Registration No.....

School of Electrical Skills
First Semester, End Term Semester Examination
Winter Semester, B. Voc. Program, Session: 2017-18

Course Code: ELE1001 **Time: 3 Hours**
Course Name: Construction Electrician – I **Max. Marks: 100**

Instructions: Answer all questions from section A, each question carries two marks. Answer any six questions from section B, each question carries five marks. Answer all questions from section C, each question carries ten marks.

Section – A

10x2=20 Marks

Q.1. (A) The colours of phase, neutral & earth wires in the house wiring are:
(a) Yellow, blue, Red (b) Red, Black, Green
(c) Red, Pink, Yellow (d) none of these

(B) The unit of frequency is:
(a) Hertz (b) KW (c) KVAR (d) KVA

Q.2. (A) The devices used for cutting the cables are:
(a) Combination pliers, cable cutter & knife (b) Pliers
(c) Crimping Tool (d) file

(B) Power in a three phase circuit is:
(a) $3V_{ph}I_{ph}\text{Cos}\,\emptyset$ (b) $\sqrt{3}\,V_LI_L\,\text{Cos}\,\emptyset$
(c) Both A & B (d) None of the above

Q.3. (A) In a Three phase, Delta Connection.....
(a) Line current is equal to phase current (b) Line voltage is equal to phase voltage
(c) Line voltage and line current is zero (d) None of the above

(B) A Diode is:
(a) Bilateral device (b) Liner Device (c) Non-Liner device (d) Passive device

Q.4. (A) What kind of material is being used for cable channel?
(a) PVC material (b) Aluminum (c) both a & b (d) CRGO

(B) The voltmeter is always connected in:
(a) Series of the load (b) Parallel to the load
(c) Series-Parallel (d) None of these

Q.5. (A) The ammeter has to be connected in electrical circuit:
(a) Parallel to the load (b) Series to the load
(c) Series-Parallel (d) None of these

(B) The unit of resistivity is:
(a) Ω (b) Ω - meter (c) Ω/ meter (d) $\Omega/\,m^2$

Q.6. (A) The material commonly used in Semiconductor devices:
(a) Silicon (b) Carbon (c) Germanium (d) both a & c

(B) In pure capacitive circuit the real power is:
(a) infinite (b) maximum (c) normal (d) zero

Q.7. (A) An ammeter should have..... Resistance

(a) Infinite (b) Very large (c) Very low (d) None of these

(B) Electrical measuring devices are:

(a) Cable, Switch, Socket (b) Pliers, Tong tester, Wire cutter

(c) Voltmeter, Ammeter, Tong Tester (d) None of these

Q.8. (A) What voltage is being preferred for domestic purpose in India.

(a) 120 V (b) 150 V (c) 220 V (d) 400 V

(B) Rheostat is:

(a) Adjustable Resistor (b) Adjustable Capacitor

(c) Adjustable Inductor (d) None the these

Q.9. (A) Which is an active source of energy?

(a) Voltage source (b) current source (c) Both A & b (d) None of these

(B) Rating of Sockets are:

(a) 2A, 5A, & 15A (b) 3V, 5V, & 15V (c) 6A, 16 A (d) None of these

Q.10. (A) Kilowatt is unit of electric:

(a) Energy (b) Power (c) Work (d) none of these

(B) The potential of earth is:

(a) high (b) low (c) zero (d) none of these

Section – B 6x5=30 Marks

Answer any six questions.

Q.1. Differentiate between single phase and three phase connection.
Q.2. Write the name of all the PPEs.
Q.3. Why the earth pin of the plug is always made longer & thicker in comparison to phase and neutral wire pin?
Q.4. Write the advantages of Safety shoes for an Electrician.
Q.5. What do you understand by measuring devices?
Q.6. Differentiate between conducting and insulating materials with examples.
Q.7. What do you mean by open and short circuit in any electrical circuit?
Q.8. What are the advantages of earthing?

Section – C 10x5=50 Marks

Answer all the questions.

Q.1. Explain the function of a diode with its application.
Q.2. Explain the working of common tools used by an electrician.
Q.3. What are the advantages and disadvantages of conduit wiring?
Q.4. Define the main parts of drill machine and their applications.
Q.5. Explain the working principle of Tube-Light with circuit diagram.

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Solutions

Section A

1. (A)	b	(B)	a
2. (A)	a	(B)	c
3. (A)	b	(B)	c
4. (A)	c	(B)	b
5. (A)	b	(B)	b
6. (A)	d	(B)	d
7. (A)	c	(B)	c
8. (A)	c	(B)	a
9. (A)	c	(B)	c
10. (A)		(B)	c

Section B

Ans1: Single phase power :-

i) Used in most homes and small business.
ii) Able to supply ample power for most smaller customer including homes & small non-industrial business.

Three phase power

i) Common in large business as well as industr & manufacturing around the global.
ii) Increasing popular in power hungry high densit data centre.
iii) Highly efficient for equipment to run on 3-phase.

2. Personal Protective equipment refers to protective clothing, helmets, goggle or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment includs physical electrical, heat - chemicals etc.

Main PPEs used by electricians are

(i) Protective clothing → Protects the body from hazards substance like hot oil, water, welding spark etc.

(ii) Helmet → Most important part of human body is head. it needs almost protection which is provided by a hard plastic helmet.

(iii) Safety shoes → Made of hard metal.

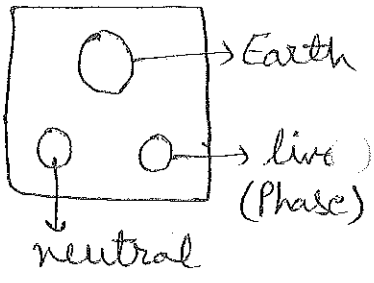
(iv) Safety hand gloves.

(v) Goggles → used for eye protection.

(vi) Face Mask.

(vii) Chemical suit.

3. The earth pin is bigger in cross-section in comprassion to line are neutral.



The main fact is that

$\Rightarrow R = \frac{\rho l}{A}$ $\Rightarrow R \propto \frac{l}{A}$ or $R \propto \frac{1}{A}$

Since in case of any earth fault with respect to the equipment it has to pass through least resistance path so this reason area of cross section made thicker so, as the area of cross section increase the resistance decrease and we are provides an easy path

for earth fault current to flow.

The following are the advantages of using thick & long earth wire.

i) It does not allow in correct plugging in a three pin Socket.

ii) It provide the sufficient contact area with the hollow pin of the socket which reduce the contact resistance of earth wire.

iii) While plugging in the earth wire makes earlier contact to the socket as compared with other two; thus the metallic body of the appliances makes contact with the earth energising similarly. When removing from the socket it losses its contact atleast.

Ans:-

i) Protect from falling & flaying objects.
ii) Protect from the punctures.
iii) Protect from cutting hazards.
iv) Protect from electrical hazards.
v) Prevents burns
vi) Protects from extreme weathers.
vii) Prevent slip trips & falls.

Ans5. A measuring device is used for the measuring the physical quantity. In the physical science quantity assurance and engineering measurement is the activity of obtaining & comparing physical quantities of real world objects & events.

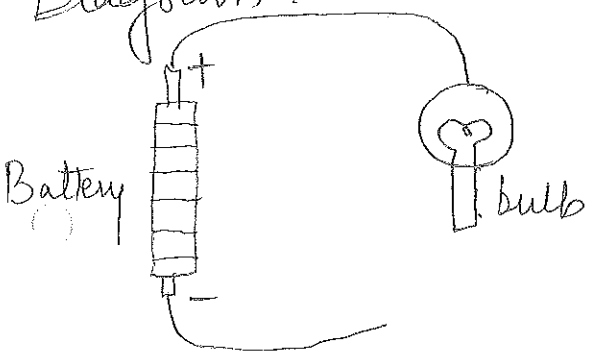
Ans6

Conducting Materials	Insulating materials
i) These material can pass electricity through them.	i) These materials can't pass electric current through them.
ii) Conductors are materials that allow free flow of electrons from one atom to another.	ii) Insulator wanted not allow free from electrons from one atom to another.
iii) Materials that are good cond^{o} generally have high conductivity.	iii) good insulating materials usually have low conductivity.
iv) Example :- Copper, aluminium, silver iron.	iv) Example :- Rubbers, Glass, plastic, pure water

Ans7:- open circuit :-

An electric circuit in which the normal path of current has been interrupted either by the disconnection of one part of the conducting path way from another.

Diagram :-

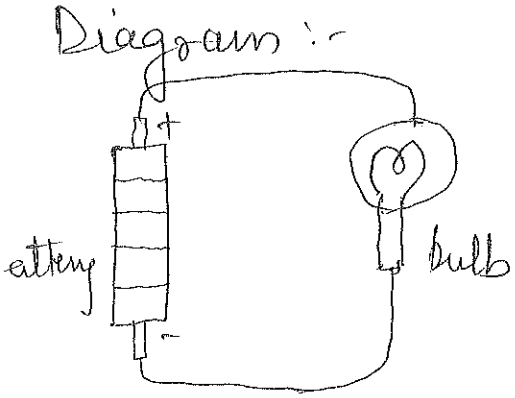


(open circuit)

→ Short Circuit :-

Close circuit means a complete electrical connection around which current flow or circulate.

Diagram :-



Short circuit

Ans 8 :-

i) Reduced phase to earth fault.

ii) Limited over voltage by using the earthing.

iii) Limited hazards caused by arcing grounds and a low level of fault ground current.

iv) will get general safety to personal and the equipment due to operation of the fuses.

