



10/1/20

Registration No.....

School of Electrical Skills
First Semester, Second In-Semester Examination
Summer Semester, B. Voc. Program, Session: 2017-18

Course Code: ELE1001

Time: 1 Hour

Course Name: Construction Electrician

Max. Marks: 20

Instructions: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks.

Section - A

(5X1=5)

1. The impedance of human body varies from:
(a) 1 k Ω to 5 k Ω (b) 0 k Ω to 10 k Ω (c) 1 k Ω to 50 k Ω (d) 1 k Ω to 100 k Ω
2. Which Indian standard is applicable for the code of practice for electrical wiring installations?
(a) IS, 694 - 1990 (b) IS, 12615:2011 (c) IS, 1293-1988 (d) IS, 732-1989
3. The current rating in Amps. of 2.5 sq. mm. PVC insulated single core industrial wire as per IS: 694/1990 is:
(a) 4 Amps. (b) 7 Amps. (c) 16 Amps. (d) 25 Amps.
4. The dimensions of phase and earth pins of 6 Amps. rating plug as per IS-1293-2005 are:
(a) 5 mm and 21 mm (b) 7 mm and 21 mm
(c) 7 mm and 29 mm (d) 16 mm and 21 mm
5. Torque can be defined as:
(a) force x distance (b) force x speed
(c) force x velocity (d) force x distance of motion perpendicular to the force

PTO

Section – B

(3X2=6)

1. Which are the two conditions must be satisfied before current can flow?
2. What is the purpose of earthing the neutral conductor?
3. What is an RCD and how it is different than ELCB?

Section – C

(3X3=9)

1. Describe the factors that influence the impedance of human body?
2. Describe in detail about the degree of protection is provided by an enclosure rated IP 55.
3. Write the minimum desired specifications to procure three phase squirrel cage induction motor of 10 HP from the market.

Date:
21-11-17

Solution of First Semester Examination-2017

School of Electrical Skills

Course code: - ELE1009

Course name: - Construction Electrician

Section - A

(05 M - Total)
↓

01M 1. Ans: - (d)

01M 2. Ans: - (d)

01M 3. Ans: - (d)

01M 4. Ans: - (d)

01M 5. Ans: - (d)

Section - B

1. Ans:

(*) The following conditions must be satisfied before current can flow.

01M (I) Availability of charges which can move or drift. More the charges free to drift, more will be current.

01M (II) Potential difference or electric field which influences charge drift.

01M (III) Define the channel routed for charge

movement. This may include path through solid, liquid or gas, or even vacuum, and may take the form of wires, resistance or other components.

2. Ans:

01M { The purpose of earthing the neutral conductor is for safety. If there is no bond between ground and neutral, it means that you have just created a system with a floating neutral, that is a neutral that has no reference to earth ground. On the plus side, now you have a system where a ground fault (a specific type of short where the hot wire touches something grounded) doesn't trip a breaker.

01M {

○

5. Ans:

Residual-current device (RCD), is an electrical wiring device that disconnects a circuit whenever it detects that the electric current is not balanced between the energized conductor and the return neutral conductor.

RCDs are generally designed to prevent electrocution by detecting the leakage current, which can be far smaller (typically 5-30 milliamperes) than the current needed to operate conventional circuit breakers or fuses (several amperes.)

ELCB is different from RCD, because RCD is current operated whereas ELCB is voltage operated device.

Section - C

1. Ans:

The electrical impedance of the human body depends upon many factors, especially the current path, the contact voltage, duration of current flow, the moisture condition of the skin, the surface of touch, temperature etc.

For voltage below 50V, the skin impedance varies widely. For higher voltage total impedance less dependent on the impedance of the skin.

If the surface are wet - contact with -conductive solutions, the measured value decrease up to half of the values with dry conditions.

As far as effect of frequency is -concerned, the impedance of skin decreases when the frequency increases.

The -current path also influences the value of the impedance of the human body. for example, the impedance from a current path - one hand to both feet is 75%. and impedance from both hands to both feet is 75%, and the impedance from both hands to both feet 50%. , and the hand to hand impedance (100%) etc.

