

**MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51**

1	Name of Course	<b>Certificate Course in Basic Electrical Engineering (302205)</b> <b>(w.e.f. 2018-19)</b>																																																														
2	Max. Nos.of Student	25 Students																																																														
3	Duration	1 Year																																																														
4	Type	Part Time																																																														
5	Nos. of Days / Week	6 Days																																																														
6	Nos. of Hours /Days	7 Hrs																																																														
7	Space Required	Theory Class Room – 200 sqft Practical – 1500 sqft																																																														
8	Entry Qualification	S.S.C. Passed																																																														
9	Objective Of Syllabus/ introduction	1) Awareness of Safety precautions 2) Knowledge of soldering techniques, use of tools in assembly. 3) Knowledge of Engineering Tools 4) Knowledge of electronic component used in Electrical & Electronics Instrument. 5) Knowledge of Power Generation Transmission & Distribution 6) Ability to read schematic layouts / diagrams.. 7) Maintenance of Computers, Engineering Tools, Electrical / Electronics Instruments & Generators / Motors																																																														
10	Employment Opportunity	The trainee will either to be able to take up jobs with agencies which maintain and repair such equipments or with working experience will be in a position to start his own independent Business.																																																														
11	Teacher’s Qualification	Diploma in Electrical Engg.																																																														
12	Training System	<table><tr><th colspan="8">Training System Per Week</th></tr><tr><td colspan="2">Theory</td><td colspan="2">Practical</td><td colspan="4">Total</td></tr><tr><td colspan="2">6 Hours</td><td colspan="2">18 Hours</td><td colspan="4">24 Hours</td></tr></table>							Training System Per Week								Theory		Practical		Total				6 Hours		18 Hours		24 Hours																																			
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13	Exam. System	<table><tr><th>Sr. No.</th><th>Paper Code</th><th>Name of Subject</th><th>TH/PR</th><th>Hours</th><th>Max. Marks</th><th>Min. Marks</th></tr><tr><td>1</td><td>30220511</td><td>Basic Engineering &amp; Basic Computers Operating skill.</td><td>TH-I</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30220512</td><td>Basic Electrical &amp; Electronics Engineering</td><td>TH-II</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>3</td><td>30220513</td><td>Basic Power Generation Transmission &amp; Distribution</td><td>TH-III</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>4</td><td>30220521</td><td>Basic Engineering &amp; Basic Computers Operating skill.</td><td>PR-I</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td>5</td><td>30220522</td><td>Basic Electrical &amp; Electronics Engineering</td><td>PR-II</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td>6</td><td>30220523</td><td>Basic Power Generation Transmission &amp; Distribution</td><td>PR-III</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td></td><td></td><td>Total</td><td></td><td></td><td>600</td><td>255</td></tr></table>							Sr. No.	Paper Code	Name of Subject	TH/PR	Hours	Max. Marks	Min. Marks	1	30220511	Basic Engineering & Basic Computers Operating skill.	TH-I	3 hrs	100	35	2	30220512	Basic Electrical & Electronics Engineering	TH-II	3 hrs	100	35	3	30220513	Basic Power Generation Transmission & Distribution	TH-III	3 hrs	100	35	4	30220521	Basic Engineering & Basic Computers Operating skill.	PR-I	3 hrs	100	50	5	30220522	Basic Electrical & Electronics Engineering	PR-II	3 hrs	100	50	6	30220523	Basic Power Generation Transmission & Distribution	PR-III	3 hrs	100	50			Total			600	255
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## SYLLABUS