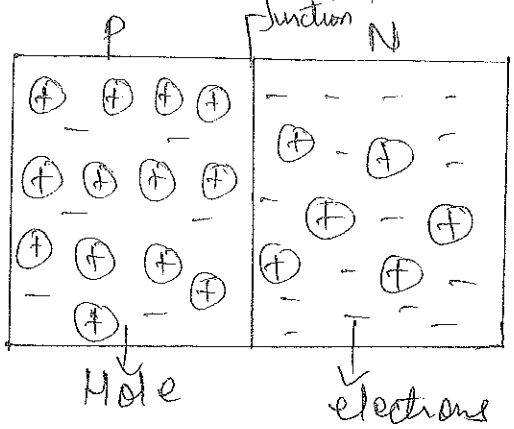
v) It will be stable neutral point.

vi) Life of the insulation will increase.

vii) Over voltage due to sudden lightning will discharge to the earth.

Section - C

Ans1:- When we combine P type & N type - Semiconductor materials together by some appropriate scheme like ions implementation or diffusion then P-N junction diode is formed properly. P-N junction will be having P-type on one side and N-type on another side.

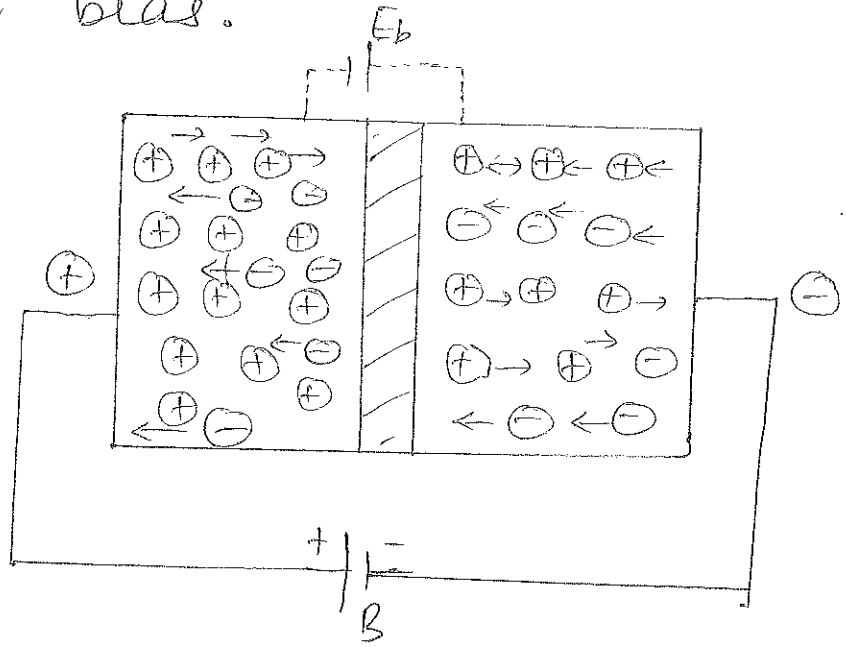


Working :-

Forward bias :-

We apply some external voltage to the diode through the external battery B, by connecting its anode to P end and cathode to N end. Then this applied voltage oppose the barrier voltage if this applied voltage is more than the barrier voltage the free electrons in the N-type will move towards the P-type and holes in the P-type will move towards N-type.

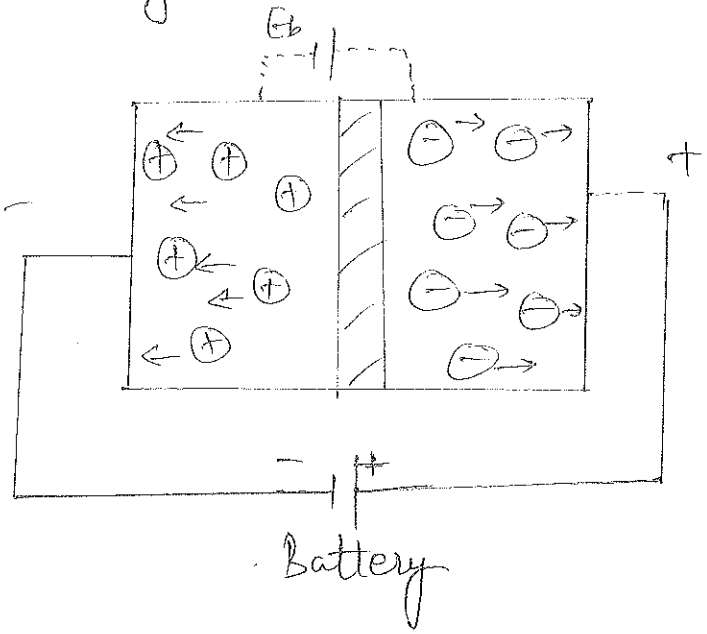
So a current which is called the forward current will flow in the P-N junction diode and this applied external voltage that force the electrons and holes in the P-N junction to move towards the junction is called forward bias.



Reverse bias :-

The external battery is connected in such a way that anode of the battery is connected N type and cathode to P type. Then in case of applied voltage B is in the same direction of the potential barrier Eb. And hence add the battery voltage. The hole in the P type move towards the cathode of the battery & electrons in the N-type & moves towards anode

This it will prevent the flow of forward current in the P-N junction, resulting in the high resistance at the junction such applied external voltage is known as reverse bias.



Applications :-

1. Conversion from AC to DC.
2. For rectifiers.
3. In DC motor for traction purpose.

Ins2 :- Basic Hand tools

1. Pliers
2. wire stripper
3. Screw driver
4. Hammer
5. knife
6. Hacksaw

1. Pliers:-
These are used for small cond^{r} cut & hold & pull the cond^{r}.

2. wire strippers:-
These are used for primarily remove the insulation from the cond^{r}.

3. Screw Drivers:-
These are used to tighten & loosen screws & install and remove slot head screws.

4. Hammer:-
It is used to drive and pull nails or staples break wall board & strikes.

5. knife:- The knife can be used to open the card board boxes containing electrical equipments and to strip insulation from large cond^{r} & Cables.

6. Hacksaw:-
A Hacksaw is generally used to cut some type of conduit and is also used to cut large cond^{r} or Cable.

Ans:- Advantages of Conduit wiring :-

1. It has a long life.
2. No risk from electrical shock
3. It is a waterproof system.
4. Maintenance is easy.
5. There is no chance of fire.
6. It will not support to combustion.

Disadvantages :-

1. It is difficult to install.
2. Fault finding process is very difficult.
3. More time is required to install this wiring system.
4. It is costly system.
5. Risk of mechanically injury is possible.

Ans:- Main parts of Drill Machine :-

1. Drill bit
2. Torque selecting ring.
3. ON/OFF trigger
4. Forward/reverse switch.

1. Drill bit :-

It is cutting tool used to remove material to create holes, almost always of circular cross-section.

Drill bit comes in many size & shapes.

2. Torque Selecting Ring :-

A tool with torque control with have an adjustable torque control ring which allows you to pre-set a maximum level of torque for your task.

3. ON/OFF Trigger :-

For supply ON/OFF in drill machine.

4. Forward/Reverse Switch :-

Forward switch is used to running the drill bit at forward direction.

Reverse switch is used to running the drill bit at reverse direction.

Ans5: A lamp is a device for converting electrical energy into light energy.

There are many types of lamps. like,

Fluorescent tubes operate on the "discharge" principal that is the excitation of a gas in glass tube, that are cooler in operation & very efficient in converting electricity into light.

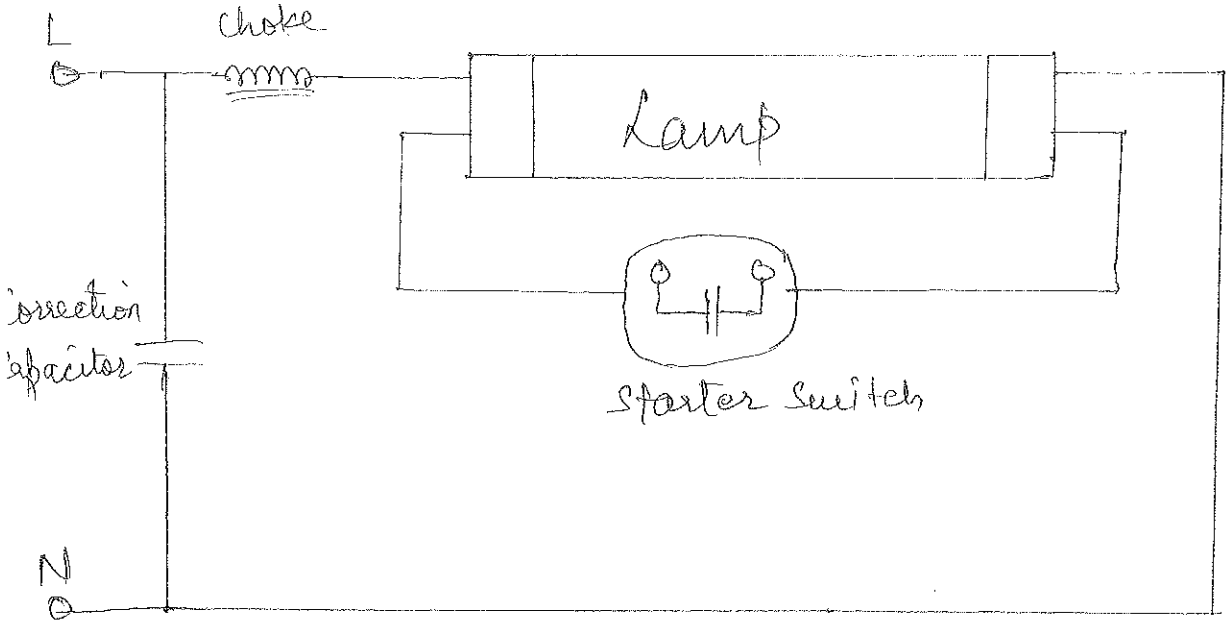
My form the basic principal of most energy efficient lamps.

A fluorescent lamp is a linear arc tube - internally coated with a fluorescent powder containing low pressure mercury vapour & argon gas.

Using a current through the electrodes of the tube produce a cloud of electrons that ionised & mercury vapour & the argon gas in the tube producing invisible ultra violet light & some blue light.