2. Ans:

The IP stands for international protection ratings. The rating consists of letter IP followed by 2-digits, the first digit stands for the level of protection that the enclosure provides against solid bodies, the second digits describe the degree of protection of the equipment inside the enclosure against water.

IP-55 enclosure characteristics: —

- (1) Protection from dust, dirt, and other non-corrosive material.
- (2) Complete protection from contact with enclosed equipment.
- (3) Protection from water, up to water projected by a nozzle against enclosure from any direction.
- (4) Available in aluminium, carbon steel, and stainless steel.
- (5) Available in wall-mounted, free standing, through, and TFC box.
- (6) Anodizing services available.

3. Ans:

The specifications to procure three phase squirrel cage IM is as follows: —

Brand name — Bharat Bijlee

Poles — 04

Speed — 1400 rpm

Frame — 132M

Specifications — IS: 325

Model — MA13M4K3

Flange mounted — Yes

Power (HP) — 10

Foot mounted — NO

Suitable for - $415V \pm 5\%$, combined
variation $\pm 10\%$.

Power (kW) = 7.5

Key features:

- o/m
- (a) squirrel-cage TEFC
 - (b) B₃ construction
 - (c) Installation - class F with temperature
rise limited to class B.
 - (d) Degree of protection IP55
 - (e) Ambient temperature $50^{\circ}C$
 - (f) Duty S₁



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Registration No.....

School of Electrical Skills
First Semester, Second In-Semester Examination
Summer Semester, B. Voc. Program, Session: 2017-18

