

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI

1	Name of Syllabus	C.C. IN Electrical Power Generation and Distribution (302208)																																																													
2	Max. No's of Student	25 students.																																																													
3	Duration	1 YEAR																																																													
4	Type	Full Time																																																													
5	No Of Days / Week	6 Days																																																													
6	No Of Hours /Days	7 Hrs																																																													
7	Space Required	Lab = 800 Sq feet Class Room = 200 Sq feet TOTAL = 1000 Sq feet																																																													
8	Entry Qualification	S.S.C. passed																																																													
9	Objective Of Syllabus/ introduction	To enable the students to 1. Acquired the detailed knowledge of important power plants in Maharashtra. 2. Understand the general concept of Generation, Transmission and Distribution. 3. Acquired the I.E. Rules, 1956.																																																													
10	Employment Opportunity	Wage Employment: 1. Generator Operator. 2. Lineman. 3. cable jointer Self Employment:- 1. Start contractor ship.																																																													
11	Teacher's Qualification	1) D.E.E. OR 2)I.T.I. (Electrician),N.C.T.V.T. ,A.T.I. OR 3)a)H.S.C. (Electrical Maintenance) OR b)H.S.C.(M.R.E.D.A.) OR c)H.S.C.(E.E.S. /D.I.W.I.D. /E.P.G.D. a)M.R.E.D.A) With 3 year Experiences																																																													
12	Training System	Training System Per Week <table><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>18 Hours</td><td>24 Hours</td><td>42 Hours</td></tr></table>						Theory	Practical	Total	18 Hours	24 Hours	42 Hours																																																		
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13	Exam. System	<table><tr><td>Sr. No.</td><td>Paper Code</td><td>Name of Subject</td><td>TH/PR</td><td>Hours</td><td>Max. Marks</td><td>Mini. Marks</td></tr><tr><td>1</td><td>30220811</td><td>Power generation</td><td>TH-I</td><td>3 hrs.</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30220812</td><td>Power Transmission</td><td>TH-II</td><td>3 hrs.</td><td>100</td><td>35</td></tr><tr><td>3</td><td>30220813</td><td>Distribution</td><td>TH-III</td><td>3 hrs.</td><td>100</td><td>35</td></tr><tr><td>4</td><td>30220821</td><td>Power generation</td><td>PR-I</td><td>3 hrs.</td><td>100</td><td>50</td></tr><tr><td>5</td><td>30220822</td><td>Power Transmission</td><td>PR-II</td><td>3 hrs.</td><td>100</td><td>50</td></tr><tr><td>6</td><td>30220823</td><td>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	Mini. Marks	1	30220811	Power generation	TH-I	3 hrs.	100	35	2	30220812	Power Transmission	TH-II	3 hrs.	100	35	3	30220813	Distribution	TH-III	3 hrs.	100	35	4	30220821	Power generation	PR-I	3 hrs.	100	50	5	30220822	Power Transmission	PR-II	3 hrs.	100	50	6	30220823	Distribution	PR-III	3 hrs.	100	50			Total			600	255
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6	30220823	Distribution	PR-III	3 hrs.	100	50																																																									
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Syllabus :- Electrical Power Generation and Distribution

THEORY - I - POWER GENERATION

No.	Chapter Name	Details of chapter
1	Safety precautions	Precautions, Tools, Signs and symbols
2	Basic electricity	Current, Voltage Resistance, Specific resistance, Temperature co-efficient, Ohm's law, series circuit ,parallel circuit, Work ,Power, Energy.
3	Battery	Primary cell, Secondary cell. Related Terms- e.m.f., p.d., internal resistance, Connection of cells.. Charging methods.
4	Magnetism and Electromagnetism	Compare magnetic with Electrical circuit . Magnetic effect , Related Rules , electromagnet , Faraday's laws . , Self induction & Mutual induction ,
5	Generator	Introduction , Working principal , Main parts , Types & applications .
6	Alternator	Introduction , Working principal , parts - stator , rotor , exciter . Relation of Pole & Speed . Rotor types ,Faults occur , Protection – Balanced Earth fault .
7	Generator	Interpoles , Armature reaction & its prevention , Commutation
8	Alternator	Single , two , three phase Alternator , Types of load on it , Voltage regulation , Synchronising , Damping winding , Automatic voltage regulator ,
9	Types of Power Generating Stations.	Introduction ,Working , Layout , Advantages & Disadvantages of -- --- Diesel power station ., Hydro –Electric, Thermal Power station , Nuclear power station, Wind power station, Tide power station, GasTurbine power station, Solar power station .
10	Conversion from A .C . to D .C .	Necessary , Methods of conversion , Comparison of their advantages & disadvantages .Three phase rectifiers(mercury arc)
11	Maintenance	Maintenance of Generator, Maintenance of Alternator Maintenance of Power station Maintenance of Battery Maintenance of Synchronous motor
12	Tariff	Introduction ,Define of Tariff , Types -- Define & their coparison --- simpl e, flat rate , two part –maximum demand ect .

