Practical Manual

ELECTRICAL WORKSHOP AND MACHINES LAB

SEM III(ECE)

Electronics &Communication Engg. (ECE)

RAO PAHALD SINGH GROUP OF INSTITUTIONS

BALANA(MOHINDER GARH)123029

Prepared By.

Mr.NAVEEN CHAUHAN

Checked By.

Mr.KARAMBIR SHEORAN

EXPERIMENT- 1

AIM:

Introduction of tools, electrical materials, symbols and abbreviations.

TOOLS

PLIER

: Generally three types of pliers are used in the electrical workshop. They are:-

FLAT NOSE PLIER:

Used for holding jobs or holding wires. It has got only two slotted jaws, which are tapered. Thus it is used for tightening or loosening small nuts.

SIDE CUTTING PLIER:

Used for cutting of thin wires and removing insulations from them. It has got cutting edge on its one of its sides.

ROUND NOSE PLIER:

Used only to hold or cut the wires. It has no gripping jaws. Its cutting edge is long and rounded on the top.

SCREW DRIVER:

It is used to loosen or tighten or to keep screws in position. It has a wooden or plastic handle and a blade of high carbon steel.

CHISEL:

FIRMER CHISEL: Generally used for carpentry works and can be used by hand pressure or with the help of mallet. It has flat blade, which varies from 12mm to

15mm.

COLD CHISEL: Used for cutting iron pieces (cold). It has cutting angle from 30°

to 45°and is made of high carbon steel.

HAMMER:

Most commonly used in the workshop. The head is made of cast iron or

forged; the claw is hardened and tampered. The striking place is slightly convex. The

head is fitted with a wooden handle of various lengths.

HACKSAW:

Used to cut metal such as iron strips, core pipes etc. it has a blade made of

high steel or tungsten.

ELECTRICAL TOOLS

TUMBLER SWITCH:

(6 A for light), this switch was used 3-4 decade ago. It is made

of Bakelite.

MCB BOX:

Known as the Miniature Circuit Breaker Box.

METAL CONDUIT PIPE WITH JUNTION BOX:

Metallic hollow pipe, which is

used as a passage for electrical house, hold wires. It is fixed to walls with the help of

metallic saddle.

METAL BEND:

Hollow metallic pipe bend to an angle of 90° to allow smooth

movement of wires inserted through the walls during wiring .

BATTEN WIRING:

It is an old fashioned wiring used 4-5 decades ago.

PVC CASING AND LAPPING:

Long rectangular box made of 2 parts. It is made of PVC and used mainly to pass wires through walls during wiring.

PVC BEND:

Work similarly as metal bends but it is made up of PVC that makes it lighter, cheaper and more durable.

BATTEN LAMP HOLDER:

mainly used to hold electric bulbs and lamps.

SWITCH BOARD WITH SWITCHES:

it contains the following:

SOCKET OUTLETS:

it is a type of electrical material through which electric

current flows from wires to various electrical appliances. It is of 6A.

TWO WAY SWITCH:

it is mainly used in staircase wiring to either on or off

the light. It is of 6A.

ONE-WAY SWITCH:

it is a device used to switch on lights of 6A.

7/20 SWG (POWER WIRE):

they are used in power purposes for duty electrical

appliances. 7/20 means 7 numbers of wires in the cable and 20 strands for thickness or

gauge size.

3/20 SWG (PHASE WIRING):

mostly used for house wiring purposes.

3/22 SWG (NEUTRAL WIRE):

it is also used for house wiring purposes.

1/18 SWG:

it is used for earthing.

FLEXIBLE CABLE:

This is a temporary wire used for both power and light but

temporarily. It is used as extension wire.

RESULT:

We have studied all the tools.

EXPERIMENT -2

AIM:

Two make a T joint of Copper 1/18 SWG wire and straight joint of 3/22 SWG

wire.

APPERATUS USED:

Side-cutting plier, 1/18 SWG and 3/22 SWG wires.

THEORY:

T-JOINT

:It is used to tape the connection from running horizontal line. It is also known

as parallel joint.

STRAIGHT JOINT

: it is used to increase the length of the 3 standard wires.

PROCEDURE:

T JOINT

1. Take 2 horizontal and vertical lengths of wires 30cm and 20cm respectively to which

the joint is to be made.

2. Remove the insulation of taping vertical length of 7.5cm

3. Remove the insulation of straight length middle portion

4. Remove the insulation of 12mm on each side of the base wire.

5. Hold the wire at 90° to running and make a neck turn to void slipping of joint

6. Wrap off conduction closely and tightly 6-8 turns on horizontal wire.

7. Round off the conductor with the help of a plier.

8. The joint is soldered and insulated with tape.

STRAIGHT JOINT:

1. Cut two pieces of cable of nearly the same length.

2. Remove the insulation from the end of both the cable pieces.

3. Separate the wire from both the cables and join the 2 cables in such a way that the individual wires are joint separately

4. For half of the length of the di-insulated cable overlapped make a trust with the help of a plier.

5. Complete the remaining half-length on the twist with the help of a plier.

CIRCUIT DIAGRAM:

PRECAUTIONS:

1) Tools should be used carefully.