Course Code: ELE1002
Course Name: Electrical Technician

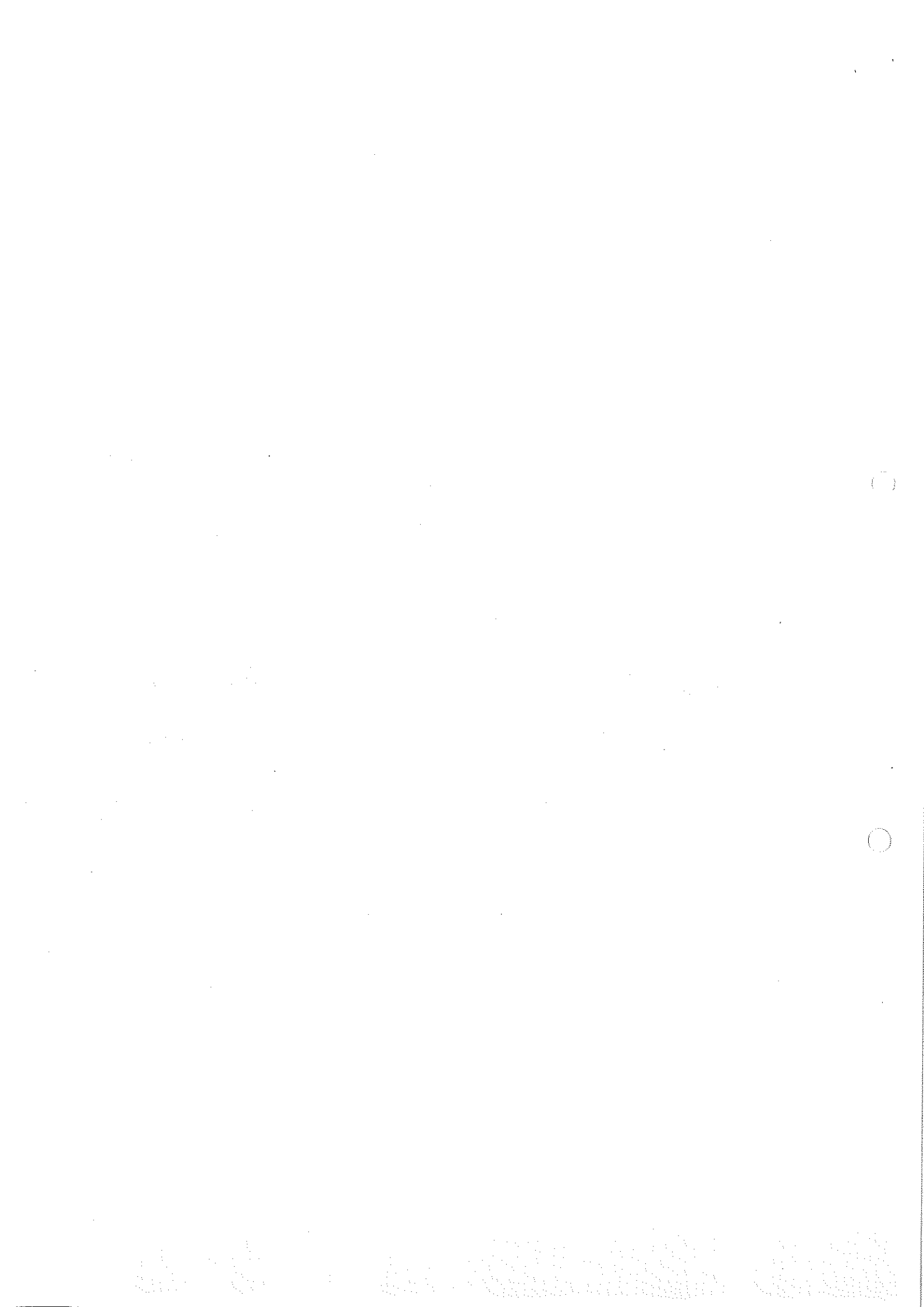
Time: 1 Hour
Max. Marks: 20

Instructions: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks.

Section – A

(5X1=5)

- The expression for total power output of a delta connected system in terms of phase voltage and current is given by _____.
(a) $3V_p I_p \cos\phi$ (b) $\sqrt{3}V_p I_p \cos\phi$ (c) $1/\sqrt{3}V_p I_p \cos\phi$ (d) $1/3 \times V_p I_p \cos\phi$
- In a star connected system, the current flowing through the line is _____.
(a) Greater than the phase current (b) Equal to phase current
(c) Less than the phase current. (d) None of above
- The core flux in transformer mainly depend on _____.
(a) Supply voltage (b) Supply voltage and frequency
(b) Supply voltage, frequency and load (d) Supply voltage and load
- The basic function of a transformer is to change _____.
(a) The power level (b) The power factor
(c) The level of the voltage (d) The frequency
- Thin laminations are used in a machine in order to reduce _____.
(a) Eddy current losses (b) Hysteresis losses
(c) Both 1 and 2 (d) Copper losses



Date
21/11/17

Solution of First Semester Examination - 2017

School of Electrical Skills

Course Code: - ELE1002

Course Name: - Electrical Technician

Section - A

Q1M 1. Ans: → (a)

Q1 2. Ans: → (b)

Q1M 3. Ans: → (b)

Q1M 4. Ans: → (c)

Q1M 5. Ans: → (c)

Section - B

Q1 1. Ans: —

Q1M { cu (copper loss) of transformer depends on current and iron loss on voltage. Hence total transformer loss depends upon volt-ampere (VA) and not on phase angle between voltage and current. i.e., it is independent of load power factor. That is why the rating of transformer is in KVA and not in kW.

2. Ans: -

Since,

$$\text{O/P voltage } V_{out} = 4200\text{V}$$

$$\text{I/P voltage } V_{in} = 230\text{V}$$

$$\text{Secondary no. of turns } N_s = 2000 \text{ turns}$$

$$\text{Primary no. of turns } N_p = ?$$

We know that, in a transformer,

0.5M

$$\frac{V_{in}}{V_{out}} = \frac{N_p}{N_s}$$

$$\text{ie, } \frac{230}{4200} = \frac{N_p}{2000}$$

0.5M

$$\text{so, } N_p = \frac{230 \times 2000}{4200} = 109.57 \text{ turns,}$$

But no. of turns should not be fractional

so,

$$N_p = 110 \text{ turns}$$

3. Ans:

(1) star (Y) connection: —

(a) Y-connection is 3-phase 4-wire system.

