

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

1	Name of Syllabus	C. C. In MOTOR ARMATURE AND WINDING (302109)																																									
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	7 th Pass																																									
9	Objective Of Syllabus/ introduction	1. To know the basic instruments & material for winding. 2. To understand different types of winding & their development diagram.3)dismantle & Reassemble of motor																																									
10	Employment Opportunity	1. Student should start his own business as a winding shop.2)To open sale & spares shop 3) To take contract of installation motor. 2. Student should work as a winder in winding shop.																																									
11	Teacher's Qualification	1. ITI NCTVT Electrician passed with 2 years experience. 2. MREDA/RMEM (MCVVC) passed with 2 years experience.																																									
12	Training System	<table><tr><th colspan="7">Training System Per Week</th></tr><tr><td colspan="2">Theory</td><td colspan="2">Practical</td><td colspan="3">Total</td></tr><tr><td colspan="2">6 Hours</td><td colspan="2">18 Hours</td><td colspan="3">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>30210911</td><td>Motor Armature & Winding</td><td>TH-I</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30210921</td><td>Motor Winding</td><td>PR-I</td><td>6 hrs</td><td>200</td><td>100</td></tr><tr><td>3</td><td>30210922</td><td>Armature Winding</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	30210911	Motor Armature & Winding	TH-I	3 hrs	100	35	2	30210921	Motor Winding	PR-I	6 hrs	200	100	3	30210922	Armature Winding	PR-II	3 hrs	100	50			TOTAL			400	185
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THEORY – I, MOTOR ARMATURE AND WINDING

A) Electricity :-

1) Electrical quantities & their units

a) Voltage, b) Current, c) Resistance, d) Power, e) Energy.

2) Basic Laws – Ohm's Law, Kirchhoff's Law, Fleming Rule, Faraday's Law, Lenz Law

3) Simple Circuit – Series circuit, parallel circuit. R-L-C Circuit.

4) Different terms of ac circuit. Frequency, Inductance, Capacitance, Reactance, Impedance, Power Factor.

B) Electric Shock and Treatment.

C) Safety Precautions in general use of electric appliances and tools.

D) Tools - Insulated Pliers. Side Cutting Pliers. Nose Pliers, Screw driver

Insulated poker. Chisels (Carpentry) Cold Chisel. Tannon Saw Hack Saw

Mallet Hammer $\frac{1}{2}$ lb ; 1lb. Pincer Bench vice.

Drill Machine Soldering iron (Electrical) Flat file Standard wire gauge etc.

E) Instruments - Familiarization only.

Voltmeter, Ammeter, Meggar,

Wattmeter, Energy meter, Avo meter

Ohmmeter, Tester, Test lamp.

F) Generators -

Construction, Yoke, Poles, air gap.

Armature, laminations,

Winding - Pole pitch, slots, Lap Winding

Wave winding. Commutations

connections at commutation

G) Motors -

Type of Excitation.

General description of speed relations.

D. C. Motors - Series, Shunt & Compound

A. C. Motors -

Three phase - wound rotor cage.

Single Phase Motors.

Starters.

D. C. motor starter.

No volt coil over load coil, over load tripping device. A. C. motor starters

a) Split phase b) Shaded pole c) condenser.

3 phase motor Starters. DOL, Motor resistance starter. Star delta starter.

H) Winding

D. C. - Two polar machine (armature winding)

Four Pole armature winding

Number of slots, Pole pitch,

Number of conductors per slot connections.

A. C. - Single phase motors.

Two pole, Four pole, Number of slots,

Pole pitch, Number of conductor per slot

connection starting winding.

Three Phase motors - Development Diagram & as above.

Winding Diagrams -

- 1) Radical and developed winding diagram
- 2) Diagram for common types of motors.
- 3) Types of windings encountered normally
Box type (Single double layer) all Concentric
- 4) End connections, knowledge about electrical degrees and distinguishing start & finish of each.

I) Winding Materials :-

- a) Types of wires
- b) Insulation on wires
- c) Presspan paper (PRESSPAN PAPER), LEHTHEROID. Cotton tape, mica, glass fiber tapes & Mylar etc.
Classification according to rating A, E, B & C & temperature rises specified as in I.S.I.
Impregnation, Preheating, Varnishing & Baking processes.

J) Bearings :- Various types of bearings, various makes etc.
Method of replacing bearing by bearing puller.

K) Rewinding process :- Name plate details .

- a) Cutting of burnt coil & weighing.
- b) Counting number of Slots .
- c) Pitch (actual counting) .
- d) Number of poles (Verification with the name plate) .
- e) Conductors per coil per slot .
- f) Size of wire (gauge)
- g) Winding on former
- h) Taping
- I) Compassing weight of burnt coil with new wound coil .
- J) Fixing of insulation in slot after clearing slots.
- K) Fixing of coil side in slot.
- L) Testing :-
 - a) Howler Test
 - b) Insulating Test
 - c) Continuity Test .