2) Fitting should be tightly fitted.

3) Connection should be tight.

4) Wire should be on the conduit, power gripped properly.

RESULT:

We have preparedthe joints.

EXPERIMENT 3

AIM:

To study staircase wiring.

APPARTUS:

3/22 SWG wires, lamp holders, two way switch, 40w bulb 3

PVC casing, strips and pliers.

THEORY:

It is that wiring which makes use of 2 switches to operate bulb at the beginning of the stair lights and the bulb gives off by pushing the button in the end. One of the terminals of the bulb is connected to the main line whose power line is connected to middle slot of two-way switch. Remaining first of there slots is connected in parallel as in crossed node.

CIRCUIT DIAGRAM:

PROCEDURE:

1. Plan the wiring and casing according to the circuit diagram.
2. With the help of plier and stripper share the ends of wire of required length.
3. Connect the wire carrying the current to the central pin of the two-way switch.
4. Connect the remaining ends A and B to the corresponding other two way switch.
5. Connect the center pin wire of second two-way switch to the lamp.
6. Connect the second point to the neutral for completing the circuit.
7. Use PVC case wiring to cover expose wiring.
8. Switch ON and OFF the two switches alternatively to the bulb.

PRECAUTIONS:

1) Tools should be used carefully.

2) Fitting should be tightly fitted.

3) Connection should be tight.

4) Wire should be on the conduit, power gripped properly.

RESULT:

We have studied .

EXPERIMENT 4:

AIM

To study hose wiring.:

TOOL USED

Tenon saw screwdriver 8 cm (8”), Screwdriver 15(6”), connector Screwdriver,

Hammer, Plier drill machine, Try square, chisel, File, Poker knife.

MATERIAL AND QUATITY:

1) T.W Batten 19mm x 13mm 42m
2) T.W batten 13mm x 13mm 10m
3) CTS/ T.R.S wire 13/. 039(3/22) 250v
4) Batten holder 2 no.
5) Plug 3pin, 5amp 1 no.
6) Tumbler Switch one-way 5amp 3 no.
7) T.W round blocks (7.75cm x 2.5) 3 no.
8) T.W board 40 mm(1+1/2”)
9) Hink clip 40 mm(1/2”)
10) Wood Screw

THEORY:

This type of wiring is used in houses. The two terminal of supply are

connected to meter and other two terminals are joined to DPIC. One end is attached to

N-link of fuse is joined to switch board of a room and neutral pole is also connection to

switch board according to our need.

CIRCUIT DIAGRAM:

TYPES OF HOUSE WIRING:

1)

CLEAT WIRING

: - This is of wiring suitable only for temporary wiring purpose.

In lamp or wet location the wire used should be moisture proof and a weather proof.

2)

P.V.C OCNDUCT WIRING

:- This uses a conduit pipe for the mechanical

protection of wire. In this system of wiring, wires are carried through P.V.C conduit

pipe for giving converging to pipes conduit pipe has certain advantage like it is

moisture proof and durable.

3)

P.V.C CASTING WIRING

: -This type of wiring is mostly used for fixing cables

on a wooden structure called batten by means of metal. It is the surface wiring

system whenever wires are broken for connecting to switch on the right point

junction box made up of either part plastic or metal C.I must be used and provided same means of earthing.

4) P.V.C CASTING WIRING

: -This type of wiring is mostly used for indoor and domestic wiring carried through a P.V.C casing wiring

PROCEDURE:

1) Draw the tangent or wiring on the board with cholk.

2) Cut the required length of T.W batten file and link chips on then and file the batten with screw of 3mm size.

3) Cut the C.T.S wire in required length and put them on batten gripped by link chips or per circuit diagram.

4) Fix the T.W round blocks and board after drilling the holes for wire.

5) Fix the batten holder, 3-pin plug and switch on round block.

6) After completing wiring it should be checked before supplying current.

PRECAUTIONS:

1) Tools should be used carefully.

2) Fitting should be tightly fitted.

3) Connection should be tight.

4) Wire should be on the conduit, power gripped properly.

EXPERIMENT –5

AIM:

To study fuses, relays, MCBs, contactor, and circuit breakers, fluorescent tube light..

APPARATUS:

Different types of fuses, relays, MCBs panel, contactors, tube, tube base, starter, choke, and wire.