(b) The speed of Y-connected motors are slow as they receive $\frac{1}{\sqrt{3}}$ line val.

$$\text{since } V_L = \sqrt{3} V_{Ph} \Rightarrow V_{Ph} = \frac{V_L}{\sqrt{3}}$$

(ii) Delta (Δ) connection: —

Q/M

- (a) Δ connection is three phase, three wire system, ie no neutral point present in Δ connection.
- (b) the speed of Δ connected motor are high because each phase gets total of line val.

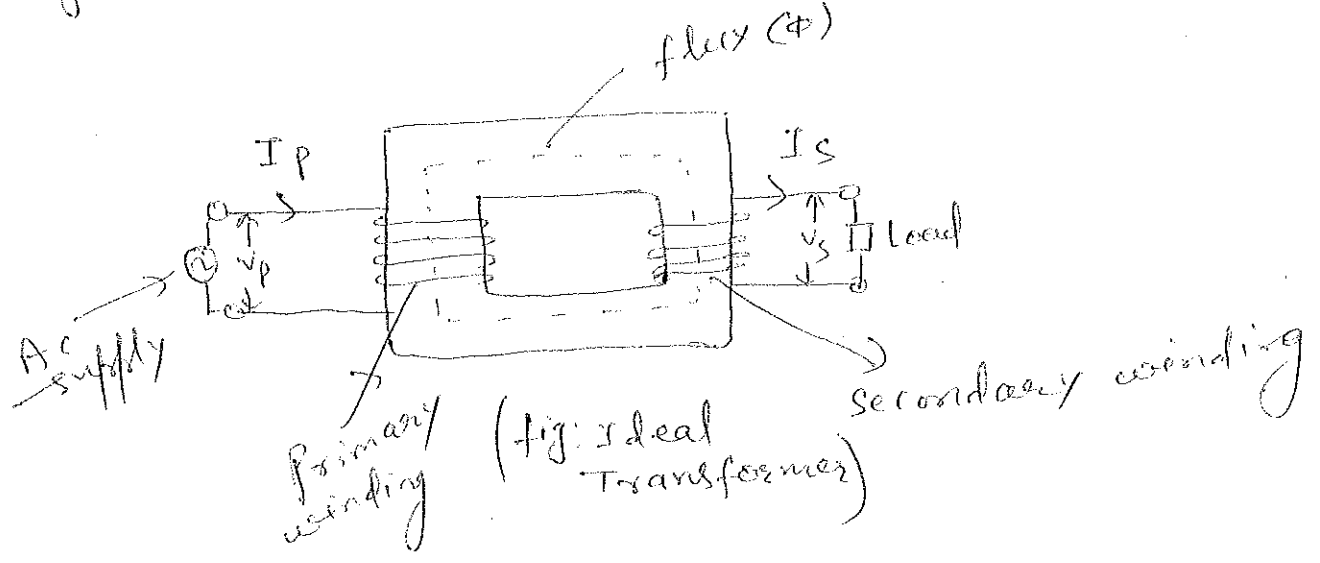
$$V_L = V_{Ph}$$

Section - C

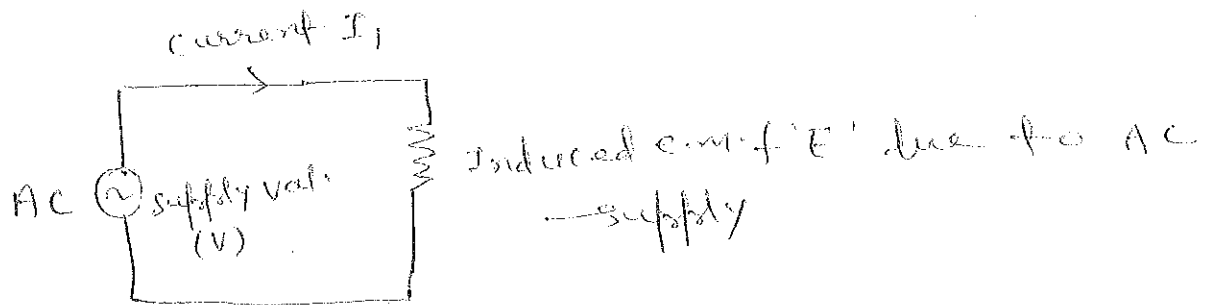
1. Ans: —

1.5 M

Transformer works on the principle of mutual inductance. This principle state that when two coils inductively coupled ~~and~~ if current in one coil changed uniformly then an e.m.f gets induced in the other coil.