### Theory & Practical – I

#### Basic Engineering & Basic Computers Operating Skill

Practical - I	Theory - I
Practical demonstration of functions of various components of a computer .Use of keyboard Different keyboard Commands. Practice of note pad and mouse	To study different blocks/parts of Computer system Practical demonstration of various components/ functions of a computer Use of keyboard. Different Keyboard Commands Practice of note pad and use of mouse
Practice on various commands of DOS and Window to check, open Change properties etc. on a computer	Practice on various commands of DOS and Window to check, open, change properties etc. on a computer
Typing practice on notepad and painting Practice to open, save, close a document In MS word writing a letter editing and formatting methods-Inserting and work with table. Practice of working on spreadsheet, using function of mathematical operations like addition, subtraction of columns of worksheet and other formule. Creating graphs. Practice of creating different types of slides, master slides using different presentations.	Typing practice on notepad and painting practice to open, save, close a document in MS word, writing a letter, editing and formatting methods- Inserting and working with table.
Practice on opening a web page, creating mail addresses and down loading. Practice on net surfing.	Various aspect of Internet & Net surfing.
Simple programs on AutoCAD, Microcap 6/7	Introduction to electrical softwares - AutoCAD, Microcap 6/7 etc. (latest version)
Safety precautions in workshop, use of fire protection devices, First aid, List of safety equipments. <b>CARPENTRY</b> Sawing and planning practice. Practice in using firmer chisel and preparing simple half lap joint.	<b>CARPENTRY</b> Description of carpenter's common hand tools such as saw planes, chisels, mallet, claw hammer, marking, dividing and holding tools-their application, care and maintenance.
<b>FITTING &amp; DRILLING</b> Basic fitting operations like chiseling, filing, tapping, hacksawing, etc. Drilling practice in hand drilling & power drilling machines (bench & portable), Grinding of drill bits. Practice in using taps & dies, threading hexagonal and square nuts etc., cutting external threads on stud and on pipes riveting practice, making earthing plates, panel boards, etc.	<b>FITTING &amp; DRILLING</b> Introduction to Fitting, Description and use of files, hammers, chisels, hacksaw frames and blades-their specification and grades, Use of steel rule, try-square, vernier caliper & micrometer screw gauges. Making tools description and use, Types of drills, description of bench/portable drilling machines, proper use, care and maintenance. Various fitting operations (Drilling, filing, tapping, etc.) Description of taps & dies, types of rivets and riveted joints, Use of thread gauge.

<b>SHEET METAL</b> Demonstration and practice of simple sheet metal work, cutting, bending, joining. Marking simple sheet metal articles.	<b>SHEET METAL</b> Introduction to sheet metal worker's common hand tools, sheet and wire gauges, Pipe and pipe fittings, Non ferrous metal sheets (Copper, Aluminium & Brass, etc.)
<b>SOLDERING &amp; BRAZING</b> Demonstration & Practice in using Trade hand tools. Different types of solder fluxes and their proper use. Introduction to the equipments used for soldering and crimping, Care & maintenance on Soldering & Crimping equipments, Soldering & Brazing practice Removing of insulations from assorted wires and cables. Joining practice with single and stranded conductors of different wires cables	<b>SOLDERING &amp; BRAZING</b> Description, specification, general use, care & maintenance of common hand tools. Soldering material, Flux and description of simple soldering and brazing common joints. Wires & Cables-Introduction, types, specifications (SWG & MM Square) & Use.
<b>PLUMBING</b> Cutting of conduit pipe, threading, making of different type of square and rectangle.	<b>PLUMBING</b> Cutting, threading & fixing of conduit accessories and installation.

