracing the BH Curve & Hysteresis loop for a specimen using C.R.O and using samples of CRGO & Dynamo grade. Demonstration on effect of eddy current on different samples. Assembly / winding of a simple electro magnet Identification of different types of Capacitors. Charging & discharging of capacitor, Testing of Capacitors using DC voltage and lamp.

17. Measurement of resistance by different methods a) Using Wheatstone Bridge b) By voltage drop method. Experiment to demonstrate the variation of resistance of a metal with the change of temperature. Measure of 'R' by drop method. Series & shunt ckts, use of Multimeter.
18. Connection of Calling Bell, Buzzer, Alarms, Electric Iron, Heater, Light & Fan etc. Rewinding /assembly of different electrical appliances. Study, maintenance and repair of domestic equipment, Electric Kettle, Heater / immersion Heater, Hot Plate geyser, washing machine, Cooking range, incubators, Furnaces, Pump set. Etc.
19. Identification and study of the parts of a D.C. machine. Practicing dismantling and assembling in D.C. Machine.
20. Connection of shunts Generators, Measurement of Voltages, Demonstration on field excitation. Connection of compound Generator Voltage measurement-cumulative and differential, No Load & Load characteristics of Series, Shunt & Compound Generator. Controlling and protecting DC Generator.
21. Demonstration and practice on identification of parts and terminals. Study of the characteristics of DC motors.
22. Study of 3 point & 4 point starters. -Connection, starting, running, speed control of motors. Testing of D.C. motors.
23. Study of Thyristor/electronic control of DC motor. -Routine maintenance.
24. Use of megger and HV tester
25. Practice in casing, Capping. Conduit wiring with minimum to more number of point. Use of two way switches, Testing of insulation by two lamp method & meggar. Fixing of calling bells/buzzers. Making of test boards & extension boards IS,732,1963/61 Identification & demonstration on conduits and accessories & their uses, cutting, threading & laying.
26. Earthing – Practice on installation of earthing system and testing of earthing system. Using an Earth Leakage Relay.
27. Demonstration of sine wave, instantaneous values etc. Study of the behaviour of R, XL & XC in A.C. ckts both in series and in parallel. Experiment on poly phase ckts. Current, voltage & power measurement in poly-phase ckts. Measurement of energy in single & poly-phase ckts. Use of phase sequence meter. Use of single phase preventer.
28. Identification of types of transformers. Connection of transformers efficiencies of transformers testing of transformer parallel operation of transformer. Use of C.T. & P.T. use of Instrument transformer. Conducting No load and short circuit tests. Testing of single phase and Three Phase. Transformers, Cleaning and maintenance of Transformers, Changing of oil.
29. Demonstration on alternators, voltage Building, load characters & regulation. Practice on installation, running and maintenance of Alternators
30. Study of M.C.P.M. meter, Multimeter, Wattmeter, P F meter, Energy meter, Frequency meter, Calibration of meter, Multimeter, C.R.O. Maximum Demand meter, Phase sequence indicator, Digital Instruments.
31. Installation of Neon Sign, Mercury vapour (H.P. & L.P.), Sodium vapour, Halogen Lamps, single tube, Double tube Practice on decoration lighting Principle of layout of lighting installation.

SEMESTER II

PAPER 1: ENGINEERING DRAWING

CONTENT:

Unit 1: Definition of Engineering Drawing. Uses of Engineering Drawing. Freehand sketching of straight lines, rectangles, squares circle, polygons etc.

Unit 2: Geometrical construction of Square, Rectangle, Triangle, Circle, Ellipse, Polygons, etc. Lettering practice.

Unit 3: Different types of line. Drawing of different types of line.

Unit 4: 1st angle projection, 3rd angle projection. Orthographic views, Isometric views.

Unit 5: Drawing of plan, elevation & side views from isometric views.

Unit 6: Dimensioning practice on orthographic views.

Unit 7: Conventional symbols of Electrical installation as per BIS code & IEEE, IES norms Drawings of the typical diagram of plug and socket outlets. Graphical symbols used in electric technology, ckt. Elements.

Unit 8: Drawing the typical diagram of D-type cartridge fuse, H.R.C. type fuse. Fuse curves Graphics as per relevant IS standard. Symbols indicating the method of operation of the instrument and accessories as per relevant IS, Standard.

Unit 9: Simple isometric drawings, isometric views of simple objects- cubes, rectangular blocks etc.

Unit 10: Free hand sketching of nuts & bolts with dimensions from samples, Free hand sketching of rivets and washers with dimensions from samples, Free hand sketching of keys with dimensions from samples. Free hand sketching of screw threads with dimensions from samples.

Unit 11: Draw the typical symbols used in electrical circuits. Graphical symbols used in electro technology, kinds of distribution systems and methods of connections.

Unit 12: Detailed diagram of calling bell electromagnet etc.

Unit 13: Sketching of brush and brush gear of D.C. machines. Lay out D.C. Panel board arrangement. Lettering-Numbers Alphabets. Sketching of D.C. 3-point face Plate starter top scale.

Unit 14: Graphic symbols for Rotating m/cs and Transformers.

Unit 15: Reading of simple blue prints.

Unit 16: Free hand isometric sketching of simple objects with dimensions. Sketching of D.C 4, point starter to scale.