The fluorescent powder on the inside of the glass tube is very sensitive to ultra violet rays & convert these radiation into visible light.

Circuit diagram :-



:- Tube Light :-

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Course Name: Electrical Technician **Max. Marks: 100**

Instructions: Answer all questions from section A, each question carries two marks. Answer any six questions from section B, each question carries five marks. Answer all questions from section C, each question carries ten marks.

Section – A

10x2=20 Marks

Q.1. (A) Which of the following is non-renewable energy?

(a) coal (b) Solar (c) Wind (d) Tidal

(B) Which of the following is renewable energy?

(a) Solar (b) Biomass energy (c) Geothermal (d) all of these

Q.2. (A) What is the unit of Electrical energy?

(a) Watt/second (b) watt (c) Joule/second (d) KWH

(B) Capacitor does not allow the sudden change of:

(a) Current (b) Voltage
(c) Power (d) None of the above

Q.3. (A) The earth, sea water and human body are all conductors of electricity.

(a) True (b) False (c) none of these

(B) Which tool is being used by an Electrician to check the supply?

(a) Phase tester (b) combination plier (c) hand (d) cutter

Q.4. (A) The current is defined as:

(a) flow of charge (b) rate of flow of charge

(c) Storage of charge (d) flow of magnetism

(B) EMF stands for:

(a) Electronic motive force (b) Electrical motion force

(c) Electro motive force (d) Electro moving force

Q.5. (A) All the lights and fans in house are connected in:

(a) Series (b) parallel (c) both a & b (d) None of these

(B) The full form of MMF is:

(a) Magneto motive force (b) Magnetic moving force
(c) Magnetic motion force (d) Magnet motion force

Q.6. (A) Which of the following are the passive elements?

(a) Resistor (b) Bulb
(c) Both a & b (d) None of these.

(B) Which of the followings are active element?

(a) Voltage source (b) Current source
(c) Both a & b (d) None of these

Q.7. (A) Transformer is a device:

(a) Static (b) Rotating (c) both a & b (d) None of above

(B) Capacitor does not allow sudden change of:

(a) Current (b) Voltage
(c) Power (d) None of the above

Q.8. (A) Internal resistance of ideal voltage source is:

(a) Zero (b) Infinite
(c) Finite (d) 100 ohms

(B) Inductor does not allow sudden change of:

(a) Current (b) Voltage
(c) Power (d) None of the above

Q.9. (A) The resistance offered by a diode, when it is reverse-biased, is:

(a) Zero (b) Low
(c) High (d) Infinite

(B) Ratio of active power to power factor is:

(a) Apparent power (b) Power factor angle
(c) Power factor (d) None of these

Q.10. (A) Capacitors for P.f correction are rated in:

(a)KW (b)KVA
(c)KV (d)KVAR

(B) In pure capacitive circuit, the real power is _____.

(a)Infinite (b) Maximum
(c) Normal (d) Zero

Section – B **6x5=30 Marks**

Answer any six questions.

Q. 1. What are the advantages of Renewable Energy Technology?
Q. 2. What are the safety precautions taken during electric shock?
Q. 3. Define series & parallel circuit.
Q. 4. On what factors does the resistance of a substance depend? Give formula for it.
Q. 5. Describe Faraday's law of electromagnetic induction?
Q. 6. What are the advantages of AC over DC?
Q. 7. What is basic principle of induction motor?
Q. 8. Explain relationship between line current, line voltage, phase current and phase voltage for
(a) Star connection (b) Delta Connection

Section – C **5x10=50 Marks**

Q. 1. Define the following laws:
(a) Flemings left hand rule (b) Ohm's law (c) KCL (d) Flemings right hand rule
Q. 2. Explain the difference between magnetic circuit and electrical circuit with diagram.
Q. 3. With a neat diagram explain the working principle of Transformer.
Q. 4. Derive e.m.f. equation of Transformer.
Q. 5. A group of 3 parallel resistance R_1, R_2, & R_3 each of 12 Ω connected in series with another group comprising of three resistance in parallel, their values being 4, 4 and 2 Ω. If a 100 V supply is applied across the circuit, what is total current in circuit?

Solution → ELE1002 Electrical Technician

Section - A (Electrical Technician)

Ans (A)
1 (a) Coal
(B) d

2 (A) d
(B) b

3 (A) a
(B) a

4 (A) b
(B) c

5 (A) b
(B) a

6 (A) c
(B) c

7 (A) a
8 (B) b

8 (A) a
(B) a

9 (A) c
(B) a

10 (A) d
(B) d

Section - B

Ans ① Advantages of green energy technology are -

① Green Energy - Environment friendly

Fossil fuels (which are non renewable energy source and which release harmful substance such as CO_2 when burned), renewable energy source have a very low impact on the environment. In fact, most of them are are positively environmentally friendly.

② Sustainable Energy - limitless supply.

Because they do not run out or as a loss, renewable energy source are sustainable. This makes them viable for use well into the future.

③ low operating cost.

Once they have been setup, renewable energy apparatus such as wind-farm and solar panels, are very cost effective to use & operate. They are rile and cheap source of energy.

④ Integrated in daily life

Renewable energy sources can be use in our daily life, they do not harm. for Eg. Cows can graze in the same field as wind turbine are at work; and solar panel can be placed on the roof of a family home.

⑤ Able to be Stored.

Renewable Energy source can be Stored Easily for Eg. Solar Energy can be Stored in the battery of 24V and more.

Ans (2). Safety precaution are:-

① ~~Call to 108~~

① Separate the person from the current source. Turn off power and unplug the switch.

② Call to ambulance (108)

③ Do CPR (Cardiopulmonary resuscitation), if necessary.

If the person is not breathing or does not have a pulse then start CPR.

④ Check for other injuries

If the person is bleeding, apply pressure and elevate the wound and burn surface is treating by supplying continous water on it.

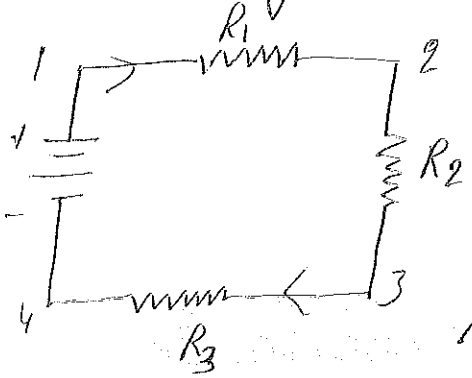
⑤ wait for 108 to Arrive.

⑤ Follow up

Admit to the hospital and An an ECG, blood test, CT Scan, MRI may be necessary.

Ans (3) Series Circuit

All components are connected end to end to form only one path for electrons to flow through the circuit.



Series Circuit

(4) → 2 × 2

$(8)^{\frac{2}{3}}$

$\sqrt{4}$

$\frac{1}{2} \div \frac{\sqrt{3}}{2}$

$\frac{1}{2} \times \frac{2}{\sqrt{3}}$

Sin

Cos

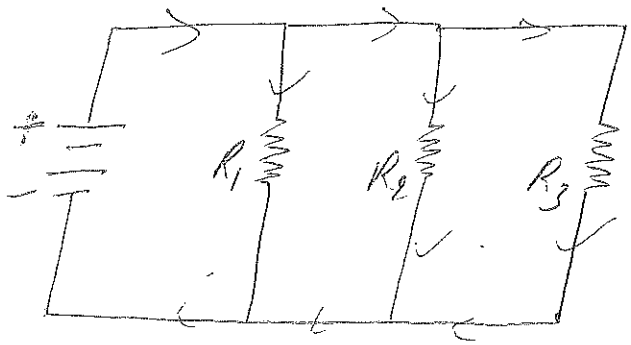
tan

Cot

Sec

Cosec

(3). Parallel Circuit, All Components are Connected between the same two sets of Electrically Common points, Creating Multiple paths for Electrons to flow from one end of the battery to the other.



Series Circuit	Parallel Circuit
(I) Voltage drop Equal to total Voltage	(I) Voltage Same for all Component
(II) Same Current for all Component	(II) Branch Current add to Equal total Curr

Ans (4) The resistance of any Substance depend on the following factor :-

(I) The resistance of a Substance depend on its length

(2) The resistance of a Substance depend on its area of Cross-Section

Formula is :- $R = \rho \frac{l}{A}$

where R = Resistance

ρ = Resistivity

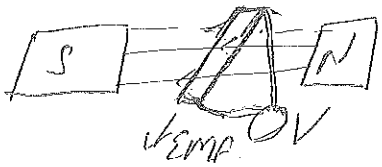
l = length

A = Area of cross Section.

Ans (5) Faraday law of electromagnetic Induction are :-

(I) first law state that whenever a Conductor are placed in a varying magnetic field EMF are induced are called induced EMF. If the Conductor ckt are closed current are induced called induced current

Second law State that the induced emf is Equal to the rate of change of flux linkages (Flux linkage is the product of turn, n of the Coil and flux associate with it.



Rate of change of flux linkage = $\frac{N d\phi}{dt}$ wb/sec.

Induced EMF = $e = -N\frac{d\phi}{dt}$

negative sign shows that the dir^n of induced current is such that the magnetic field produce by it will oppose the very cause produce it.

Ans (6) Adv of AC over DC are:-

(1) AC Electrical distribution System can Easily allow changes in voltage using transformer

By using transformer, AC power can be change upto very high voltage for transmission and then changed down again to safer voltage for Consumer to use which comparatively very much less of power then DC.

(2) AC has less Copper loss (More heating Effect) than DC and it is Easier and cheaper to produce too.