**Theory & Practical - II**  
**Basic Electrical & Electronics Engineering**

<b>Practical - II</b>	<b>Theory - II</b>
<p>Familiarization with shop layout, hand tools &amp; machines Safety Precautions, including use of fire-fighting equipment, Elementary first aid, and treatment for electric shocks.</p> <p>Skinning the Cable, installation of Aluminum conductor cable and copper conductor. Joining practice with Single Strand Conductor and Multi Strand Cables and joints of bare conductors such as Britannia, straight, western union, Tee etc.</p> <p>Soldering practice on joints of wires.</p> <p>Soldering Copper Aluminum lugs with wire/cable ends., crimping joints of wires and cables, Crimping lugs with wire/cable ends.</p> <p>Fixing and Connections to common electrical accessories e.g. switches, plug, sockets Holders, fuses, M.C.B. etc.</p>	<p>Types, grades, shapes and sizes of insulated wires and cables, their proper selection and use. Different type of joints e.g. Britannia, Straight, Tee, Western union. Care in making a good joint on aluminum wires and cables. Letters signs and symbols used in Electrical Technology.</p>
<p>Identification of AC &amp; DC supply. Measurement of voltage, current, power and energy on A.C. and D.C. using Voltmeter, Ammeters, Watt meters and Energy meter. Verification of Ohm's Law.</p> <p>Measurement of resistance by Ohm meter, multimeter etc. Practice in using shunts and Multipliers, Determination of specific resistance. Selection of resistors for various applications.</p> <p>Wiring for a simple circuit in metal conduit and P.V.C. Conduit in accordance to I.E. rules and I.S.</p> <p>Measurement of Earth Resistance.</p> <p>To check a capacitor and determine its capacity.</p>	<p>Ohm's Law &amp; its application, Concept of Electrical Circuit e.g. Series, Parallel and Mixed Circuits. Identification of AC &amp; DC Meters.</p> <p>Resistance and laws of resistance. Problems on laws of resistance, Kirchhoff laws and their application. Wheat stone bridge and its application.</p> <p>Testing of wiring installations, Common faults their causes &amp; remedies.</p> <p>Earthing and its Purpose and Types. I.E. rules regarding Earth and Earth resistance. Measurement of earth resistance by use of Megger.</p>
<p>Preparation of Electrolyte, charging batteries checking accumulators for charge and discharge conditions, Determination of internal resistance of any cells of accumulator.</p>	<p>Electrolysis, Primary and Secondary cells, Dry cell. Standard cell. Grouping of cells. Construction &amp; working of lead acid and alkaline accumulators, Common defects in accumulators their causes, indication and remedies. Battery charging.</p>

<p>Making a simple electromagnet, studying its field strength by varying Ampere-Turns</p> <p>Finding the Permeability of iron, study Connections and testing of electric bell/Buzzer/Door chime and its connections with bell indicator. Study the construction and operation of an electromagnetic overload relay.</p>	<p>Magnets, their types, shapes, properties, B-H curve, methods of magnetization and demagnetisation.</p> <p>Electromagnets, their advantages over Permanent magnets, Solenoids.</p> <p>Electromagnetic induction (Self &amp; Mutual)</p> <p>Faradays Laws of Electromagnetic induction Lenz's law , eddy currents.</p>
<p>Measurement of Power and Power factor in A.C. Circuits, Determination of Inductance Capacitance and Impedance by Inductance Bridge, Capacitance Bridge and Impedance Bridge respectively. Practicals on simple R, L &amp; C series &amp; parallel circuits</p>	<p>Capacitor, working &amp; types. Capacity of capacitor and Energy stored in capacitor.</p> <p>Electrical terms normally used in A.C. e.g.</p>
<p>Bridge and Impedance Bridge respectively. Practicals on simple R, L &amp; C series &amp; parallel circuits</p>	<p>Capacitor, working &amp; types. Capacity of capacitor and Energy stored in capacitor.</p> <p>Electrical terms normally used in A.C. e.g. R.M.S. Value, Maximum value, Average value, Inductance, Capacitance, Impedance, and Reactance. Power and Power Factor in A.C. Disadvantages of poor P.F. and methods of improvement. Simple A.C. circuits, single phase &amp; three phase.</p>
<p>Identify the HT &amp; LT winding of transformer. Verify its transformation ratio. Determine the magnetization curve of transformer.</p> <p>To determine the Iron loss and copper loss in transformer.</p>	<p>Transformer, working principle, types as per core, single phase and three phase, parts of power transformer. Voltage transformation ratio of transformer. Cooling of transformer. Different methods used for cooling. Parallel operation of transformer, Losses in transformer, Copper loss, Losses due to hysteresis &amp; eddy current.</p>
<p>Connections and testing of contactors and alarm circuits</p>	<p>Illumination terminology, laws of illumination Types, Construction &amp; working of incandescent lamps Principal of discharge lamps, construction, working &amp; use of Fluorescent lamps Mercury vapour lamp sodium vapour lamps and Neon signs.</p>
<p>Tool Identification, safety precautions, Familiarization with Electronic Components.</p> <p>Different Type of Soldering Iron. Use of Soldering Iron. Color Code of Fixed Resistors.</p>	<p>Knowledge of tools used in Electronics Lab. Safety precaution in Electronics Lab.</p> <p>Soldering Process. Flux. Basic Electronic Components.</p>