PRACTICAL - I - POWER GENERATION

- 1.To study the electrical symbols.
- 2.Identification of tools.
- 3.Verification of ohm's Law.
- 4.To study the properties of series circuit.
- 5.To study the properties of parallel circuit.
- 6.To measure the voltage ,current of given circuit.
- 7.To measure the power by wattmeter.
- 8.To calculate the energy bill of given load.
- 9.To connect the cells in series .
- 10.To connect the cells in parallel.
- 11.To connect the cells in series and parallel
- 12.Verification of Faraday's law.
- 13.To study the parts of Generator
14. To start the Generator and connect the load.
- 15.To study the parts of Alternator.
16. Identification of terminal of generator.
- 17.Testing of generator by megger.
- 18.Installation of D.C. Generator.
- 19.Testing and identification of alternator terminals.
- 20.To start run and build up voltage in alternator.
- 21.To study the working of Thermal power station.
- 22.To study the working of Hydro power station.
- 23.To study the working of Solar power station.
- 24.To study the working of Thermal power station.
- 25.To study the working of Wind power station.
26. To test the metal rectifier.
27. To study the panel board to a M.G. set.
28. Connection of synchronous motor.
- 29.Connection of capacitor bank with load.
30. Overhauling of DC Generator.
31. Overhauling of Alternator.
32. Overhauling of Battery.
33. Synchronizing of alternator by Dark lamp method.
34. Synchronizing of alternator by Bright lamp method.
35. Synchronizing of alternator by Synchro scope method

THEORY - II - Power Transmission

No.	Chapter Name	Contains of chapter
1	Alternating Current	Definition , Generation of A .C . , Magnitude of E M .F . at different instants, A C . waveform , Sinusoidal E .M . F .& Definitions ,Idea of in phase , out of phase , leading , lagging . , Pure A . C circuits . , Series combinations R , L , C . Power factor , Three types of Power in A . C . , Causes of low P F . Power Factor improvement equipment - advantages & disadvantages - 1] Stastic capacitor , 2] Synchronous condenser , 3] Phase advancers. Importance of P . F . improvement - for consumer & for generating station. Comparison of two methods – Meeting the increased K W Demand on Power station.
2	Capacitor	Definition , Capacity factors , related terms , Series & Parallel connection, Types , Uses , Skin effect & its factors .
3	Conductors , Insulator , Wires .	Conductor & Insulator definition & materials . Thermal classification of insulating materials , Term – wire & cable , stranded cable , standard colour code of cable cores , measurement of cable size , Wire types --& uses , Types of flexible wires.
4	Fuses	Introduction , General fitting arrangement , Materials of Fuse wire , related definitions , Fuse units properties , Main types of Fuses – Low voltages& high voltage , Kit –Kat , Cartridge , H .R. C., Miniature circuit breaker , Difference between Fuse & Circuit breaker .
5	Line Supports	Wooden pole , Reinforced cement concrete , Pole , steel tower . O .H . Lines & U . G . Cables compare , Material for O .H . Lines & Properties . Line supports properties , Main components of overhead Lines --- Conductors , Supports , Insulators , Cross arms , danger plate , lightning arrestors , anti- climbing wires ect .
6	Single phase motor	Introduction, working principle, types and their working and uses. Changing the D.O.R.
7	I.E. Rules	I.E. Rules of pertaining to O.H. lines I.E. Rules of pertaining to ground clearance Sag and its affecting factors, conductor spacing
8	Transmission voltage Transmission lines	Low, medium, high, extra high voltages Two wire , Three wire , Four wire, Six wire, Seven wire.
9	Tools and Accessories	Hand Glows. Gum Boot , Safety belt, ladder, Pulley, Crain
10	Installation of transmission line	Installation of Poles Installation of tower Installation of insulators Installation of conductors
11	Lay out of transmission line	Transmission line in Maharashtra. Transmission line of national grid

PRACTICAL - II - Power Transmission

- 1.To study the R-L in series .
- 2.To study the R-C in series.
- 3.To perform straight joint of 7/20 P.V.C. wire
4. To perform Tee joint of 7/20 P.V.C. wire.
- 5.To study the different types of capacitor.
- 6..To study the Series combination of capacitor.
- 7.To study the parallel combination of capacitor.
- 8.To measure the S.W.G. of different wires.
- 9.To study the different types of fuses.
- 10.Practice of excavation for pole installation
- 11.Practice of excavation for Tower installation
- 12.Practice of excavation for Stay wire installation
- 13.To start and run split phase motor.
- 14.To study the universal motor.
- 15.To start run and reverse permanent capacitor motor
16. Study the tools required for transmission line.
- 17.Western union joint of A.C.S.R. conductor.
- 18.Britaniya joint of A.C.S.R. conductor.
- 19.Installation of Pin type over head insulator.
- 20.Installation of Shakale type over head insulator.
- 21.Installation of Suspension type over head insulator.
- 22.Study the voltage grade of Transmission line.
- 23.Installation of service wire.
- 24.Installation of low and medium voltage transmission line.
- 25.Safety measures while working on transmission line.
- 26.Installation of stay wire.
- 27.Practice of changing the D.O.
28. Study the major Transmission lines in maharastra.
29. Study the layout of national grid.