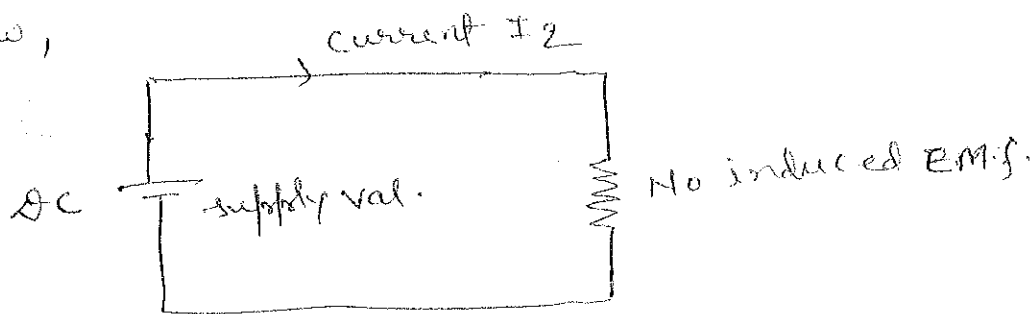


No, we can't use transformer to step-up or step-down DC voltage, because without AC supply there will be no induced e.m.f. on the windings so, there will be no transformation.



$$I_1 = \frac{V - E}{R}$$

now,



$$I_2 = \frac{V}{R}$$

here, $I_2 \gg I_1$

since transformer windings are highly inductive in nature with a smaller amount of resistance and as we know that inductive property is satisfied only when there is an AC supply. so, instead of AC if you are applying DC supply then there is a chance that the winding may get burnt due to heavy current.

flow in the winding, as transformer winding resistance is low and no e.m.f. is induced in the winding so, heavy current is flow. (No AC supply, no induced e.m.f.).

2. Ans: —

The transformer is a static device; i.e., we don't get to see any movement in its parts, so no mechanical losses exist in the transformer and only electrical losses are observed. So, there are two primary types of electrical losses in the transformer:

1. Copper loss
2. Iron losses

1. Copper loss: — These losses occur in the ~~case~~ ^{winding} of the transformer ~~and are~~ ~~generated due to~~ when heat is dissipated due to the current passing through the windings and internal resistance offered by the windings.

To minimize these losses the windings of transformer are made thick so that the resistance are minimized.

2. Iron losses :- These losses occur in the core of the transformer and are generated due to the variations in the flux.

There are two types of Iron losses in the transformer.

(a) Eddy current loss :- In transformer, AC current is supplied to the primary winding which sets up alternating magnetizing flux. When these flux links with secondary windings, it produces induced emf in it. But some part of this flux also gets linked with other conducting parts like steel core or iron body of the transformer, which will result in induced e.m.f in those parts, causing small circulating current in them. This current is called eddy current. Due to this eddy current some energy will be dissipated in the form of heat.

(b) Hysteresis loss :- Due to AC flux set up in the magnetic core of the transformer, it undergoes a cycle of magnetisation and demagnetisation. Due to hysteresis effect there is loss of energy in this process, which is called hysteresis loss.

To minimize eddy current and hysteresis loss we use very good high grade core material like silicon steel with lamination of smallest thickness.

3. Ans: —

400V, 3-phase supply means 400V is line voltage.

(a) Ans:

For a star connection

$$V_p \text{ Phase vol. (} V_p) = \frac{V_L}{\sqrt{3}}$$
$$= \frac{400}{\sqrt{3}} = 230.94 \text{ V}$$
$$\approx 231 \text{ V.}$$

$$\boxed{V_p = 231 \text{ V}}$$

(b) Phase current (I_p) = $\frac{V_p}{R_p} = \frac{231}{50} = 4.62$

$$\boxed{I_p = 4.62 \text{ A}}$$

(c) since in star connection

Phase current (I_p) = Line current.

$$\text{So, } I_L = I_p = 4.62 \text{ A}$$

$$\boxed{I_L = 4.62 \text{ A}}$$

(1)

(2)

(3)

(4)



1000

1000

1000

Registration No.....