(3) In AC, It is Continously change with time but DC does not change

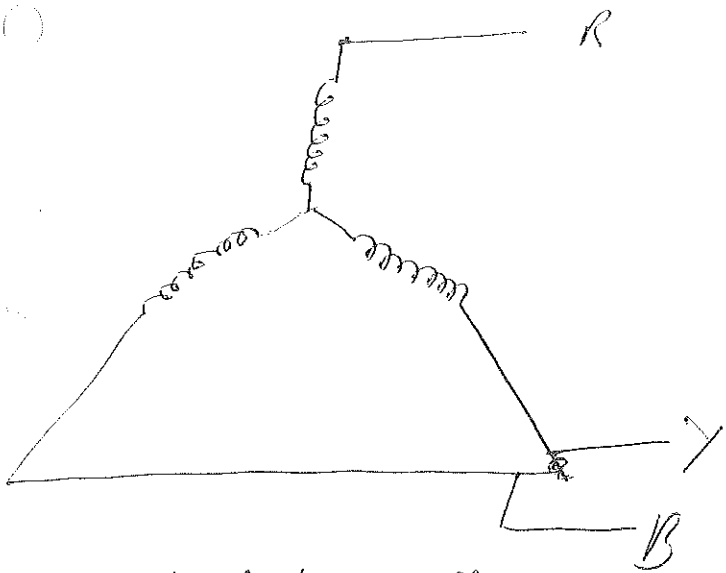
Ans(7) Basic principle of induction motor.

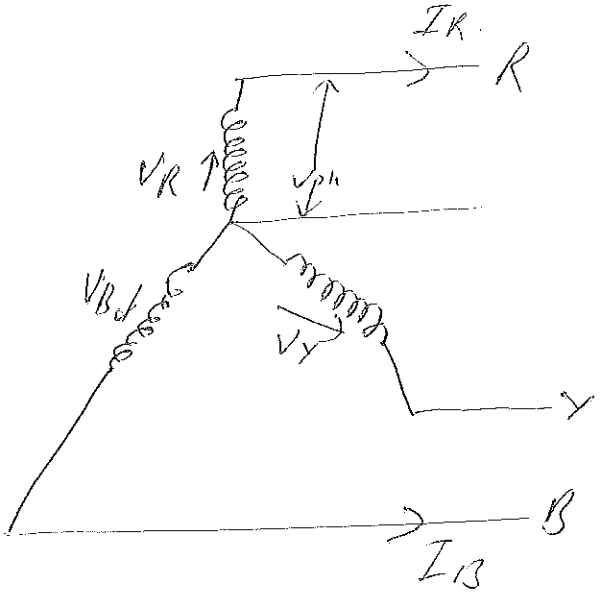
"In an induction motor only the Stator winding is fed with an AC supply. Alternating flux is produced around the Stator winding due to AC supply"

OR.

When a current carrying Conductor placed in a magnetic field it feels a force which rotate the rotor and electrical energy is converted into magnetic energy.

Ans(8) (a) Star Connection





In balanced cond^n in Star Connection

$$V_R = V_Y = V_B = V_{ph}$$

In Star Connection current is same as phase current.

So $I_R = I_Y = I_B = I_L$

where I_R is line current of R phase

I_Y is line current of Y phase

I_B is line current B phase.

So phase current is same as line current.

So $I_R = I_L = I_B = I_L = I_{ph}$

for Voltage in Star Connection

From diagram.

$V_{RY} = V_R + (-V_Y)$

$V_{YB} = V_Y + (-V_B)$

$V_{BR} = V_B + (-V_R)$

* Angle bet^n V_R and V_Y is 120°
* Angle bet^n V_R and $-V_Y$ is $180° - 120° = 60°$ (Electrical)

So $V_L = |V_{RY}| = \sqrt{V_R^2 + V_Y^2 + 2V_R V_Y \cos 60°}$

$= \sqrt{V_{ph}^2 + V_{ph}^2 + 2V_{ph}V_{ph} \times \frac{1}{2}}$

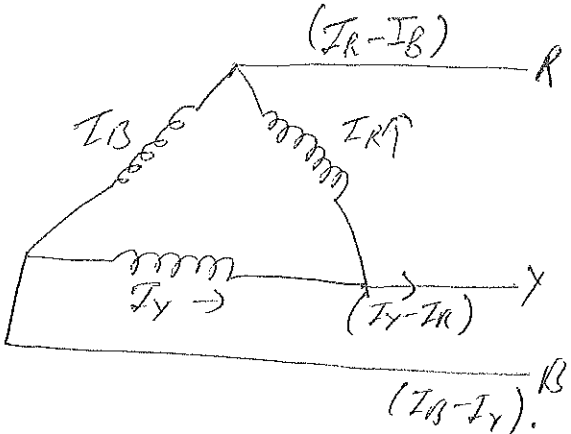
$= \sqrt{3}\, V_{ph}$

So $\boxed{V_L = \sqrt{3}\, V_{ph}}$

$\boxed{I_L = I_{ph}}$

So Power = $\boxed{V_{ph} I_{ph} \cos\phi = \frac{V_L}{\sqrt{3}} I_L \cos\phi}$

(b) For Delta Connection.



So Voltage in Delta Connection are -

There is some angle difference between R, & R & Y, Y & B is 120

So $V_R = V_{YB} = V_{BR} = V_L$

Then

$V_L = V_{ph}$

In delta Connection the line voltage is Equal to phase voltage.

For line current & phase current in delta connection.

$$I_1 = 2 I_{ph} \cos\left(\frac{60^\circ}{2}\right)$$

$$= 2 I_{ph} \left(\sqrt{3}/2\right)$$

$$= \sqrt{3} I_{ph}$$

$$I_2 = I_1 = I_3 = I_L = \sqrt{3} I_{ph}$$

$$\text{So } P = \sqrt{3} \times V_L \times I_L \times \cos\phi$$

$$P = 3 \times V_{ph} \times I_{ph} \times \cos\phi .$$

Section – C

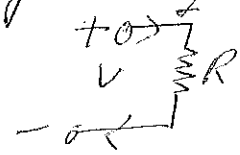
Ans 1 (a) Fleming left hand rule.

"Whenever a current carrying conductor is placed in a magnetic field it experiences a force due to the magnetic field. The direction of force acting on the conductor can be found out by Fleming left hand rule. The middle finger points in the direction of current". It is used for Electric Motor.

(b) Ohm's law

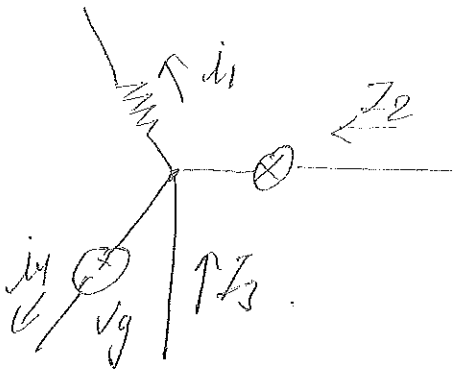
"Ohm's law state that the current through a conductor between two point is directly proportional to the voltage across the two point"

$$\boxed{I \propto V} \qquad I = \frac{V}{R}$$



where I = Current in Ampere R = Resistance in ohms.
V = voltage in volt

(c) KCL → Kirchoff Current law.



"The algebraic Sum of Currents in a network of Conductor meeting at a point is Zero"

At any node (Junction) in an Electrical Circuit, the Sum of Currents flowing into that node is Equal to the Sum of Currents flowing out of that node.

$$\sum_{k=1}^{n} I_k = 0 .$$

Ans

(d) Flemings Right hand Rule. (For Generator). Shows the direction of induced Current.

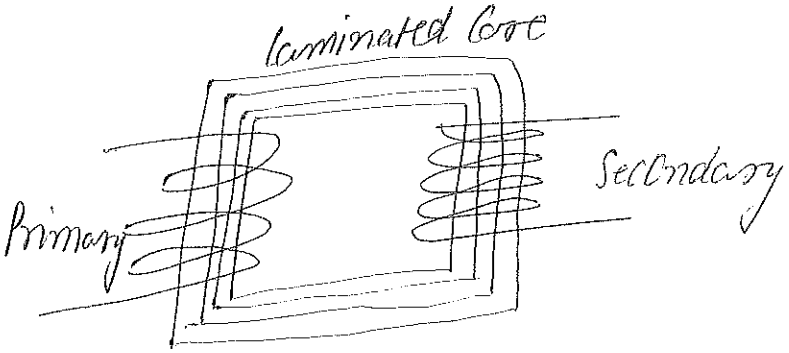
"When a Conductor (such as a wire attached) to a Circuit moves in a magnetic field, an Electric Current is induced in the wire due to Faraday law of induction"

Ans (e)

Magnetic Circuit	Electric Circuit
1) The closed path for magnetic flux is called magnetic Circuit	The closed path for electric Current is called Electric Circuit
2) Flux = $\frac{mmf}{Reluctance}$	Current = $\frac{EMF}{Resistance}$
3) The Flux is measured in weber (wb)	Current I is measured in amperes.

Law (4) Kirchhoff flux and MMF law	KVL and KCL
Magnetic lines of flux start from North pole and ends at South pole	Electric lines of current start from positive charge and ends on negative charge.
(5) Non magnetic material like air, rubber, glass etc.	perfect insulator like glass, air, rubber, PVC.
Permeability	Conductivity
Reluctivity	Resistivity
Flux density $B = \frac{\Psi}{A} = \frac{Wb}{m^2}$	Current density $E = \frac{V}{d}$
Permeance $= \frac{1}{\text{reluctance}}$	Conduction $= \frac{1}{\text{resistance}}$

Ans (3) Diagram and working principle of Transformer are:-



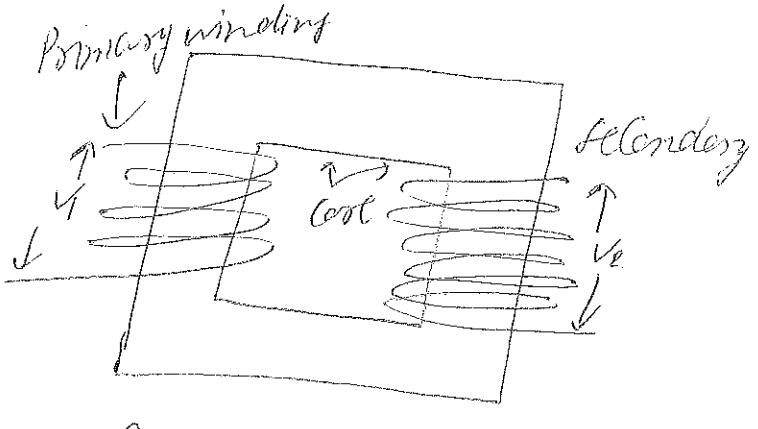
"According to Faraday's laws of Electromagnetic induction, there must be an EMF induced in the second. If the circuit of the later winding is closed, there must be an current flowing through it."

