

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

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|--|--|-------|-------|------------|------------|--|---------|------------|-----------------|---------|----------|------------|------------|---|----------|------------------------|------|-------|-----|----|---|----------|-----------------|------|-------|-----|-----|---|----------|--------------------|-------|-------|-----|----|--|--|-------|--|--|-----|-----|
| 1 | Name of Syllabus | C. C. In Electrical motor winding (302104) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Max.Nos of Student | 25 Students | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Duration | 6 Month | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Type | Part Time | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Nos Of Days / Week | 6 Days | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | Nos Of Hours /Days | 4 Hrs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | Space Required | Workshop = 200 Sq feet Class Room = 200 Sq feet TOTAL = 400 Sq feet | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | Entry Qualification | 8 th Pass | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | Objective Of Syllabus/ introduction | 1. Trainees should be able to check & repair house wiring & electrical appliances, electric motor, pump 2. Trainees should be able to run electrical shop of sale & maintenance &rewinding shop.3. installation of pump | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | Employment Opportunity | 1.To start his own electrical repair &winding shop shop.2. To work as electrician cum winder in electric shop & small scale industry as winder 3)To start his electrical spare part shop. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | Teacher’s Qualification | ITI / N.C.T.V.T. in Electrician Trade with 1year experience OR Vocational Technician in the Trade of MREDA with 1year experience | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | Training System | Training System Per Week <table><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>6 Hours</td><td>18 Hours</td><td>24 Hours</td></tr></table> | | | | | | Theory | Practical | Total | 6 Hours | 18 Hours | 24 Hours | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Theory | Practical | Total | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 Hours | 18 Hours | 24 Hours | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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>Min. Marks</td></tr><tr><td>1</td><td>30210411</td><td>Electric Motor Winding</td><td>TH-I</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30210421</td><td>3 phase winding</td><td>PR-I</td><td>6 hrs</td><td>200</td><td>100</td></tr><tr><td>3</td><td>30210422</td><td>single Phase Motor</td><td>PR-II</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>400</td><td>185</td></tr></table> | | | | | | Sr. No. | Paper Code | Name of Subject | TH/PR | Hours | Max. Marks | Min. Marks | 1 | 30210411 | Electric Motor Winding | TH-I | 3 hrs | 100 | 35 | 2 | 30210421 | 3 phase winding | PR-I | 6 hrs | 200 | 100 | 3 | 30210422 | single Phase Motor | PR-II | 3 hrs | 100 | 50 | | | TOTAL | | | 400 | 185 |
| Sr. No. | Paper Code | Name of Subject | TH/PR | Hours | Max. Marks | Min. Marks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 30210411 | Electric Motor Winding | TH-I | 3 hrs | 100 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 30210421 | 3 phase winding | PR-I | 6 hrs | 200 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 30210422 | single Phase Motor | PR-II | 3 hrs | 100 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | TOTAL | | | 400 | 185 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

THEORY – I - ELECTRIC MOTOR WINDING

1. Importance of safety and general precautions observed in the Institute & in

Sections. Importance of the trade.

2. Engineering hand tools, as hammers, chisels, punch, clamp Hack saw. Files etc. steel tape.

Marking & measuring tools, steel rule. Try square. Scriber.

3. Types of bearing. Study methods of Replacing bearing.

, Preheating. Process of Impregnation Varnishing & backing process.

Rewinding Process. Name plate details. Cutting of burnt coils and weighting.

Counting number of slot... Pitch (Actual counting) Number of pole.

Conductor per coil per slot. Pitch (Actual counting) Winding form

Tapping. Fixing Insulation paper in slot after clearing slot.

Fixing of coil side in slot. Connection.

4. A.C. Single phase motor construction, Working principle and use of different types of single phase motor. Split phase induction motor. Capacitor motor. Capacitor start Capacitor run motor.

Capacitor start motor. Shaded pole motor

5. Universal (A.C. Series) motor. Repulsion motor. Direction changing of above motor.

6. A.C. & Motor. Construction, working, principle and use of Different type of 3 Induction motor.

Squirrel cage Induction motor.