Use of various Meters for Measuring Voltage, Current , Resistance etc. Safe Handling of Instruments . Use of Digital & Analog Multimeter. Familiarization with CRO. Measurement of L, C and R using LCR bridge.	Passive Components: Resistor, Capacitors & Inductor, Moving coil & Moving Iron meter. Working principle of analog Multimeters.  Introduction to surface mounting devices.
Identification & Testing of various types of Diodes. Familiarization with CRO, Operating knobs. Construction of Half Wave & Full Wave Rectifiers.  Calculation of Ripple using Filters to improve DC Output.	Conductor, Insulator and Semi Conductor. P Type and N-Type semi conductors. P-N Junction, Diode Construction, V-I Characteristics, Forward and Reverse Bias, Half Wave , Full wave rectification using Centre tap transformer and Bridge Rectifier. Filter Circuit. Regulator, Zener Diode. Varactor, PIN, Tunnel Diode, LED, LDR, IRED, LCD, etc.
Transistor Testing, study the transistor characteristics. Construction of single stage amplifier. Construction of a transistor- switch and to drive a relay.	Transistor- Construction, Working and Configuration, Symbols. Input & Output Characteristics of Common Base, Common Emitter and Common Collector Configuration, Biasing of Transistors. Small Signal & Multi Stage Amplifier- RC Couple, Direct Couple and Transformer Coupled Amplifier. Concept of Negative & Positive Feedback.
Construction of RC Phase Shift Oscillator. Construction of Astable and Bistable multivibrator. Plotting of V-I Characteristics of SCR/Triac, study of light Dimmer	Oscillator & Multi vibrators. : R C & L C Oscillators. Astable & Bistable Multivibrator using transistor Circuit
Lab Demonstration of all types of Digital Logic Gates.	SCR Construction, UJT, Power MOSFET, TRIAC, DIAC- Construction and Working.
Verification of all truth table.	Digital Electronics- Introduction, Number System, Binary to decimal conversion and vice versa. Digital Logic Gates, Op Amps applications, IC 555. Introduction to assembly of different types of ICs used in Electronics circuits.
Familiarization with various IC and their Packages.	Concept of static charge

Identification of different wiring materials their specifications. Practice in fixing and connecting wiring accessories such as switches, plugs, lamp holders.	Introduction and explanation of electrical wiring systems, I.E. Rules for different wiring system - both domestic as well as industrial. Basic requirement of Electrical installation i.e. Safety, Conductor Voltage Drop, Life expectancy, Economy etc.
Lay out marking on wiring boards (a) one lamp control by one S.P. switch (b) Two lamp control by two independent switches. (c) one lamp controlled by two way switches. Wooden battens practice through simple circuits.	Explanation of circuits branching max. load/ckt/ way as per rules. Wiring material used for PVC cables, I.E. Rules, Indian standards regarding the above wiring such as - clip distance fixing of screws, cable bending etc. Casing & Capping wiring material & different available sizes. Different type of Circuits commonly used in Wiring systems.
Practice in P.V.C. insulated cable wiring on wood battens with distribution board and Number of circuits. One lamp control from three different locations. Practice of wiring in conduit, using metal clad 3-pin plug, earthing the conduit using the earth clips and earth wire. Practice in conduit wiring industrial power wiring to wire a single-phase motor with switch & starter.	Conduit pipe wiring materials and accessories, types and sizes of conduit. I.E. Rules for earthing conduits using earth clip and earth wire - IS 732- 1963.
Demonstration and practice of multistoried building wiring layout.	Wiring workshop, factories and houses. Their special precautions as per I.E. Rules. Knowledge of fire Insurance rules and its applications.
Domestic wiring installations for mixed load, both light and power & Installing Energy meter. Trouble shooting of different types of wiring.	Explanation and lay out of wiring for Multi-Storeyed Buildings as per I.E. Rules. Explanation of inter connection wiring circuits in the main building and auxiliary blocks, Meter boards and its locations. Study of lay out symbols in the preparation of layout diagrams. Causes & Remedies for faults in different wiring system .