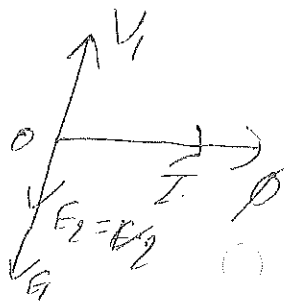
OR

"When a current in the primary coil is changed, the flux linked to the secondary coil also change. An EMF is induced in the secondary coil due to faraday's law of Electromagnetic induction

Ans(1). E.M.F. Equation of transformer

If N





Let N is Number of turns in a winding

ϕ_m is the maximum flux in the core in weber (Wb)

According to faraday law of Electromagnetic induction

$$\text{EMF}, \quad e = -N \frac{d\phi}{dt}$$

Instantaneous

ψ is Alternating flux

so $\phi = \phi_m \sin 2\pi f t$

Hence $e = -N \dfrac{d(\phi_m \sin 2\pi f t)}{dt}$

$$e = -N \phi_m \cos(2\pi f t) \times 2\pi f$$

$$e = -N \phi_m \times 2\pi f \cos(2\pi f t)$$

If $\cos(2\pi f t) = 1$ at maximum value.

$$E_m = N \phi_m \times 2\pi f.$$

E.M.F. Eqn of transformer

Max Induced EMF

$$E = \frac{2\pi}{\sqrt{2}} \times \phi_m f N = 4.44 \phi_m f N \text{ volt}$$

fo Voltage

This is EMF Equation of transformer

$$\boxed{E = 4.44 \phi_m f N \text{ Volt}} \quad \left(\frac{2\pi}{\sqrt{2}} = 4.44\right)$$

If E_1 & E_2 are primary & secondary EMF

N_1 & N_2 are primary and secondary turns

fo Voltage ratio is

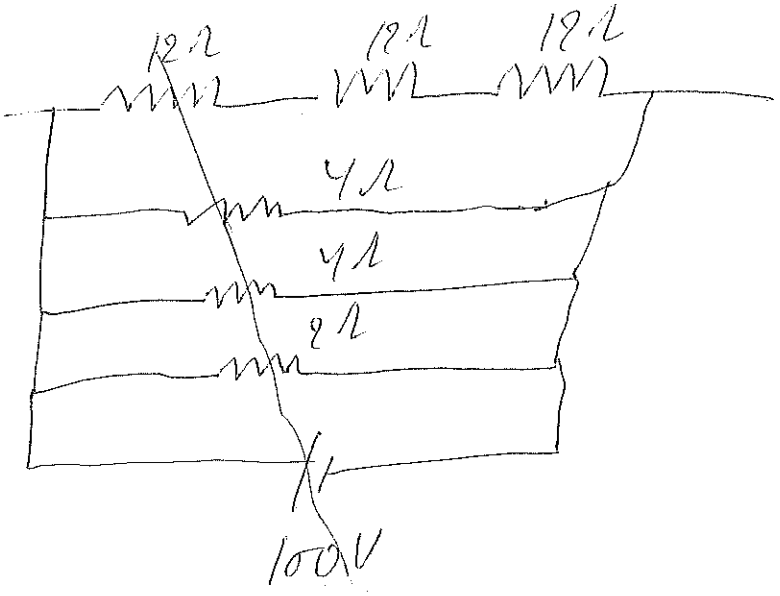
$$\frac{E_1}{E_2} = \frac{4.44 \phi_m f N_1}{4.44 \phi_m f N_2}$$

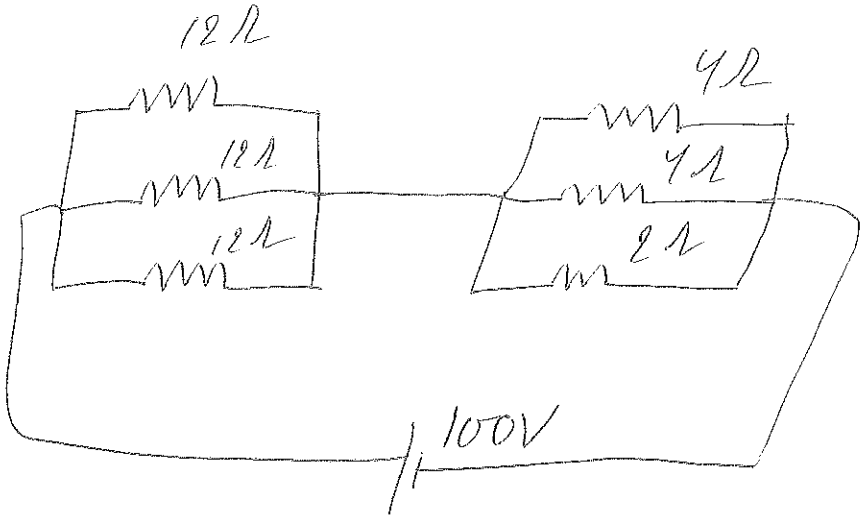
$$\boxed{\frac{E_1}{E_2} = \frac{N_1}{N_2}}$$

Ans (9) 3 parallel Resistance R_1, R_2, R_3 Each of 12Ω.

In 4Ω, 4Ω, 2Ω

Voltage = 100 Volt.





$\frac{1}{12} + \frac{1}{12} + \frac{1}{12}$

$\frac{1+1+1}{12} = \frac{3}{12} = \frac{1}{4}$

$\frac{1}{4} + \frac{1}{4} + \frac{1}{2}$

$\frac{1+1+2}{4} = \frac{4}{4} = 1$

$4\Omega \quad + \quad 1\Omega$

series $= 5\Omega$

$R = 5\Omega$

$V = 100V$

$I = \frac{V}{R} = \frac{100}{5} =$ 20 Ampere.

Registration No.....

School of Electrical Skills

First Semester, End Term Semester Examination

Winter Semester, B. Voc. Program, Session: 2017-18

Course Code: ELE1003 **Time: 3 Hour**

Course Name: Maintenance Technician Electrical **Max. Marks: 100**

Instructions: Answer all questions from section A, each question carries two marks. Answer any six questions from section B, each question carries five marks. Answer all questions from section C, each question carries ten marks.

Section – A **10x2=20 Marks**

Q. 1. (A) A Bird sitting on the conductor of a 3 Ø supply will:

(a) get shock (b) will not get shock (c) get burns (d) none of these

(B) The full form of MCB is:

(a) Miniature current breaker (b) Miniature control breaker

(c) Miniature circuit breaker (d) Moulded circuit breaker

Q. 2. (A) What is the full form of MCCB?

(a) Moulded current circuit breaker (b) Moulded case circuit breaker

(c) Moulded circuit current breaker (d) Miniature current circuit breaker

(B) What is the full form of RCD?

(a) Residual current device (b) Resistance current device

(c) Residual care device (d) Resistance care device

Q. 3. (A) What are the combination of resistance?

(a) Series (b) Parallel (c) Series-Parallel (d) None of the above

(B) What happens if we throw water on electrical equipment which is already on?

(a) Dangerous (b) Fire Vanishes (c) Both a & b (d) None of these.

Q. 4. (A) Apparent power in AC system is:

(a) Product of voltage and current

(b) Product of rms voltage and rms current

(c) product of voltage and current at no load

(d) product of voltage and current at full load

(B) Inductor does not allow the sudden change of:

(a) current (b) voltage (c) power (d) none of the above

Q. 5. (A) What is the full form of PPEs?

(a) Private protective equipment (b) practical protective equipments

(c) personal protective equipment (d) personal private equipment

(B) Which of the following instruments should be connected in series connection?

(a) voltmeter (b) Ammeter (c) Wattmeter (d) Energy meter

Q. 6. (A) What is the full form of PVC?

(a) ply viscous chlorine (b) poly vanity care

(c) poly vinyl chloride (d) poly vender chrome

(B) Which colours should never be used for a phase wire?

(a) Yellow-blue (b) Green – black (c) Black – red (d) Green – blue

Q. 7. (A) What should cross section area of the wire for 25A current rating to be preferred.
(a) 2 mm^2 (b) 4 mm^2 (c) 10 mm^2 (d) 6 mm^2

(B) Which of the following are active element?
(a) current source (b) voltage source (c) both a & b (d) None of these

Q. 8. (A) In our country power is generated at the frequency of:
(a) 60 cycle/sec (b) 50 cycle/sec (c) 200 cycle/sec (d) 100 cycle/sec

(B) The On/ Off switch in the house wiring is always connected in:
(a) phase (b) neutral (c) earth (d) none of the above

Q. 9. (A) Thin laminations are used in electrical machines in order to reduce:
(a) Hysteresis loses (b) Eddy current losses (c) both a & b (d) Copper losses

(B) The core flux in transformer mainly depends on:
(a) supply voltage and frequency (b) supply voltage and load
(c) supply voltage (d) supply voltage frequency and load

Q. 10. (A) In pure capacitive circuit, the average power is:
(a) maximum (b) Infinite (c) Zero (d) Normal

(B) The colours of phase, neutral & earth wire in the house wiring are:
(a) red, black, green (b) yellow, blue, red
(c) red, pink, yellow (d) none of the above

Section – B 6x5=30 Marks

Answer any six questions.