School of Electrical Skills
First Semester, Second In-Semester Examination
Summer Semester, B. Voc. Program, Session: 2017-18

Course Code: ELE1003

Time: 1 Hour

Course Name: Maintenance Technician Electrical

Max. Marks: 20

Instructions: Answer all questions from section A, each question carries one mark. Answer all questions from section B, each question carries two marks. Answer all questions from section C, each question carries three marks.

Section – A

(5X1=5)

- Ratio of active power to power factor is:
(a) Apparent power (b) Power factor angle
(c) Power factor (d) None of these
- In pure capacitive circuit, the real power is _____.
(a) Infinite (b) Maximum (c) Normal (d) Minimum (e) Zero
- Four bulbs of 40 W each are connected in series with a battery across them, which of the following statement is true?
(a) The current through each bulb is same.
(b) The voltage across each bulb is not same.
(c) The power dissipation in each bulb is not same.
(d) None of the above.
- The relation among time period T and frequency is defined by _____.
(a) $T = 1 / \text{frequency}$ (b) $T = 0.5 / \text{frequency}$
(c) $T = 0.85 / \text{frequency}$ (d) $T = \text{frequency}$
- The rms value of sine wave is 100 A. Its peak value is _____.
(a) 70.7 A (b) 141.4 A (c) 150 A (d) 282.8 A.

PTO

Section – B

(3X2=6)

1. Draw the resulting voltage, current and power waveforms if a sinusoidal voltage is applied to a resistive load.
2. Why the circuit Current (I) decreases, when the value and inductive reactance (X_L) increases in the circuit?
3. Define Power Factor? What are the disadvantages of low power factor?

Section – C

(3X3=9)

1. With the help of power triangle describe active power, reactive power and apparent power.
2. What are the advantages of three phase supply over to a single phase supply?
3. Given the AC current wave $i = 100 \sin 2\pi t$
 - (a) Find the angular velocity, frequency and period of the wave.
 - (b) By using sine wave show the relation of voltage and current when the load is pure inductive.

Date
21-11-17

Solution of First Semester Examination-201
School of Electrical Skills

Course Code: ELE1003

Course Name: Maintenance Technician Electrical

Section - A

1. Ans. → (a)

2. Ans. → (e)

3. Ans. → (a)

4. Ans. → (a)

5. Ans. → (b)

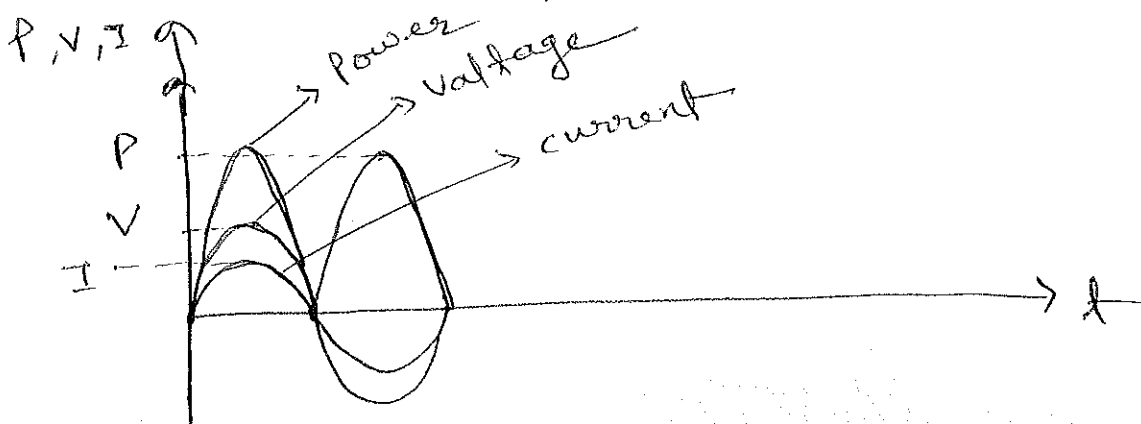
Section - B

1. Ans:

Since in a resistive ckt phase angle between voltage and current is zero,

in other words

So, the graph (resulting) of voltage, current and power ~~is~~ with respect to time is