Wiring of the Low Power A.C./D.C. Machines in metal conduit systems as per I.E. Rules and wiring their panels.	Working principal and applications of Different types of DC motors and their controls. Different types of variable speed AC motors and their controls. Different types of motors used in industries ie. Squirrel cage Induction Motor, Slip ring Induction motor, Single phase Induction Motor, their classification according to the environment & cooling methods. Motor Size, Selection of speed & their normal method of wiring, breaking with AC/DC etc., Their connections lay out and earthing. Code practice for earthing of Industrial wiring. Application of 3-point, 4-point star delta starters.
Testing of different wiring installations by megger. Insulation tester, earth continuity test	Explanation of Megger & types, use of megger in fault location in wiring system. Explanation of wiring and earthing of different domestic appliances.
Simple rewinding for fans and F.H.P. motors.	Simple rewinding procedure of fans and F.H.P. motors as per I.E. Rules.
Fault location and remedies practice both in domestic and industrial wirings.	Common faults , causes and remedies in domestic and industrial wiring installations . Methods of locating faults.
Demonstration and practice on telephone cable wiring and shielding of cables Winding of a small transformer.	Explanation of different telephone cables with specifications. Procedure for shielding telephone wiring Introduction to A.C. & D.C. windings used in various electrical appliances

#### List of Tools, Equipments :

Sr. No.	Name of Items	Qty.
1.	Measuring Tape Steel 100cm	10Nos.
2.	Rule Steel 300mm	10Nos.
3.	Screw Driver heavy duty 200mm insulated thick stem	10Nos.
4.	Screw Driver heavy duty 250mm with insulated thick stem handle	10Nos.
5.	Plier Insulated combination 200 mm	10Nos.
6.	Knife double blade electrician 100mm	10Nos.
7.	Pincer 150mm	10Nos.
8.	Scriber 150mm x 4mm	10Nos.
9.	Punch center 150mm x 8mm	10Nos.
10.	Hammer ball peen 0.75kg with handle	10Nos.
11.	Hammer cross peen 115gms with handle	10Nos.
12.	Saw Tenon 250mm	10Nos.
13.	Firmer chisel wood 12mm	10Nos.
14.	Gimlet 6mm	10Nos.
15.	Bradawl 100mm	10Nos.
16.	Wire stripper 150 mm	10Nos.

17.	Tool Bag / Box	10Nos.
18.	Rubber Gloves	10Nos.
19.	Voltage sensor (pencil type)/ Electronic Tester	10Nos.
20.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	10Nos.
21.	Plier insulated 150 mm	10Nos.
22.	Digital Multimeter	10Nos.
23.	Soldering iron, 25W 230 V	10Nos.
Sr.No.	Name of Items	Qty.
1.	Screw Driver 100 mm with handle	4 Nos.
2.	Screw driver kit (set of six blades with common insulated handle)	4 Nos.
3.	Screw Driver 150 mm with insulated handle	4 Nos.
4.	Plier insulated 200 mm	4Nos.
5.	Plier round nose 100 mm	4 Nos.
6.	Plier flat nose 150 mm	4 Nos.
7.	Tweezer 100 mm	4 Nos.
8.	Scissor blade 150 mm	2 Nos.
9.	Wire stripper 200 mm	4 No.
10.	Soldering iron 25 watt , 65 watt	2 Nos. each.
11.	Desoldering pump.	4 Nos.
12.	Soldering gun/Desoldering gun	2 Nos.
13.	Soldering iron 250 watts.	4 Nos.
14.	Drill machine hand 0 to 6mm capacity	4 Nos.
15.	Drill machine electric portable 0 to 6mm capacity	1 No.
16.	Drill machine electric portable 0 to 12mm capacity	1 No.
17.	Drill machine electric portable 0 to 12mm capacity	1 No.
18.	Drill machine pillar 0 to 12 mm capacity	2 set.
19.	Allen Key	2 Nos.
20.	Oil cane 1/2 litre	4 Nos.
21.	Grease gun	1 No.
22.	Grinder Bench Motorised	1 No.
23.	Pulley puller	1 Set
24.	Bearing puller	1 Set
25.	Rawl plug tool and Bit	2 Nos. each.
26.	Hacksaw frame 300mm, 200mm	4 Nos.
27.	Try square 150mm blade	4 Nos.
28.	Plum bob (Brass)	4 Nos.
29.	Snip straight 150mm	4 Nos.
30.	Snip curved 150mm	2 sets.
31.	Drill SS twist block	2 sets.
32.	(3mm,5mm,6mm,8mm,10mm, 12mm )Set of seven	4 Nos.
33.	Drill SS carbide Bit (4mm,5mm,6mm)Set of three	4 Nos.
34.	Plain smooth cutter 50mm	4 Nos.
35.	Gauge wire (Imperial )	4 Nos.
36.	File flat 200mm 2nd cut	4 Nos.