7. Slip ring induction motor. Changing direction of rotation.

8. Control and starting of 3 motor. Introduction about overload relay. Single phase preventer.

Construction and working principle of DOL. Star-delta Rotor resistance starter.

9. A.C. winding: No. of pole. No. of slot. Coil pitch. No of conductor per slot. No. of coils.

10. Coil form Single layer and double layer winding. Connections types. Radical and developed winding diagrams. Diagram for common type of motor. End connections.

11. Generator: Construction, working principle types of Generators. Use of different generators.

12. D.C. motor:- Construction, working principle Types of motor, use of different motors.

13. D.C. Field winding. Introduction about series field and shunt field. No. of Turns of wt. Frame, and Insulation. Connection with field pole checking Of poles.

14. Armature and commutator. Deification of armature and commutator construction working. Principle of armature and commutator.

15. Armature winding. Two polar/pair polar armature Turns. Coils, Leads of coils coil span. Coils per pole coil group pole pitch, coil pitch.

16. Pitch factor No of slot No. of slot No. of segment Hand winding. Farmer winding loop winding double loop winding. Triple loop winding.

17. Armature winding Lap winding Wave winding

18. Armature testing:- Ground test in commutator. Short test in commutator Coil testing by test lamp. Find out reverses.

19. D.C. motor, control and starting Construction and working principle Of Three point and four point starter.

20. A.C. motor, Generator, D.C. motor common fault. Cause and remedies.

PRACTICAL - I - THREE PHASE MOTOR WINDING

1. To connect 3 PHASE motor to supply. With DOL and star-Delta starter.
2. D.C. Field winding *Dismantle machine. *Not all parts of machine *Note detail name plate. *Count No. of poles. *Count No. of coils.
3. *Count light / width * Count turns per coil * Measure winding wire gauge. * Type of connection * Make form for coil.
4. *wound coil on former. *Cotton tapping on coil *Put insulation paper in slot *Connection/varnishing *checking & Reassembly.
5. To connect D.C. motor with Three point starter and four point starter.
6. Armature winding:- *Dismantle armature from Machine. *Note name plate. *Count No. of slot/segment. *Count coil pitch/ commutate. Pitch. *Observe winding connection & type
7. * Count wire gauge * Count No. of turns. * Clean armature slot. * Put insulation paper in slot. * Put winding in slot.
8. * Lap winding/Simplex Duplex/Triplex Type *put wages in slot. *Checking of coils *Varnishing
9. * Wave winding / simplex Duplex / Triplex type *Put wages in slot. *Checking of coils *Varnishing.

PRACTICAL - II – SINGLE PHASE MOTOR

1. Importance of the trade training. Types of the work done in the trade. Introduction to safety including fire fighting equipments.
2. Use of steel rule, try square scribe divider, making out both inches, Use of hand tools, such as, Hammer chisel. Hack saw etc.
3. Rewind Table/Exhaust/ Pedestal Fan *Dismantle of fan. Noting all parts. *Observe whether it is shade pole or Capacitor motor *Cutting of burnt coil. *Measure wire gauge. *Count No. of slot. * Count No. of coil. * Count no of turns in each coil * put insulation paper in each slot. * Making of form. * Making of coils. * Cotton tapping on coils.
4. * Put coils in slot. * Connection of coils * Checking of coils . connection. * put wages in slot. * Reassembly of fan. Connection of capacitor. *Give supply. *Checking of noise and other mech fault.
5. Motor Rewinding (single phase) *Dismantle of motor. *Noting all the parts and name plate. *Observe connection type * cutting burnt coil. * Measure wire gauge.
6. * Count No of slot/coil pitch. * Count No of turns in each coil * Draw developed winding diagram. * Clean stator * Put insulation paper in slot. * Making of Coils by former.
7. *Put coils in slot. *Connection Coil. * Checking of /cotton tapping. *Put wages in slot/varnishing. *Re-assembly of motor. *Give supply. * Checking of mechanical fault/speed/current.
8. 3 phase motor rewinding *Dismantle motor * Noting all parts of the motor. * Note Name Plate details. Observe winding connection.
9. *Count No. of slot. *No of coil/No of pole *No of Turns in burn coil. * Count pitch, measure gauge No *Making of form as per shape of old coil. * clean stator slots/put insulation paper.
10. For single layer winding. * Put coils in slot. * Draw developed diagram. * Connection of coils. * Checking of coil/connection put Wedges in slots. *Cotton tapping varnishing and assembly/ give supply check current noise. Temp speed.
11. . For double layer winding *Put coils in slot *Draw developed diagram. *Connection of coils. * Checking of coils/connections put Wages in slot. *Cotton tapping varnishing and Assembly *Give supply *Check current/noise/Temp/speed & mean fault.