THEORY - III - Distribution

	Chapter Name	Contains of chapter
1	Wires & Cables	Introduction , Classification according to Voltage , Construction of Paper –insulated Lead Covered Cables , Types of 3 ph . Cables , Cable type Designation ,
2	Measuring Instruments	Introduction, Deflecting/Controlling/Damping system, Moving Iron voltmeter and Ammeter, Moving Coil instrument, Wattmeter, Energy meter, Ampere Hour meter, Frequency meter, Power factor meter, Earth resistance Tester
3	.Earthing	Definition, Types, necessity, I.E. Rules 1956, Voltage Transformer Earthing , Grounding Transformer .
4	Transformer	Introduction , Principal , Construction – Primary ,secondary - core . Types of Transformer , Transformer ratio , Cooling methods .EMF equation of transformer, Losses of transformer. Voltage regulation of transformer. , Booster transformer .
5	Circuit Breaker	Introduction ,Requirements, classification- M.C.B. ,O.C.B., Air Blast, construction and advantages ,Vacuum C .B . advantages & uses , Switchgear components – Bushings , C .B . contacts ,Instrument Transformer , Bus –bars & conductors
6	Transformer	3 phase Tr . parts applications , Efficiency , All Day efficiency , Auto Tr , C.T & P.T. Construction – working & connection for 3 Ph . 3 wire system , 3 ph . 4 wire system . Types of 3 ph . Tr connection , scott connection , Parallel connection of 3 ph . Tr
7	Sub –stations	Introduction , A .C . substations types - pole –mounted , outdoor type , indoortype , one line diagram of generating station to distribution of supply , Ring mains system & Interconnected system of Distribution , Under ground Sub-station sketch & important points . Symbols for equipment in Sub-station - Bus- bar , Singal –break isolating switch , Double break switch , O .C .B . ,Arcing horn , etc . Bus –bar arrangement in Sub –stations sketches 1) Single (2) Duplicate
8	Underground cable system	Introduction , Classification according to Voltage , Construction of Paper –insulated Lead Covered Cables , Types of 3 ph . Cables , Cable type Designation , Installation of Cable Lines – General , laying cables in Trenches – Laying Conduit – built & tier –by – method . , Undreground PVC Cables- construction , range selection current rating of Aluminium, power cable , short circuit rating , Bending ,radius , Load factor ,Cable jointing, Faults in the under ground cableMethod of locating faults.
9	Maintenance	Maintenance of Sub Station.Maintenance of Pannel board.Testing of earthing . Protection of Trans. Buchholz Relay , Earth faults Relays etc . Sketch , Adventages & disadvantages .
10	Relay	Introduction , Protective Relays –circuit Terms – Pick up current , Current setting , P .S .M . , Functional Relay Types – Sketchs of Induction Type- Overcurrent Relay , Directional power Relay ,Impedance Relay , Current , Voltage Differential Relay .Types of Protection - Primary & Back – up
11	Switchgear	Introduction , Define , Switchgear Equipment –1) Switches - Air-break , Isolator , Oil .2) Fuses 3) C .B . \$) Relays . Switchgear Accommodation – Outdoor type , Indoor type . Causes of Short –circuit Faults in Three phase System - Definition - Symmetrical & Unsymmetrical .

PRACTICAL - III - - Distribution

- 1.To study the construction of cable.
2. Installation of single phase energy meter for domestic purpose.
3. Installation of Three phase energy meter for commercial purpose.
- 4.To measure the power of single phase induction motor.
- 5.To measure the frequency of given supply.
- 6.To measure the power factor of given load.
- 7.To measure the earth resistance by earth tester.
- 8.To prepare plate earthing.
9. To prepare pipe earthing.
10. Calculate the voltage ratio of given single phase transformer.
11. Calculate the current ratio of given single phase transformer.
- 12.Find out the iron losses of given single phase transformer
- 13.Find out the copper losses of given single phase transformer
- 14.Find out the voltage regulation of given single phase transformer.
15. Find out the all day efficiency of single phase transformer.
- 16.To study the construction of M.C.B.
- 17.To study the construction of O.C.B.
18. Find out the all day efficiency of three phase transformer.
- 19.Maintenance of power Transformer.
- 20.Perform parallel connection of Three phase transformer.
- 21.Practice of changing the transformer oil.
- 22.Installation of lighting Arrester.
- 23.Installation of panel board of low voltage distribution
- 24.Repairing of panel board of low voltage distribution.
- 25.Installation of panel board of medium voltage distribution
- 26.Repairing of panel board of medium voltage distribution.
- 27.Laying the Under ground cable normal condition.
- 28.Laying the under ground cable across road.
- 29.Fixing the gland to the cable.
- 30.Fault finding of the under ground cable.
- 31.Practice of jointing the under ground cable.
32. Fault finding, repairing of circuit breaker.
- 33.Replacement of transformer from sub-station.