39.	File flat 250mm smooth	2 Nos.
40.	File round 200mm 2nd cut	4 Nos.
41.	File half round 2nd cut 200mm.	4 Nos.
42.	File round 100mm 2 <sup>nd</sup> cut	1 No.
43.	File triangular 150mm	4 Nos.
44.	File Rasp, Half round 200mm Bastard	1 No.
45.	Vice hand 50mm jaw	2 Nos.
46.	Stock and die conduit ( for 1"to 2 x 1/4")	2 Nos.
47.	Vice table 150 mm jaw	1 No.
48.	Vice Pipe table.	2 Nos. each.
49.	Crimping tool	2 Nos.
50.	Pipe cutter to cut 5cm dia.	2 Nos.
51.	Winding gun	2 Nos.
52.	Micrometer (analog & digital)	2 Nos.
53.	Multimeter digital	2 No.
54.	Ammeter MI, 0 -1 A .	2 Nos.
55.	Ammeter AC, 0 - 5 - 10 - 15 A	1 No.
56.	Tong tester ( 0 to 25 A, 0 - 50 A multi range )	4 Nos.
57.	Tong tester ( 0 to 50 A, 0 - 100 A multi range )	1 No.
58.	Ammeter AC 0 - 25 A	1 No. each
59.	Ammeter DC 0 - 5 - 10 - 15 A multi range	1 No.
60.	Voltmeter AC 0 - 150 - 300 - 600 V	2 Nos.
61.	Voltmeter DC 0 - 150 - 300 - 600 range	2 Nos.
62.	Megger 500 V, 1000V (Hand/motorized)	1 No.
63.	Earth fault locator	2 Nos.
64.	Watt meter single phase 3 KW	4 Nos.
65.	Watt meter 3 phase 2 element 3/5KW	8 Nos.
	Varnish baking oven	
	Fire extinguisher	
66.	Fire buckets	8 Nos.
67.	Watt meter single phase, single element (Flush mounting type) multi Range: 0-750-1500 Watt. rectangular shape.	8 Nos.
68.	Ammeter MI type, Rectangular shape, flush mounting, size106x84mm, multi range, 0-5-10 A.	8 Nos.
69.	Voltmeter MC type AC, Rectangular shape,	2 Nos.
70.	flush mounting,size106x 84mm, multi range,0-	2 Nos.
71.	150-300 V.	2 Nos.
72.	Auto Transformer, continuous variation, single phase, flush mounting type, 0- 270 V, 5 A.	2 Nos.
73.	DC compound motor1-phase a.c. motor (Capacitor start cap. Run) Stepper motor 3-phase induction motor (slip ring) 3hp 3-phase induction motor (squirrel cage) 3hp	2 Nos.