Unit 17: Free hand sketching of simple objects. Layout arrangement of D.C. Generators & motors, control panel

Unit 18: Free hand sketching of Staircase wiring.

Unit 19: Free hand sketching of simple Geometrical shapes & hollow shapes. Drawing of simple electrical ckts. Using electrical symbols. View of simple solid & hollow bodies. Drawing of sine waves. Views of simple solid and hollow bodies' ckt. Diagram of battery charging ckts. With all Details of panel board, Blue print reading.

Unit 20: Exercises on Blue print reading of connection to motors through Ammeter, voltmeter & K.W. meters. Exercises on Blue print reading, tracing the wiring diagram of an alternator & reproducing it in proper sequence with protective equipment sketching the synchroniser connections. Free hand sketching of simple objects related to the trades.

Unit 21: Diagram of connection to a squirrel cage induction motor. Sketching the connection diagram of controlling & protective devices for Induction motors. Development of winding diagram for a two pole D.C. dynamo or motor. Preparation of working drawing from sketches.

Unit 22: Sketching of simple objects related to trades. Sketching of different shapes of coil. Further practice in Blue print reading. Drawing development diagram for single-phase A.C. motors.

Unit 23: Drawing the development diagram for D.C. Simplex Lap & Wave winding.

PAPER 2: WORKSHOP CALCULATION & SCIENCE

CONTENT:

Unit 1: Units – Definition, different types & system of units, F.P.S., C.G.S & S.I - conversion.

Unit 2: Applied workshop problems involving addition, subtraction, multiplication and division. Different types of materials used in industry, their uses & properties.

Unit 3: Applied workshop problems involving common fractions. Application of fraction to shop problems. Properties and uses of copper, zinc, lead, tin, aluminium, brass, bronze, solder, bearing metals, timber, rubber.

Unit 4: Different types of Insulators used in Electrical industry Mass and Weight, Difference between mass and weight, Specific Gravity & Density, Related problems. Archimedes principle. Relation between Sp. Gravity and density.

Unit 5: Rounding of decimal values use of approximation. Speed, Velocity, Acceleration, Retardation, Equations of motions, related simple problems Properties & uses of cast iron, wrought iron, plain carbon steel, etc.

Unit 6: Reduction of common fractions to decimal and vice-versa - related shop problems. Momentum of a moving body. Force, Its units in SI & FPS Systems.

Unit 7: L.C.M., H.C.F. Square roots & Cube roots, Newton's Laws of motion and related problems.

Unit 8: Factorisation, Simple algebraic problems Laws of parallelogram of forces.

Unit 9: Ratio & proportion, related shop problems. Friction, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction.

Unit 10: Average and related shop problems. Work, Power & Energy, Their units and related problems.

Unit 11: Factorisation of polynomials. (Simple problems). Rotational motion. Angular velocity and acceleration.

Unit 12: Square roots & Cube roots by the method of factorisation. Centrifugal & Centripetal forces. Related problems.

Unit 13: Standard algebraic formula and related problems. Moment of a force. Couple and Torque. Related problems.

Unit 14: Percentage and related shop problems Moment of Inertia, Radius of gyration. Mechanical properties of metals, tenacity, elasticity, malleability, brittleness, hardness, compressibility and ductility, etc.

Unit 15: Solving of Quadratic equations. Simple problems on moment of Inertia.

Unit 16: Simple Problems on Profit & Loss. Levers, its different types and their advantages. Simple related problems.

Unit 17: Simple Problems on Profit & Loss. Mechanical advantage, Velocity ratio, Efficiency of different types of levers.

Unit 18: Mensuration – Perimeter and Area of Square & Rectangle. Simple problems on straight and bell cranked levers.

Unit 19: Perimeter and Area of Triangle. Simple machines - Determination of efficiency of simple m/cs. Like winch, pulley blocks, wheel and compound axle.

Unit 20: Circumference and area of Circle. Transmission of motion through Belt, Pulley, Gears, etc. and related problems.

Unit 21: Calculation of Volume and weight of simple solid bodies- Cubes, Cuboids, solid and hollow cylinders and related shop problems.

Unit 22: Trigonometry functions & Ratios. Use of trigonometric tables, Applied problems. Definition of Stress, Strain, Young's modulus, Bulk modulus, Factor of safety, Their related problems. Effect of force on materials such as expanding, bending, twisting and shearing.

Unit 23: Simple problems on Heights & Distances using trigonometric ratios. Heat and temperature, Thermometric scales centigrade, Fahrenheit & Kelvin scale and their conversion. Names and uses of temperature measuring instruments used in workshop.

Unit 24: Calculation of areas of triangles, etc. with the aid of trigonometry. Calorimetry, Latent Heat, Their related problems.

Unit 25: Use of trigonometric formulae and applied problems. Expansion of Solid, Liquid and Gases, Their related problems.

Unit 26: Drawing & reading of simple graphs. Transmission of heat, Conduction, Convection and Radiation.

Unit 27: Logarithms- Use of Logarithmic tables for multiplication & division. Different forms of energy, Thermal, mechanical and electrical, conversion from one to another.

Unit 28: Applied workshop problems involving, use of Logarithmic tables.