CONSTRUCTION:

Fluorescent tube is a low-pressure mercury vapour lamp. The lamp is in the form of long glass tube due to low pressure, with fluorescent powder coating to its inner surface. Tungsten filaments coated with barium oxide are placed at each side of the tube. The tube contains small amount of mercury with small quantity of argon gas at low pressure. When the temperature increases mercury changes into vapour form. At each end of the tube, electrode in spiral form is made of tungsten coated with electrons emitting barium. A capacitor is connected across the circuit to improve the power factor.

CIRCUIT DIAGRAM:

PROCEDURE:

1. Fix the tube holder and the choke on the tube base.

2. Phase wire is connected in the choke and neutral direct to the tube.

3. Fix the fluorescent tube between the holders.

4. Finally connect the starter in series with the tube.

PRECAUTIONS:

1) Tools should be used carefully.

2) Fitting should be tightly fitted.

3) Connection should be tight.

4) Wire should be on the conduit, power gripped properly

EXPERIMENT NO:6

AIM

To study the construction of D.C. machine

APPARATUS: D.C. machine assembly

THEORY:

D.C. Machine:

DC Machines are of two types:

1. D.C. motor
2. D.C. generator

Following are the main parts of D.C. machines:

1. Magnetic Yoke
2. Pole core and pole shoes
3. Pole coils
4. Armature core
5. Armature coils
6. Commutator
7. Brushes and bearings

D.C. Machine Construction Diagram

PROCEDURE:

The assembly of D.C. machine is observed and following parts are studied in detail

as described below

1.Magnetic Yoke: Magnetic Yoke serves the double purpose:

a) It carries the magnetic flux produced by the poles.

b) It provides the mechanical support for the pole and acts as a protecting

cover for the whole machine.

2.Pole Core & Pole Shoes: Pole core & pole shoes serve the following purpose:

a) Pole core spreads the flux in the air gap to reduce the reluctance of magnetic path

b) Pole shoes provide the support for the pole coils.

They are made up of thin laminations of steel with thickness 0.25mm to 1mm.

3.Pole Coils: Pole coils are made up of copper wire. These are placed on pole core.

4.Armature Core: It houses armature coils & causes them to rotate, hence cuts the flux produced by field winding. It is cylindrical & made up of laminations of approx 0.5mm thickness. It is keyed to the shaft laminations are used to reduce the eddy currents.

5.Armature Windings: These are usually former wound. Various conductors are placed in armature slots, which are lined with insulating material.

6.Commutator: The function of commutator is to collect the current from the armature conductors. It converts the a.c. of armature conductor into unidirectional current in external load. It is cylindrical structure with wedge shaped segments insulated from each other by thin sheets of mica. Number of segments is equal to number of armature conductors.

7.Brushes & Bearings: Brushes collect the current from commutator. They are made of

carbon & are of rectangular shape. Brush holder is mounted on spindle & brushes can slide. Ball bearings are used for less wear and tear.

DISCUSSION:

D.C. generator converts the mechanical energy in d.c. electrical output and D.C. motor converts the d.c. electrical input into mechanical energy output.

EXPERIMENT NO. 7

AIM:

To perform the speed control of D.C. shunt motor by:

- Field current control method
- Armature voltage control method

APPARATUS

: D.C. shunt motor ,ammeter ,voltmeter and rheostat

THEORY:

The speed of D.C. shunt motor can be controlled by two methods:

- By changing the field flux:

It can be done by connecting a rheostat in the field circuit of a motor .By varying the rheostat we can get the different values of field current or flux and hence different speeds of motor.

- By changing the armature voltage:

It can be done by connecting a rheostat in the armature circuit of a motor. By varying the rheostat we can change the armature voltage ,hence we get the different motor speeds.

CIRCUIT DIAGRAM:

PROCEDURE:

1 Connect the circuit as shown in the diagram.

2 Keep the armature rheostat to maximum and field rheostat to minimum value.

3 Switch on the D.C. supply and motor will start running at slow speed.

4 Note down the speed ,field current and armature voltage.

5 Repeat step4 for various positions of rheostat,till armature rheostat reaches to it's minimum value.

6 Now increase the field rheostat in steps and note down the readings as in step 4 till the field rheostat reaches it's maximum value.

7 Bring the field rheostat to it's maximum value and switch off the motor.

OBSERVATION TABLE:

RESULT:

The speed of the motor can be changed by field flux and armature voltage control method.

PRECAUTIONS:

1 All connections should be clean and tight.

2 Keep the position of armature and field rheostat at the required position .

3 The range of meters should be selected carefully .

4 The zero setting of meters should be checked before starting the experiment.

EXPERIMENT NO. 8

AIM

: To perform direct load test. On D.C shunt motor and D.C. series motor .

APPARATUS:

D.C. shunt motor ,D.C. series motor with brake arrangement ,ammeter, voltmeter and rheostat.