Q. Ans:

Since, current (I) = $\frac{\text{Voltage (V)}}{\text{Resistance (R)}}$

but for inductive ckt, $I = \frac{V}{\text{Inductive reactance (X}_L\text{)}}$

So, current is inversely proportional to ~~to~~ X_L . hence ^{as} X_L increases, the ckt current (I) decreases.

For example: -

Let $V = 220\text{V}$, $R = 10\Omega$, $L = 0.02\text{H}$, $f = 50\text{Hz}$

So, $X_L = 2\pi fL = 2 \times 3.14 \times 50 \times 0.02 = 6.28\Omega$

$$I = \frac{V}{X} = \frac{220}{\sqrt{R^2 + X_L^2}} = \frac{220}{\sqrt{10^2 + 6.28^2}} = 11.8\text{A}$$

$$\boxed{I = 11.8\text{A}}$$

But for $V = 220\text{V}$, $R = 10\Omega$, $L = 0.04\text{H}$, $f = 50$

$$X_L = 12.56$$

$$\boxed{I = 13.70\text{A}}$$

So, from example it is proof that as $X_L = 12.56$, $I = 13.70\text{A}$ which is greater than $I = 11.8\text{A}$ when X_L is 6.28Ω .

3. Ans: -

Power factor is defined as ratio of real power flowing to the load, to the apparent power in the ckt.

$$\text{Power factor (P.F.)} = \frac{\text{Real power}}{\text{Apparent power}}$$
$$= \frac{V I \cos \phi}{V I}$$

Q/M

So, $\boxed{\text{P.F.} = \cos \phi}$

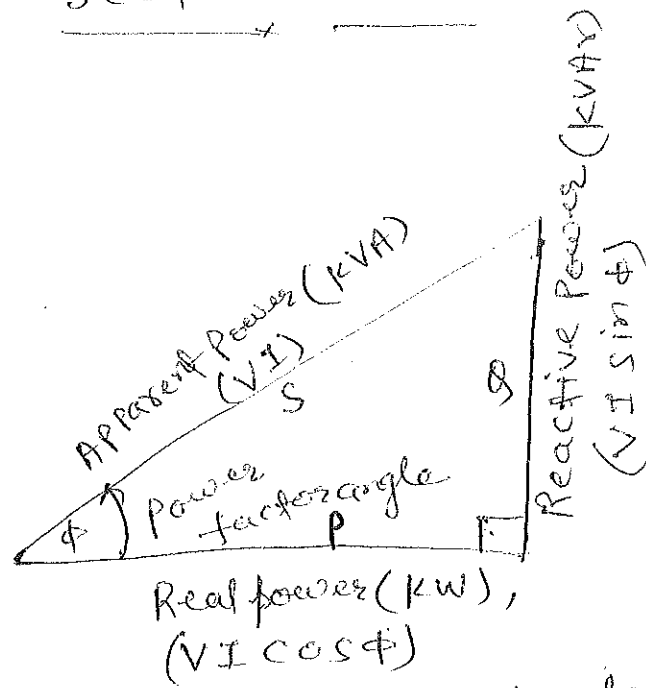
The important disadvantages of low power factor are

(i) Higher current is required by the equipment, due to which economic cost of equipment increased.

(ii) At low P.F., the current is high which gives rise to high copper losses in the system and therefore the efficiency of the system is reduced.

Section - C

1. Ans: —



(Fig: - power triangle)

Since, total electrical power =

voltage across the element \times current -
through the element

This is - called apparent power and denoted by 'S'.

A fraction of this total electrical power which actually does our useful work is - called as active power. it is denoted as 'P'.

$P = \text{active power} = \text{Total electrical power} \times \cos \phi$
and its unit is watt.