Q. 1. What are the fundamental concepts of safety? Also explain need of safety.
Q. 2. What precautions you should take while:
(a) Using a ladder (b) House on fire (c) mixing acid and water
(d) working on the pole (e) working on electrical appliances
Q. 3. Identify the symbols.

(i) (ii) (iii) (iv) (v) (vi)

Q. 4. What precautions an electrician should take in handling tools?
Q. 5. Give the symbol and unit of following quantities:
(a) R (b) L (c) C (d) Time (e) frequency (f) Force (g) Power (h) Current
(i) mass (j) Voltage (k) Speed (l) Active Power
Q. 6. State the concept of 5S.
Q. 7. Define circuit breaker, what are the types of different circuit breakers and list out the three condition that cause a circuit breaker to trip?
Q. 8. If the circuit's voltage remains constant and resistance increases, then what will happen to the current?

Section – C 5x10=50 Marks

Q. 1. Define the conductor, semiconductor, and insulator with examples.
Q. 2. List the steps to be taken to give the first-aid treatment to the electrician after electrical shock.
Q. 3. How an ammeter and voltmeter connected in circuit explain with a neat diagram?
Q. 4. Define power factor. What are the disadvantage of low power factor and how to improve it?
Q. 5. Explain both the Kirchhoff's laws with examples.

Solution - ELE1003 Section - A (maintenance Technician (Electrical) (1)

Q - 1 => A → (B)
B → (C)

Q - 2 => A → (B)
B → (A)

Q - 3 => A → (C)
B → (A)

Q - 4 => A → (B)
B → (A)

Q - 5 => A → (C)
B → (B)

Q - 6 => A → (C)
B → (B)

Q - 7 => A → (D)
B → (C)

Q - 8 => A → (B)
B → (A)

Q - 9 => A → (B)
B → (D)

Q - 10 => A → (C)
B → (A)

Ans 5. (a) R →  unit Ω (ohm)

(b) L →  H (Henry)

(c) C → (Farad) F

Section B

Ans 1. ★ fundamental concept of safety are given below:-

(a) learn safe ways of doing your job.

(b) Always think safety and Act safely.

(c) follow safety Rules which are meant only for your protection

(d) Report to your sepesior in any kind of unsafe condition or Act.

(e) Report to your superior in kind of injury, however, small it may be.

★ Needs of Safety:-

(a) for safety of human life

(b) to prevent injury of human body.

Ans 2. (a) Using a ladder :- Ladder must be held by another person on the ground so that it's may not slip.

(b) House on fire:- Do not throw water on a live Conductor. It is dangerous, Disconnect the electric supply immediately. liquid carbon dioxide extinguishers or dry sand may be wed for putting out fire.

(c) Mixing acid and water:- Always add acid to water drop by drop but not water to acid.

(d) Working on the pole :— → if the work is small, use ladder which must be held, by a coolie, use safety belt, use insulated tools do not touch the live wire with naked hand.

→ if the work is more :- off the circuit breaker in Power House, put a plate on it written 'MAN AT WORK', use ladder and coolie, use safety belt, short-circuit all wires on both the sides of pole and earth it

(e) Working on electrical appliances :- Be sure that the appliances like irons, heaters, etc. are disconnected from the supply.

Ans 3. (i) Radiation (ii) Fork lift Truck

(iii) Caution, Risk of electric shock

(iv) General warning Risk of danger

(v) Smoking and Naked flames Prohibited.

(vi) Wear hand protection,

Ans 4. ★ following precaution should take in handling tools :—

① The sharp-edged tools such as pocket knife, chisel should never be put in pocket without shield.

② When cutting with a chisel always cut away from yourself rather than towards yourself.

③ Befor using a hammer its handle must be examined

④ All injuries must be attended to immediately, Since delay may cause infection.

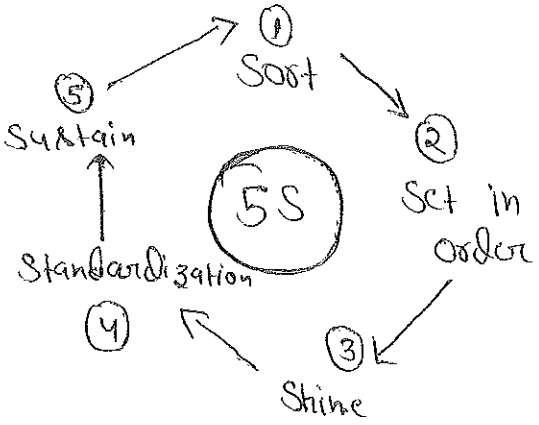
⑤ only a suitable tool should be used for the proper purpose

Ans 5.

Name	Symbol	Unit
(a) Resistance	R	ohm (Ω)
(b) Inductance	L	henry (H)
(c) capacitance	C	farad (F)
(d) Time	t	second (s)
(e) Frequency	f	Hertz (H_z)
(f) force	F	Newton (N)
(g) power	P	watt (W)
(h) current	I	Ampere (A)
(i) mass	m	Kilogram (kg)
(j) Voltage	V	volt (V)
(k) Speed	S	m/s
(l) Active power	P	watt (W)

Ans 6. ~~Concept of 5's :-~~

Ans. 6. Concept of 5's :- The concept of 5S used for management of workplace. This concept is given by Japan their is 5 Japanese words, which define the procedure of management.



Sort :- Eliminate the obstacles. ~~reduce the~~ remove the unnecessary items. and only keep useful once.

Ans 7. "Circuit Breaker is a device use to protect the electric circuit Automatic in overcurrent condition."

★ there are different types of Circuit Breaker:→

(i) SF_6 Circuit Breaker
(ii) Vaccum Circuit Breaker
(iii) Air circuit Breaker
(iv) Oil circuit Breaker etc.

★ 3 condition for trip the circuit Breaker:-

① Overhead lightning
② Short circuit fault
③ ground fault

Ans 8.

Voltage → constant

Resistance → Yes

then current → Yes

because

$V = IR \Rightarrow \frac{V}{R} = I$

Set in order:- Arrange and put all neccessary items of fixed place so that they can be easily selected for use.

Shine:- Clean your workplace on daily basis and keep workplace safe & easy to work.

Standardize:- Establish procedures and ensure everyone knows their responsibilities of performing the sorting organizing & cleaning.

Sustain:- Training & discipline for self-motivation of do work without being told.

Ans-7 => Circuit breaker is a device use to protect the electric circuit Automatically in overcurrent condition.

=> there are different types of circuit breaker.

a) SF_6 circuit breaker
b) Vaccum circuit breaker.
c) Air circuit breaker.
d) oil circuit breaker.

=> 3-Condition for trip the circuit breaker:-

i) over-head lightening.
ii) Short circuit fault
iii) ground fault

Ans-8 => Voltage ⟶ Constant

Resistance ⟶ increase

then Current ⟶ Decrease

because of ohm's law :- $\boxed{V = IR}$ $\Rightarrow \frac{V}{R} = I$

Section - C

A-1 ⇒ **Conductor:-** A conductor is an object or type of material that allows the flow of an electrical current in one or more directions. Electrical current is generated by the flow of negatively charged electrons, positively charged holes.

ex:- copper, Silver, Al.---etc.

Insulator:- An electrical insulator is a material ~~where internal electric charge do not flow freely~~ which has very high resistance due to this no current will flow threw it.

ex:- rubber, wooden -- etc.

Semiconductor:- A semiconductor material has an electrical conductivity value falling between that of a conductor and an insulator. Their resistance decreases as their temperature increases so current flow rate increase with temp. increase.

ex:- Silicon, Germenium---etc.

Ans. ⇒2⇒ Very first turn off the power and Separate the person from current's source.

⇒ Call the Ambulance immidetely.

⇒ Try to Separate the person from current using non-conductive object such as wooden or plastic broom handle.

⇒ When we safely remove the person, do CPR if the person is not breathing.

⇒ If the person is bleeding, apply pressure and elevate the wound if it's in an arm or leg.

⇒

Ans. 3

⇒ Ammeter :-

- It is an electrical device used to measure the value of current flowing in the closed circuit.
- It is always connected in series because its internal resistance is zero.

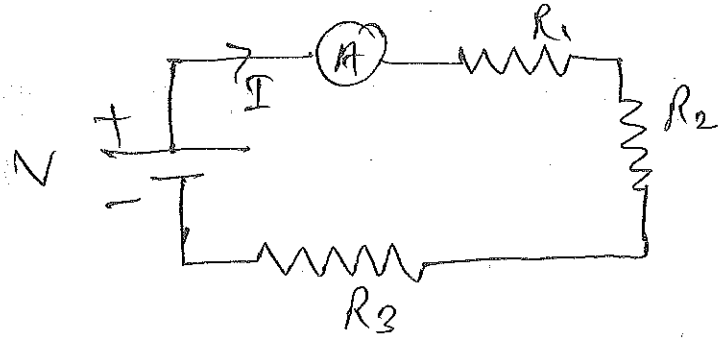
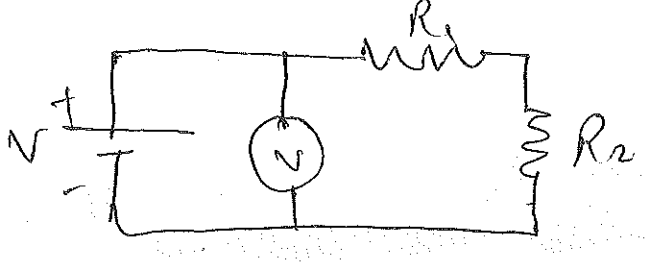


fig. with ammeter connected in series

⇒ Voltmeter :-

- It is an electrical device used to measure the value of voltage across the circuit.
- Its internal resistance is infinite due to which it is always connected in parallel.