**Theory & Practical - III**  
**Power Generation, Transmission & Distribution**

<b>Practical - III</b>	<b>Theory - III</b>
<p>To study the Hydroelectric power system of generation</p> <p>Study the Thermal power system of generation</p>	<p><b>POWER GENERATION</b></p> <p><b>Introduction:</b></p> <p>Importance of electrical energy. Generation sources of energy, Comparison of energy resources, Units of energy, Relationship among electrical energy, mechanical, electrical &amp; heat energy. value of fuels. Types of fuels.</p> <p>Advantages of liquid fuel &amp; solid fuel.</p> <p><b>Power Generation:</b></p> <p>Various ways of electrical power generation. Thermal Hydro electric Nuclear Non-Conventional</p> <p><b>Thermal :</b></p> <p>Coal based, diesel based &amp; Gas based Turbine. Schematic diagram of each of these types and their site selection and limitations. Constituents in steam power station.</p> <p><b>Hydro Electric:</b></p> <p>Schematic arrangement of Hydro-Electric Power Station. Choice of site for Hydro Electric Power Station. Constituents of Hydro Electric Plant. types of Hydro Electric Power station. Make up of plant like Dam, conduit, penstocks and scroll case, draft tube and tailrace etc.</p> <p><b>Nuclear:</b></p> <p>Schematic arrangement of Nuclear Power Station.</p> <p>Composition of an atomic Nucleus. Types of nuclear reactor, Pressure water reactor, Light water reactor, heavy water reactor, Boiling water reactor, High temperature gas reactor, fast breeder reactor principle, Nuclear fusion. Selection of site for Nuclear Power Station. Comparison of above Power Plant.</p> <p><b>Non-Conventional</b></p> <p>An introduction to Power generation through non-conventional power generation such as Solar, Bio-Gas, Wind energy and Micro-hydel</p>

<p>Identification and specification of different type of insulating materials used.</p> <p>Binding of Pin type insulator, shackle type and suspension type insulators.</p> <p>Skinning and dressing of cables.</p> <p>Straight joint of different types of underground cables.</p> <p>Test /check the insulation resistance of cables by using megger.</p> <p>Locating the faults (open circuit, short circuit &amp; leakage) in cables.</p> <p>Fixing of jumper by crimping tool.</p>	<p><b>TRANSMISSION OF ELECTRICAL POWER</b></p> <p><b>Electrical Supply System :</b> Typical constant current power supply scheme, Comparison of AC and DC transmission. Advantages of High transmission voltage. Various system of power transmission and their comparison.</p> <p>Introduction to High voltage DC transmission system (HV DC).</p> <p>Introduction to Single phase , three phase-3 wire system in transmission lines</p> <p>Electrical supply system used in railway transportation.</p> <p><b>Overhead Lines:</b> Main components of overhead lines-Types of powerline Low voltage line medium Voltage line &amp; high voltage line Voltage standard Conductor materials, line supports, Insulators, types of Insulators, Potential distribution over suspension insulator string, string efficiency &amp; method of its improvement. <b>Corona :</b> Introduction to Corona and its effects, factors affecting corona loss &amp; methods of reducing loss, sag of conductor between two poles.</p> <p><b>Performance of Transmission Lines:</b> Classification of overhead transmission lines. i e Resistive line inductive line, inductive line with compensation &amp; inductive line connecting two large systems</p> <p>Performance of single phase short transmission line. Three phase transmission line. Effect of load Power factor on regulation and efficiency.</p> <p><b>Under Ground Cable :</b> Construction of cables. Material for cables, its insulation. Classification of cables, cables for 3-phase service, Laying of under ground cable. Types of cable faults and their location</p>
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<p>Installation operation and maintenance of oil circuit breaker.</p> <p>Installation, operation and repair of air circuit breaker.</p> <p>Installation, operation and repair of SF6 circuit breaker.</p> <p>Installation and operation of lightning arrestor on HT line.</p> <p>Installation of bus bar and bus coupler on LT line.</p> <p>Replacement and testing of transformer oil.</p> <p>Test and replacement of transformer bushes on HT &amp;LT side.</p>	<p><b>DISTRIBUTION OF POWER</b></p> <p><b>Sub-station:</b> Its function and equipment used in substation.</p> <p><b>Distribution System :</b> Classification of distribution system-AC distribution, D.C. distribution, methods of obtaining 3-wire dc system. Overhead v/s underground distribution system</p> <p><b>Introduction to Switch Gear:</b> Essential features of switchgears. Switch gear equipments, bus-bar arrangement, Switch gear accommodation, Short circuit, faults in power system.</p> <p><b>Introduction to protection schemes -</b> Types &amp; Characteristics of relays ( Overcurrent, Over voltage, IDMT, Differential protection scheme of transformer, Buchholz relay, Carrier protection schemes)</p> <p><b>Circuit Breakers :</b> Circuit breakers - arc , Principles of arc extinction, Methods of arc extinction, Classification of circuit breakers, Oil circuit breakers Air-blast circuit breaker, Vacuum circuit breaker, SF6 circuit breaker, MCB, ELCB.</p> <p><b>Fuses</b> Desirable characteristics of fuse element, Fuse element material, Types of fuses,HRC fuses, ICTP switch,Low voltage fuses, High voltage fuses, Current carrying capacity of fuse element , Difference between a fuse and a circuit breaker. Introduction of MOV lightening arrestors used in HT lines.</p> <p><b>Transformers</b> Introduction, types, Power transformers, Distribution transformers, transformer on load, its losses, efficiency &amp; regulation of transformer, condition for maximum efficiency, transformer oil &amp; its dielectric strength, Resin base transformers.</p>
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**List of Tools, Equipments :**