TOOLS

| | Tools requirements. | QTY |
|-----|---|-------|
| 1) | Insulated pliers 6" | 4 NOS |
| 2) | Nose pliers 6" | 4 NOS |
| 3) | Side cutting pliers 6" | 4 NOS |
| 4) | Insulated screw Driver 12" | 4 NOS |
| 5) | Insulated screw Driver 6" | 4 NOS |
| 6) | Insulated screwdriver 6" | 4 NOS |
| 7) | Connector | 4 NOS |
| 8) | Knife | 4 NOS |
| 9) | Tennon saw | 2 No |
| 10) | Hack saw | 2 No |
| 11) | Firmer chisel | 2 Nos |
| 12) | Cold chisel | 2 Nos |
| 13) | Hand drill M/C | 2 Nos |
| 14) | Pincer | 2 Nos |
| 15) | Ball peen hammer 500 gm. | 2 Nos |
| 16) | Cross peen hammer 500gm | 2 Nos |
| 17) | Mallet | 2 Nos |
| 18) | Electric soldering Iron | 2 Nos |
| 19) | Blow lamp | 2 Nos |
| 20) | Spanner set | 2 Nos |
| 21) | Scissors | 2 Nos |
| 22) | File | 2 Nos |
| 23) | Standard wire gauge | 2 Nos |
| 24) | Three legs pulley puller | 2 Nos |
| 25) | Two legs pulley puller | 2 Nos |
| 26) | Bench vice | 2 Nos |
| 27) | Centre punch 100 mm | 2 Nos |
| 28) | Steel rule 300 mm | 2 Nos |
| | | |
| | EUIPMENT/MACHINE | |
| 1) | Voltmeter = 0- 500 V | 2 Nos |
| 2) | Ammeter (MT) 0-15 A | 2 Nos |
| 3) | Megger 1000V | 2 Nos |
| 4) | Ohm Meter | 2 Nos |
| 5) | Tong Tester (Clip on tester) | 2 Nos |
| 6) | Magnetic compass. | 2 Nos |
| 7) | Micrometer | 2 Nos |
| 8) | Techno Meter | 2 Nos |
| 9) | Winding stand | 2 Nos |
| 10) | Electric backing ovens 240v, 2000w with temp control. | 1 No |
| 11) | Test lamp / Growler | 2 Nos |
| 12) | Ceiling fan stator | 2 Nos |
| 13) | Table/ exhaust/ Pedestal fan | 2 Nos |
| 14) | Single phase motor | 2 Nos |
| 15) | Motor | 2 Nos |
| 16) | D.C. Machine armature | 2 Nos |
| 17) | D.C .Machine pole | 2 Nos |
| 18) | D.O.L starter | 2 Nos |
| 19) | Star Delta starter | 2 Nos |
| 20) | Growler Inside & Outside | 2 Nos |

Reference Books :-

- | | |
|---------------------------|---------------------------|
| 1. Motor Armature Winding | - M. L. Anwani |
| 2. Sope Winding | - Prakash Shaha |
| 3. Motor Rewinding | - Sham Pitake / Shekatkar |
| 4. Electrical Technology | - B. L. Theraja |