Ans. 4 Power factor :-

- It is the ratio of real power flowing to the load to the apparent power in the circuit.

OR

It is the phase angle between voltage & current.

- It is denoted by $\cos\phi$.

=> Disadvantages of Low power factor :-

- Higher current is required by the equipment due to which the economic cost of equipment is increased.
- At low p.f., current is high which gives rise to high copper losses in the system therefore efficiency of the system reduced.
- High current produce a large voltage drop in the apparatus which result in poor voltage regulation.

=> Power factor Improvement :-

- By using series capacitors.
- By using shunt compensators.

Ans. 5

Kirchhoff's Laws

KCL (Kirchhoff's Current Law)

KVL (Kirchhoff's Voltage Law)

(A) KCL :- (Kirchhoff's Current Law)

The algebraic sum of currents at any junction of a network is zero.

OR

Acc. to this law, total incoming current is always equal to the sum of outgoing current at any node.

Eg.

then according to KCL,

$I_1 + I_4$ = Incoming current

$I_2 + I_3 + I_5$ = Outgoing current

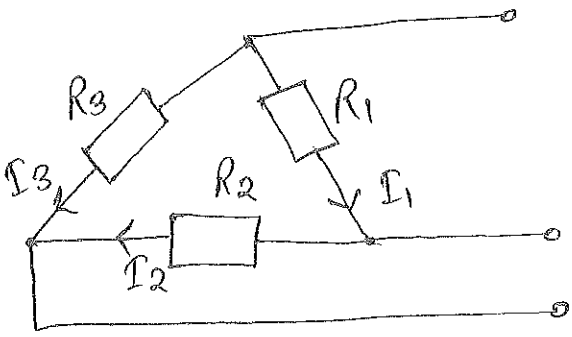
$\Rightarrow$ **Incoming current = Outgoing current**

$\Rightarrow$ $I_1 + I_4 = I_2 + I_3 + I_5$

(B) Kirchhoff's voltage Law :-

In any closed electric circuit, the algebraic sum of potential drops (I·R) is equal to the sum of impressed emf.

Eg.



$$R_1 i_1 + R_2 i_2 - R_3 i_3 = 0$$

This equation can be achieved by using kirchhoff's voltage Law.

Registration No.....

School of Electrical Skills

First Semester, End Term Semester Examination

Winter Semester, B. Voc. Program, Session: 2017-18

Course Code: ELE1004 **Time: 3 Hours**

Course Name: Construction Electrician – II **Max. Marks: 100**

Instructions: Answer all questions from section A, each question carries two marks. Answer any six questions from section B, each question carries five marks. Answer all questions from section C, each question carries ten marks.

Section – A 10x2=20 Marks

Q. 1. (A) The main function of a switch is to safely:

(a) Break the circuit (b)Make the circuit

(c) Make and break the circuit (d) Regulate the current flow in the circuit

(B) Quick make and break mechanism in the switches is incorporated:

(a) To save time of operation (b) To avoid heavy frictional forces between blades and clips

(c) To avoid heavy arcing between blades and clips (d) All the above option

Q. 2. (A) Lamps in house go dim on starting a heater. this is due to:

(a) Heavy current taken by heater leaving less from lamps

(b) Small current taken by heater reducing lamps current by this much amount

(c) Causing heavy voltage drop in the supply circuit

(d) All the above options

(B) In the case of three phase four wire installation if output and input neutral cable become loose:

(a) All the lights will become off (b) All the lights will become dim

(c) All the lights will become bright (d) Some lamps will glow very much bright and may fuse

Q. 3. (A) If earth wire of smaller size is used:

(a) It will melt (b) It will spoil the insulation

(c) It will produce heavy voltage drop in the earth wire (d) None of the above

(B) Types of wiring used for godowns , workshops and public building is:

(a) Casing and capping (b) Batten wiring (c) Conduit wiring (d) None of the above

Q. 4. (A) Metallic casing of electrical apparatus is always earth:

(a) To insure operators' safety (b) To insure equipments safety

(c) To insure installation safety (d) None of the above

(B) As per I.E rules frames of every generator, motor, metallic part of transformers or any other electrical apparatus are to have double earthing. This is done:

(a) To reduce the earth resistance of consumer earth (b) To have more reliability

(c) To reduce the resistance of earth continuity conductor (d) None of the above

Q. 5. (A) Main distribution board is provided with three phase 400volt, 50 Hz supply and also earthing bus bar to:

(a) Lights and fans of 230volt rating cannot energized from the main distribution box

(b) Lights and fans of 230volt rating can be energized as per I.E rules

(c) Lights and fans of 230volt rating can be energized but it will not be according to I.E rules

(d) Lights and fans of 230volt rating can be energized without sacrificing safety

(B) Protection of motor for overloading is given by:

(a) earthing (b) starter (c) fuses (d) all the above

Q. 6. (A) Earthing arrangement of substation in rocky soil will be by:

(a) plate earthing (b) pipe earthing

(c) earth electrode place in horizontal trenches (d) driving iron rod

(B) Unit of emf is:

(a) volt (b) ohm (c) ampere (d) hennery

Q. 7. (A) Cross section of wire to be taken for 100 A current is:

(a) 10sq mm (b) 2.5sq mm (c) 6sq mm (d) c35sq mm

(B) The maximum resistance of an electrical earthing system as per indian standard should be:

(a) less than 2 ohm (b) more than 2 ohm (c) more than 10 ohm (d) more than 100 ohm

Q. 8. (A) Megger is a:

(a) Source of emf (b) Source to measure high resistance

(c) Type of a null detector (d) Current carrier

(B) Megger is used for:

(a) Providing additional emf (b) Bridge balance

(c) Testing insulation resistance (d) Controlling the temperature

Q. 9. (A) 6 sq. mm wire is suitable for:

(a) 100 A (b) 32 A (c) 150 A (d) 50 A

(B) Megger work on the principle of:

(a) Kirchhoff's current law (b) Ohm's law

(c) Gauss's law (d) Electromagnetic induction

Q. 10. (A) The supply of megger is given by:

(a) Ac motor (b) Ac generator (c) Permament magnet dc motor (d) Dc generator

(B) Test lamps is used to:

(a) Measure voltage (b) Measure current

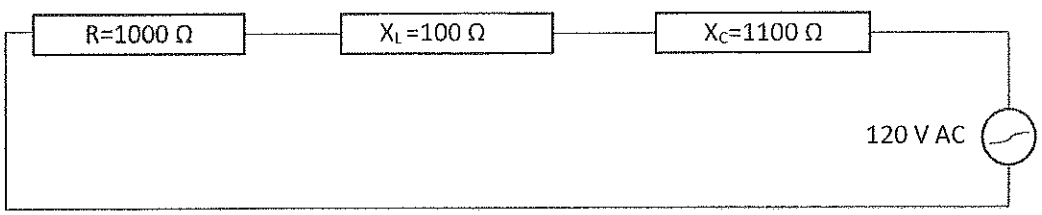
(c) Testing insulation resistance (d) Determining the presence of supply

Section – B 6x5=30 Marks

Answer any six questions.

1. What is an ELCB? Write 4 of its purposes?
2. What is MCB? Explain the types of MCB and their ratings.
3. What is inductor? Derive formula for series and parallel connections of inductor with a diagram.
4. Explain how capacitor and inductor will behave in a dc circuit.
5. Calculate total capacitance if 1nf, 20 nf and 5 nf are connected in: (a) series and (b)parallel
6. Explain how capacitor and inductor will behave in an ac circuit.
7. Define capacitor. What is its SI unit and symbol? Also draw a labelled diagram of capacitor.
8. Calculate apparent power and true power consumed by the given circuit.

Given-phase angle = – 45 degree, cos (-45) =0.7071, I = 84.9 mille ampere

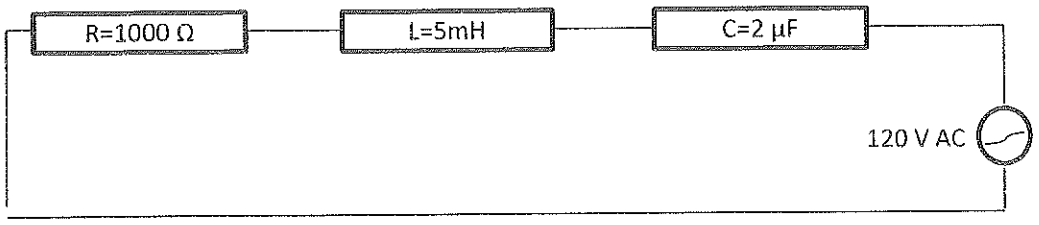


Section – C

10x5=50 Marks

Answer all the questions.

1. Explain different methods of earthing.
2. Explain 5 different conditions of an electric circuits.
3. What is RCCB? Explain its types.
4. Calculate inductance, capacitance, total current and total impedance.



5. Explain the working principle of MCB with a diagram.

   What is the tripping current I at which TYPE B circuit breaker triggers within a time of t=0.4s?

Solution → Construction Electrician - II BLE1004

	(A)	(B)
1)	c	c
2)	c	d
3)	c	a
4)	a	b
5)	c	b
6)	c	a
7)	d	a
8)	b	c
9)	b	d
10)	c	d

Section - B

A-1

ELCB → Earth leakage circuit breaker is designed to prevent injury, death and fire arising from electric shock to human body.

→ This device cut off the power supply before real danger could arise.

→ It is arranged to operate very quickly with extremely low leakage current.

→ Its protection against electric shock provided by ELCB is greater than that by fuse or MCB

Its purpose are
(a) Protection against electrocution
(b) Protection against indirect contact
(c) Protection against fire
(d) Energy conservation

A-2) MCB → Mainature circuit breaker are overcurrent protection devices which can be switched on again after they have been triggered.