Sr.No.	Name of Item	Quantity
1.	Screw driver 100 mm.	4 Nos.
2.	Screw driver 300 mm.	4 Nos.
3.	Plier Gas 250 mm.	4 Nos.
4.	Plier Gas 200 mm	4 Nos.
6.	Plier round Nose 150 mm.	4 Nos.
8.	Plier Flat Nose 150 mm.	4 Nos.
9.	Tweezers 150 mm.	2 Nos.
10.	Blow lamp 2 pint.	2 Nos.
11.	Melting pot,	1 Nos.
12.	Soldering Iron 250 watt.	4 Nos.
13.	Soldering Iron 125 watt.	4 Nos.
14.	Hammer ball pien 0.4 Kg.	4 Nos.
15.	Spanner Kit (Double Ended).	1 set.
16.	Drill machine Hand 0- 8 mm capacity.	1 No.
17.	Drill machine electric Portable 0- 6 mm capacity.	1 No.
18.	Drill machine electric Portable 0-12 mm capacity.	1 No.
19.	Oil cane 1/2 litre.	4 Nos.
20.	Allen key.	1set.
21.	Grease Gun (medium size)	2 Nos.
22.	Grease Gun (small size).	2 Nos.
23.	Hack saw frame 300 mm.	4 Nos.
24.	Hack frame 200 mm.	4 Nos.
25.	Snip straight 200 mm.	4 Nos.
26.	Snip curved 200 mm.	4 Nos.
27.	Spanner single ended 6mm - 25 mm.	2 set.
28.	Spanner double ended 6 mm -19 mm.	2 set.
29.	Drills S.S. twist block 2 mm- 12 mm.	2 set.
30.	File flat 200 mm 2 <sup>nd</sup> cut.	4 Nos.
31.	File flat 200 mm bustard.	4 Nos.
32.	File round 200 mm bustard.	4 Nos.
33.	File round 150 mm 2 <sup>nd</sup> cut.	4 Nos.
34.	File flat 200 mm smooth.	4 Nos.
35.	Instrument files (set of 12).	2 set.
36.	Bench vice 100 mm jaw.	2 Nos.
37.	Bench vice 150 mm jaw.	4 Nos.
38.	Tap set 3 mm- 10 mm (set of 9).	2 set.
39.	Die set 3mm - 10 mm (set of 9).	2 set.
40.	Vice hand 50 mm jaw.	4 Nos.
41.	Multi meter (digital).	2 Nos.
42.	Ammeter MI, 0-25 A.	2 Nos.
43.	Ammeter MI, 0-5-10-15 A.	2 Nos.
44.	Tong tester 0-25 -50 A. (multi range).	2 Nos.
45.	Voltmeter 0- 600 V.	2 Nos.
46.	C T, ( 100/5A).	2 Nos.
47.	P T, (11000/ 400 V).	2 Nos.
48.	Megger 500 V, 1000 V manual / motorised	2 Nos. each

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