Practical – I, Motor Winding

1. Motor Cleaning for rewinding.
2. Data collection.
3. Former preparation.
4. Measurement of wire gauge (with the help of micrometer) & turns.
5. Coil preparation.
6. Slot insulation.
7. Coil fitting practice.
8. Connection practice.
9. Varnish practice.
10. Terms of DC motor winding.
11. Terms of AC single phase motor winding.

12. Terms of ac 3 phase motor winding.
13. Stator winding. Single layer, Double Layer.
14. Types of winding coils.
15. Winding material.
16. Winding process.
17. Testing.
18. Single phase motor winding.
19. Table Fan winding.
20. Ceiling Fan winding.
21. Field Coil winding.
22. phase single layer winding.
23. phase double layer winding.
24. DC motor field coil winding.

Practical – II, Armature Winding

1. Preparation of armature for winding.
2. Armature Lap Winding (Simplex)
3. Armature Lap Winding (Duplex)
4. Armature Wave winding
5. Use of internal & External Growler.

TOOLS & EQUIPMENTS

Sr.No.	Trainees ' Kit	For Instructors
1.	Rule wooden 4 fold 600 m.m	2
2.	Scriber 15 mm x 4 mm. (knurled centre portion)	2
3.	Pincer 150 mm.	2
4.	Pliers insulated 150 mm.	3
5.	Screw Driver Insulated 150 mm.	3
6.	Punch Centre 150 mm. x 9 mm .	2
7.	Knife double bladed electrician	4
8.	Hammer Cross pen 115 grams. With handle.	2
9.	Electrician connector, insulated handle.	4
10.	Electrician Testing Pencil (Neon tested) 500 V.	4
11.	Heavy duty Screw driver 200 mm. (Insulated)	2
12.	Heavy duty screw driver 250 mm. (Insulated)	2
13.	Rule Steel 300 mm.	2
14.	Saw Tenon 250 mm.	4
15.	Hammer Ball Pen 0.75 kg. with handle.	2
16.	Firmer chisel wood 12 mm.	2
19.	Side cutting Pliers Insulated	4
20	Spanner 150 mm. adjustable 15 degree.	1
21	Blow lamp 5 liters.	1

22	Melting pot	1
24	Chisel cold flat 12 mm x 200 mm.	2
25	Chisel wood firmer 25 mm. and 6 mm.	2
26	Drill machine hand to 5 mm. capacity	2
28	Oil can 0.12 liter.	1
29	Grease gum .	1
30	Pulley Puller	1
32	Bearing puller	1
34	K.W. Meter 0 to 1 k.w. capacity	1
35	Tong tester (Clip on meter)	1
36	Growler Internal & External	1
37	Test lamp	4
38	Megger 1000 V	1
39	Mallet hardwood 0.50 kg.	2
40	Hacksaw frame 200 mm. 300 mm. adjustable.	2
41	Try square 150 mm. blade.	1
42	Pliers flat Nose 100 mm. (Insulated)	2
43	Pliers round Nose 100 mm. (Insulated)	2
44	Drill set 3 mm., 5 mm. 6 mm.	2
45	Wire gauge Imperial	2
46	Soldering Iron, 125 watt , 65 w	1
47	File half round , bastard 8 ”	2
48	Hand Vice 2” jaw	2
49	Micrometer 25mm	1
50	Magnet horse shoe	1
52	Compass Magnetic needle	2
53	Voltmeter M.C.O. 500 V.D.C. (Box type)	1
54	Ammeter M.C.O. 15 A.D.C. (Box type)	1
55	Ammeter M.C.O. - 5 A..C.	1
56	A.C. Voltmeter M.I.O. 500 V	1
57	A. C . Ammeter M.I.O. 75 A	1
58	A. C. Ammeter M.I.O. 5 A	1
59	Megger 500 volts.	1
60	A. C. Energy meter single phase 5A 250V	2
61	Bench Vice 5’	2
62	Bench working 2.5 x 1.20 x 0.75	2
63	Steel Cupboard 2.5 x 1.20 x 0.50 meters	1
64	Instructor ’s table (3’ x 2’ x 2 ½ ’)	1
65	Instructor ’s chair.	1
66	Fire extinguishers	2

67	Fire Buckets	4
68	Copper bit soldering iron ½ lb.	1 set.
69	Series type Ohm- meter 0.2000 app.	1
70	Shunt type Ohm - meter 0.25 app.	1
71	Pipe vice to take pipes up to 2” dia.	2
72	Analog multimeter Sanwa P-II	2
73	Micro OHM Meter	2
74	Various types of Single phase AC Motors	1 each
75	Various types of Three phase AC Motors	1 each
76	Various types of DC Motors	1 each
77	Armatures of various sizes & capacity	8
78	Armature Holder	2
79	Mili Ohmmeter	2

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 |