Rating → 2A, 4A, 6A, 10A, 13A, 16A
20A, 25A, 32A, 40A, 50A, 63A

Types of MCB :-

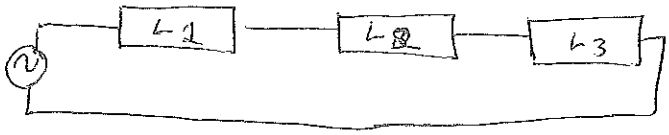
⇒ Type B → provides line protection
→ It trigger at 3 to 5 times the rated current

⇒ Type C → used for ~~equipment~~ equipment with high starting currents
→ It triggers at 5 to 10 times the rated current

⇒ Type D → used for equipment with high starting current
→ It triggers at 10 to 20 times the rated current

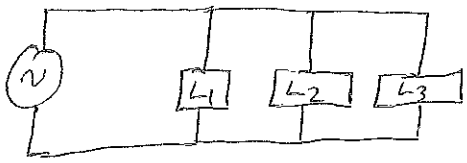
A-3) Inductor → also called a coil, choke or reactor
→ is a passive 2-terminal electrical component that stores energy in a magnetic field when electric current flows through it.

for series connection



$$L_t = L_1 + L_2 + L_3$$

for parallel connection

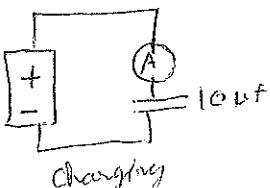


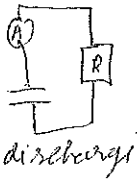
$$\frac{1}{L_t} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$$

A-4) Capacitor in a DC circuit

When charging a high current flows at the beginning. During the charging process, the charge current become smaller and smaller until it is zero after charging the capacitor blocks the DC current

During discharging current flows until the charges on the capacitor plates are have evened out.

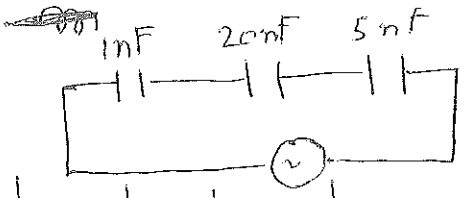




Inductor in a DC circuit

It is equivalent to a short circuit to DC because once the storage phase has finished, the current i that flows through it is stable, $i_L = \frac{V}{R}$ no self induced emf is produce $V_L = 0$. The IT act like an ordinary connecting wire, its $R = 0$

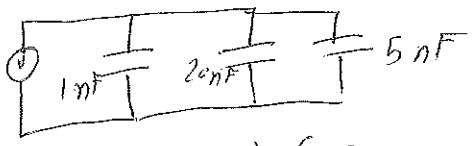
A-5) (a)



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$= \frac{1}{1} + \frac{1}{20} + \frac{1}{5} \Rightarrow C = \frac{20}{25} = \frac{4}{5} = 0.8\ nF$$

(b)



$$C = C_1 + C_2 + C_3$$

$$C = 5 + 20 + 1 = 26\ nF$$

A-6) Inductor in AC circuit :-

when a AC voltage is applied to an Inductor the voltage leads the current by 90° phase angle. Since Inductors oppose change in current changing current induces an emf. This is considered an effective resistance of the inductor to AC. Inductor store their energy in the form of a magnetic field that is created when a voltage is applied accross the terminals of an inductor

Capacitor in AC circuit :-

when capacitior is connected directly across the AC supply voltage. As the voltage varies the capacitor charges and discharges with respect to this change. A current will flow through the circuit, first in one direction, then in the other However no current actually flows through the capacitor.

A-7)

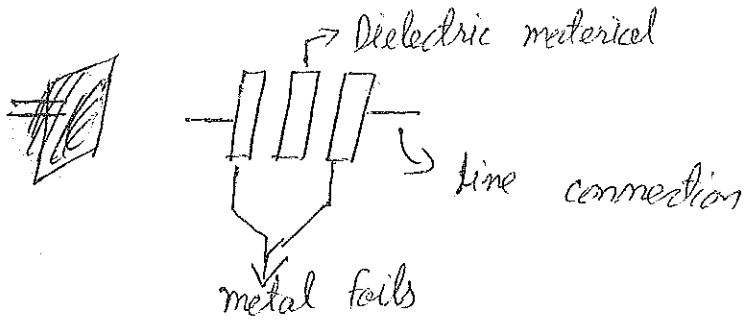
Capacitor ⇒ a device use to store an electric charge consisting of one or more pair of conductors separated by an insulator.

Capacitance ⇒ It is the ability of a system to store an electric charge.

$C = \frac{Q}{V}$ → charge
→ Voltage

dielectric material ⇒ It is a very poor conductor of electric current. when it is place in an e.f no current flow in them, Instead electric polarization occurs.

symbol → ⊣ ⊢



A-8) apparant power :-

$P = E I$

$= 120 \times .0849$

$= 10.2$ VA

True power

$P = E I \cos\theta = 120 \times 0.0849 \times 0.7071 = 7.2$ watt

or

$P = I^2 R = 0.0849^2 \times 1000 = 7.2$ watt

Section – C

Q4-1) (a) Plate earthing :-

In this, a plate made up of either copper or galvanized iron is buried vertical in the earth pit, which should not be less than 3 meter from the ground level.

(b) Pipe earthing :-

A galvanized steel and a perforated pipe of approved length and diameter is placed vertically in a wet soil in this kind of earthing. It is the most common system of earthing.

(c) Earthing through water pipe :-

In this, the waterman (galvanized GI) pipes are used for earthing purpose. Make sure to check the resistance of GI pipes and use earthing clamps to minimize the resistance for proper earthin connectio

(d) Rod Earthing -

It is same as pipe earthing. A copper rod or Galvanized steel or GI pipe of length above 2.5 m are buried upright in the earth manually or with the help of pneumatic hammer. The length of embedded electrodes in the soil reduced earth resistance to a desired value.

(e) Strip earthing :-

In this method, strip electrodes of cross section of not less than 25 mm X 1.6 mm is buried in a horizontal trenches of a minimum depth of 0.5 m The length of the conductors ~~are~~ ~~used~~ buried in the ground would give a sufficient earth resistance and this length should not be less than 15 m

Q-2) (a) 5 types of electric condition

Normal condition :-

Normal loading of a circuit is where the current flowing is within the capability of the circuit and/or the connected equipment.

(b) overload condition :-

An overload is a condition where the current flowing is more than the circuit and/or connected equipment is designed to safely carry

(c) Short circuit :-

A short circuit is a condition where two or more conductors come in contact with one another resulting in a current flow that bypasses the connected load.

(d) Ground fault :-

A ground fault is a condition where a hot conductor comes in contact with a grounded surface, such as a grounded metal raceway, metal water pipe, sheet metal and so on,, as

(e) Open :-

An open circuit is a condition where the circuit is not closed somewhere in the circuit.

A-3) RCCB → Residual current operated circuit breaker

↳ It protect human being, domestic animal and property if the basic protection or fault protection fails

↳ It switch off equipment at all poles in a short period of time if, caused by insulation faults

↳ It is an additional measures not a substitute for protection measure.

The selection of the RCCB is determined by the nature of the faults currents that the electrical equipment can cause in the event of an fault.

RCCB type A → Used as personal protection eg in household installation

→ In almost inductive, non inductive and capacitive equipment, AC fault currents with n/w frequency of the dc voltage as can pulsating DC fault current

RCCB type B → Used for eg training rooms with experimental equipments, laboratories.

In electronic equipment eg frequency converters, fault currents can occur as mixed current caused by harmonics or as smooth dC

RCCB type B+ → used for superior preventive fire protection for electronic equipment with dC fault current of up to 20KHz

RCCB type F → Used in frequency converters operated with single phase where fault currents arising from a frequency mix of up to 1KHz

(A-4) $X_L = 2\pi f L$ $\quad f = 60\,Hz$

$= 6.28 \times 60 \times .005$

$= 1.884\ \Omega$

$X_C = \dfrac{1}{2\pi f C}$

$= \dfrac{1}{6.28 \times 60 \times 0.000002}$

$= 1327\ \Omega$

$Z = \sqrt{R^2 + (X_L - X_C)^2}$

$= \sqrt{1000^2 + (1.884 - 1327)^2}$

$= 1660.1\ \Omega$

$I = \dfrac{E}{Z} = \dfrac{120}{1,660.1} = 0.072$ amps

(2-pp

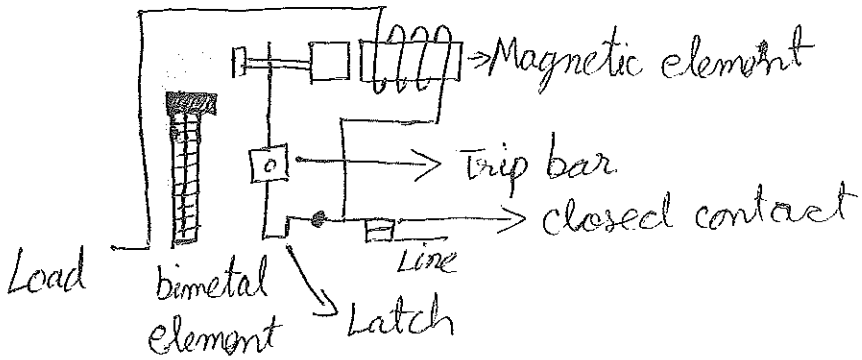
A-5) → MCB protect line and equipment from overloads and short circuits.

→ MCB are overcurrent protection devices which can be switched on again after they have been triggered.

→ They have a thermal and an electromagnetic trip. Both trips are connected in series.

→ In the event of an overload, the bi-metal heats up and triggers the circuit breaker.

→ In the event of a short circuit, the electromagnet trip decouples the latch without delay. The strike armature disconnects the connects the contact piece before the short circuit can reach its maximum value



Numerical → $t_t = 0.4\ s$

type B → 5 time the I_r

$I_t = 5 I_N = 5 \times 13\ A$

$= 65\ A$