Electrical Power Generation and Distribution
LIST OF MATERIALS FOR 25 STUDENTS.

Sr. No	Details of Materials	Quantity
1	Voltmeter a.c. 0—250v	4 no
2	Voltmeter D.c. 0—250v	4 no
3	Voltmeter a.c. 0—500v	4 no
4	Voltmeter D.c. 0—30v	4 no
5	Ammeter A.C. 0—1 Amp.	4 no
6	Ammeter A.C. 0—10 Amp.	4 no
7	Ammeter A.C. 0—5 Amp.	4 no
8	Ammeter D.C. 0—1 Amp.	4 no
9	Ammeter D.C. 0—5Amp.	4 no
10	Speedometer	1 no
11	Wattmeter 0—250W	1 no
12	Wattmeter 0—500W	1 no
13	Wattmeter 0—1500W	1 no
14	Energy meter 5-15Amp.	1 no
15	Power Factor meter	1 no
16	Frequency meter	1 no
17	Galvanometer	4 no
18	Rheostat 50 ohm's	4 no
19	Rheostat 450 ohm's	4 no
20	Rheostat 1150 ohm's	4 no
21	D.C. power supply 30V—1Amp.	2 no
22	Tube fitting	4 no
23	Bell	2 no
24	Buzzer	2 no
25	Emergency light	2 no
26	Lead acid battery	2 no
27	Three phase main switch 16 amp.	2 no
28	Three phase main switch 32 amp.	2 no
29	Gum boot	10 no
30	Rain coats	10 no
31	Voltage Stabilizer	2 no
32	Inverter	1 no
33	Work Bench	4 no
34	Bench vice	4 no
35	Pipe vice	2 no
36	Measuring Tape	4 no
37	Steel rules	4 no
38	Micrometer	2 no
39	S.W.G.	4 no
40	Filler gauge	2 no
41	Multi meter	4 no
42	Try square	4 no
43	Pipe cutter	4 no
44	Hacksaw with blade	6 no
45	Hand Drill machine	2 no
46	Chisel	6 no
47	Spanner Set (Double Ended)	2 no
48	Screw Driver	20 no
49	Hammer	10 no

50	Pocker	8 no
51	Varnier calipers	4 no
52	Files	10 no
53	Wire stripper	20 no
54	Tester	20 no
55	Pliers	20 no
56	Electrician knife	20 no
57	Mallet	6 no
58	Tennon saw	6 no
59	Firmer chisel	10 no
60	Dial Gauge	4 no
61	Ring spanner	5 sets
62	Box spanner	5 sets
63	Rope 5meter, 10meter, 15meter	4 each
64	Ladder	4 no
65	Hand Gloves	20 no
66	Safety belts	10 no
67	Fire fighting Extinguisher	4 no
68	First aid box	2 no

REFERENCE BOOKS

No	Name of the book	Author
1	Basic Electrical Engineering	M.L. Anwani
2	Basic Electrical Engineering	Sharma
3	Electrical wiring Estimating and costing	S.L. Uppal
4	Electrical Wiring Estimating and costing	J.B. Gupta
5	Basic Electrical Engineering vol- 1,2,3,4	P.P.Shah
6	Basic Electrical Engineering vol.1,2,3,4	B.L. Thareja
7	Electrical Machine	V.K.Mehata
8	Indian Electricity Rules	Nausheer Bharucha D.B. Taraporewala sons and co.
9	Vidyutshastra vol.1,2,3,4	P.P.Shah
10	Electrical Technology	Edwardm Hughes
11	Electrical Technology	Bhatnager
12	Electrical Technology	B.L.Thareja
13	Fundamentals of Electrical Technology	V.K. Mehata
14	How to repair major appliances	Ernest Tricomi
15	Electrical Appliances: Installation and Maintenance (Second Edition)	E.Molloy
16	Basic Electronics	Berard Grob
17	Electrical Technology	H.Cotton
18	Elementary Electrical Engineering	M.L.Gupta
19	Principle of Generation System	Bhatia,