The other fraction of power is - called reactive power. This does no useful work, but it is required for the active work.

to be done. It is denoted by 'Q' and

mathematically it is given by

$$Q = VI \sin \phi, \text{ and its unit is VAR (Volt AMP Reactive).}$$

01M

this reactive power oscillates between source and load.

Q. Ans:

Three phase system has following advantages as compare to single phase system.

(1) Power to weight ratio of 3- ϕ alternator is high as compare to 1- ϕ alternator.

It means, for generation of same amount of electrical power, the size of 3- ϕ alternator is small as compare to 1- ϕ alternator. So, the overall cost of alternator is reduced for generation of same amount of power. Moreover, due to reduction in weight, transportation and installation of alternator become convenient and less space is required to accommodate the alternator in power houses.

(2) For electric power transmission and distribution of same amount of power the requirement of conductor material

e/m
is less in 3- ϕ system as compare to 1- ϕ system. Hence, the 3- ϕ transmission and distribution system is economical as compare to 1- ϕ system.

e/m
(3) 3- ϕ motor is having better power factor and efficiency as compare to 1- ϕ motor.

(4) A 3-phase system can be used to feed a 1- ϕ load, where as vice-versa is not possible.

3. Ans: -

(a) Ans: Since, $i = 100 \sin 2\pi t$ — (I)

~~Compare eqnⁿ (I) by $i =$~~
 ϕ we know,

$$i = i_m \sin \omega t \quad \text{--- (II)}$$

Compare eqnⁿ (I) and (II)

$$i_m = 100 \text{ amp}$$

$$\boxed{\omega (\text{angular velocity}) = 2\pi \text{ rad.}}$$

$2m$
since, $\omega = 2\pi f$.

ϕ $f = \frac{\omega}{2\pi}$, where 'f' is frequency

$$\text{So, } f = \frac{2\pi}{2\pi} = 1 \text{ Hz.}$$

ie, $f = 1 \text{ Hz}$

We know that period of wave $(T) = \frac{1}{f}$

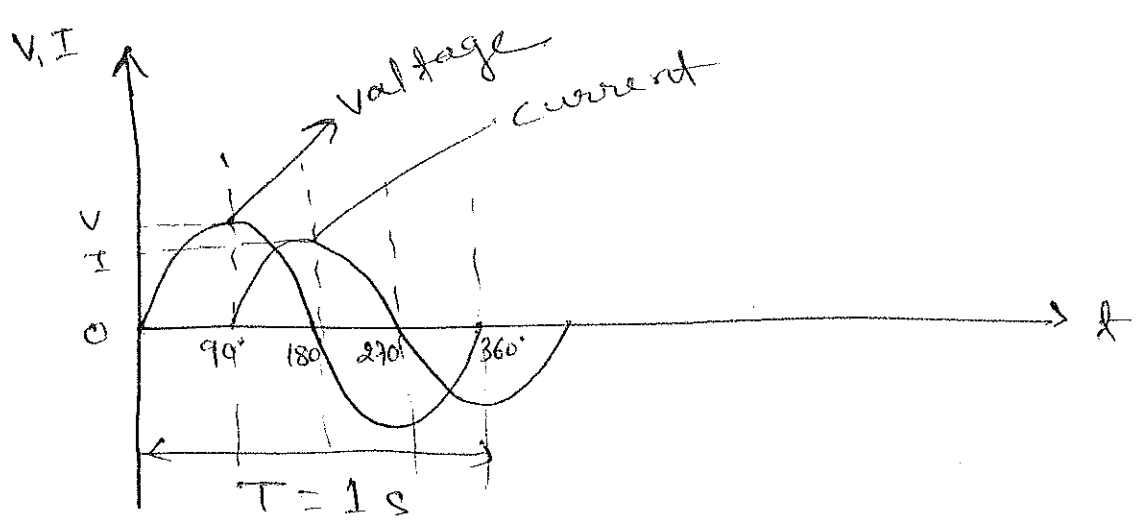
or, $T = \frac{1}{1} = 1 \text{ s}$

so, $T = 1 \text{ s}$

(b) Ans: —

In pure inductive load current lags voltage by 90° .

So, the wave form relation among voltage and current are: —



(fig: Relation of vol. and current)