THEORY:

Brake test is carried out on a D.C. shunt motor and D.C. series motor to determine its parameters including efficiency.In this test a belt is wound round a pulley and two ends are attached to two springs.The force acting on pulley is equal to the difference between readings of two spring balances If R is the radius of the pulley and w1 and w2 are weights on two springs then shaft torque is given by :S

Shaft torque Tsh= (w1-w2)*R Kgm

Motor output Poutput=2*3.14*N*T*9.81/60 watts

Motor input= V*I watts

Efficiency= Poutput/Pinput*100%

CIRCUIT DIAGRAM:

PROCEDURE:

D.C. shunt Motor:

1 connect the circuit as shown in the figure

2 Apply rated voltage of 200v D.C. to the motor.

3 Increase the load on the motor slowly to it's full capacity.

4 Note down the reading of ammeter ,voltmeter,w1,w2 and diameter of pulley.

5 Using above formula calculate shaft torque,input power,output power and efficiency of the motor.

D.C. series motor:

1 connect the circuit as shown in the figure.

2 Apply some load on the motor.

3 Switch on the D.C. mains and start the motor.

4 Increase the load slowly to the rated value.

5 Note the readings of all meters, speed and both spring balances.

6 Remove the load slowly and switch off the motor.

7 Measure the diameter of pulley.

OBSERVATION TABLE:

RESULT:

The efficiency of D.C. shunt motor is = and D.C. series motor is =

PRECAUTIONS:

1 Increase the load on the motor slowly

2 While measuring RPM keep the tachometer in line with the pulley.

3 Take the readings of ammeter and voltmeter accurately.

4 Give a gap of some time between two tests to avoid overheating of motor.

5 Do not touch any naked connection of the circuit.

EXPERIMENT NO:9

AIM:

Star-Delta starting of three phase induction motor.

APPARATUS:

Three phase induction motor,star delta starter.

THEORY:

NEED FOR STARTER:

At the standstill the motor behaves as the short circuit secondary transformer and it draws heavy current from mains, which can cause the damages at the starting. It can cause the heavy drops in power line. So direct online starting of motor is not desirable. The motor has to be started at reduced voltage. For heavy duty motors some starting methods are used or resistance has to be included in the circuit at starting.

CIRCUIT DIAGRAM:

PROCEDURE:

Star Delta method of starting:

All the six terminals of stator winding are brought out and are connected as shown in Fig. In the starting the stator winding is connected in start and full voltage is applied across these terminals. The voltage of each phase is 1/3 of normal value. As the motor picks up the speed, the change over switch disconnects the winding of motor. Now it connects the winding in delta across supply terminals.

This method reduces the current taken by the motor to one third the current it would have drawn if it was directly connected in delta. However, the starting Torque is also reduced to one third. This method is cheap, but it should be used when high starting torque is not required like machine tools, pumps, motor generator etc.

DISCUSSION:

Star Delta method is a safe method for starting of induction motor as the inrush current in the starting is very high without the starter.This is due to the absence of back emf at the starting.

PRECAUTIONS:

1. Make sure that all connections are tight.
2. The connections should be according to circuit diagram.
3. Don’t touch the naked connection ,it may give shock.

EXPERIMENT NO. 10

AIM:

To perform the no load and block rotar test on a three phase induction motor.

APPARATUS:

Ammeter, voltmeter, two wattmeters, three phase variac

THEORY:

During the no load test full rating voltage of 440 v is applied to motor and the motor is run without load.During block rotor test the rotor is blocked by mechanical load and a small voltage just sufficient to full load current to flow is applied to motor.

Following observations are taken:

Power= v3 VoIoCos

Cos = Power /v3 VoIo

Iw =Io Cos

Iu=IoSin

Ro=Vo/Iw

Xo=Vo/Iu

Req=Pb/Ib2

Zeq= Vb/Ib

Xeq= v Zeq2-Req2

CIRCUIT DIAGRAM:

PROCEDURE:

No-load test:

- Connect the circuit as shown in the diagram.
- The variac should be at zero voltage and motor should be unloaded.

- Switch on the three phase a.c. supply.
- Start the motor at reduced voltage and slowly increase the supply voltage.
- Observe the direction of rotation and to reverse the direction of rotation change the phase sequence.
- Take the readings of all the meters.
- Increase the load on motor gradually and take the reading.
- Switch off the supply.

Block Rotar test:

- Block the rotar by mechanical load
- Slowly increase the voltage to allow the full rating current to flow.
- Take the readings of all the meters and calculate the parameters using above formulae
- Switch off the supply

RESULT:

The total power drawn by the motor is equal to the sum of two wattmeters readings

W=W1+W2

DISCUSSION:

The No load test and block rotor test is helpful in finding different parameters of the motor like Series and shunt parameters.

PRECAUTIONS:

- All connections should be neat and tight.
- Connecting leads should be perfectly insulated.
- There should be no error in ammeter and voltmeter.