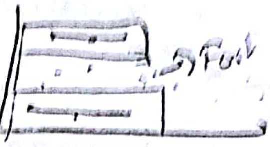
WORLD'$ OF AME

MODULE 3 NOTES

BY.●WORLD'$ OF AME●

Mass of proton = 1.67×10^{-27} kg 

Mass of electron = 9.1×10^{-31} kg

Mass of electron = $\frac{1}{1836}$ of proton.

mass of proton is 1,837 times greater than electron.

proton weighs ≃ 1,845 times as much as e^-

No: protons and neutrons determines the overall weight of atom.

North seiking Pole / South seiking Pole.

Magnetism:

(Amp. right hand grip rule / coffee mug)
Cork screw rule - direction of magnetic field (straight conductor)

Clasp rule - polarity

Biot savart law - strength of magnetic field.

field force lines on thickness rather than length.

Magnetomotive force (like P.d)

MMF = I × N (At) Amp. turn.
unit

MMF is measured by Gilberts.
Symbol = F

Permanent magnet Alnicose.

Magnetising force (H): $H = \frac{mmf}{l} = \frac{IN}{l}$ (At/m)

Reluctance : Amp turn/web. (At/wb)

Reluctance - opposition to becoming magnetised.

magnetic flux, $\phi = \frac{MMF}{reluctance}$ unit = weber

Permeability - It has no unit.

Permeability, $\mu = \frac{B}{H}$ B - flux density, H - magnetising force.

Types of magnetic materials:

Ferromagnetic material - Permeability greater than 1
(highly magnetise same direction) eg: Iron, nickel, cobalt.

Paramagnetic material - Permeability slightly greater than 1
(weakly magnetise same direction) eg: Platinum, manganese, chromium, Al

diamagnetic material: Permeability less than 1. Slightly diamagnetic
(weakly magnetise opposite direction) cants. eg: bismuth.

✓ If force is more magnetic lines of force pass easily.

✓ Magnetic screen or shield: Magnetic lines of force does not go inside the instrument, it just pass through outer case of the instrument.

The point at which magnetic material loses its property is called curie temperature. (Permanent 400° C)

Care of magnet:

✓ keeper bars are made of soft iron core.

Use keeper while magnet is stored, the magnetic flux will continuously circulate through the magnet and not leak off into space.

✓ Bar magnets should always be stored in pair with north and south pole placed together this provides path for magnetic flux without any flux leakage.

✓ Flat magnet depends on thickness and doesnot depend on length.

Ferrite - Nonmagnetic material that has fero magnetic properties of iron.

no: of turn

Two parallel conductor:

(i) Current in same direction - field strength decrease of conductors attract

(ii) Current in opposite direction } - field strength increase conductors repel.

direction of current flow in conductor:

(•) dot current flow towards you

x current flow away from you.

Convential flow (+)ve to (-)ve

Electron flow (-)ve to (+)ve.

Emf,

$$E = \frac{\mathcal{E}}{Q}$$

E = potiantial difference in volts.

$\mathcal{E}$ = energy expanded or absorbed in joules

Q = charge measured in coulombs.

Current I = Q (charge) (A) / t (time). (s)

One coulomb equal to 6.28 billion billion electrons

6.28×10^{18}

Velocity of charge is called dirft velocity or average velocity.

Factors affecting resistance $R = \frac{\rho l}{A}$

1mil is 1000 of an inch

1 square mil = 1.27 circular mil

1 circular mil = 0.785 square mil.

Scanned by CamScanner

Power, $\dot{P} = \frac{\varepsilon}{t}$

P = power (W) ε : energy (Joule), t = time (s)

The rate of doing work.   amount of doing work

Resistance: (R) (Flow of charge opposition)

Unit ohm.

Factor, $R = \frac{\rho l}{A}$

Types of resistor:

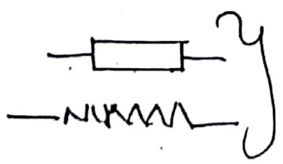
(i) Wire wound resistor - Procelain material
↓ manganin wire ↓
↓ Used for high precision   high power, high stability

(ii) Ceramic metal - acurate resistance, high stability under extreme temp.

(iii) Metal film - ~~exate~~ excellent tolerance and temp co.eff extremely reliable

(iv) deposited carbon - lower current and closer tolerance.

(v) Carbon composition - Produce electric noise, low cost (stray)



Symbol of resistor

Semiconductors - Thyristor, Thermistor, carbon.

Wheatstone bridge ⇒ $R_x = \frac{R_1}{R_2} \times R_3$

Resistivity - ohm meter

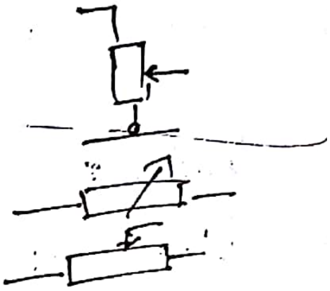
... siemen/meter

$G = 1/R$

Reciprocal of resistance is conductance

$G = \frac{A \sigma}{l}$ $(\sigma = \frac{1}{\rho})$

+ Potentiometer - 3 terminals, 4 wires
controls voltage



Rheostat - 2 terminals, 2 wire.
controls current

First and Second color band with never be gold or silver.

If third band is gold multiply 10 %.

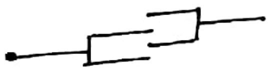
If third band is silver " 1 %.

If there is no fourth band tolerance 20 %.

Wire wound - control large amounts of current and have
high power ratings.

Potentiometer is used to obtain a variable voltage from fixed voltage source to apply to an electrical load.

Capacitor -||- unit farad.

condensor - 

Factors affecting capacitor $C = k \frac{A}{d}$

No: of plate $(n-1)$

In capacitor → positive lead → long

If leads are same size - negative side diff. colour

Power, $P = \frac{E}{t}$

P = power (W) — The rate of doing work.
E = energy (Joule), amount of doing work
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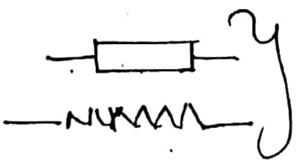

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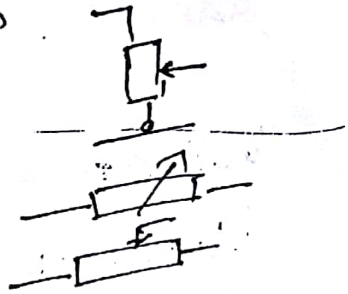

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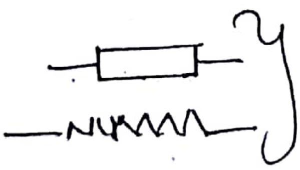
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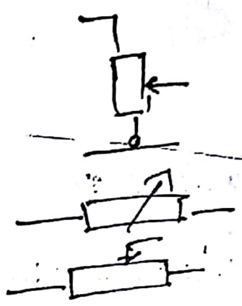

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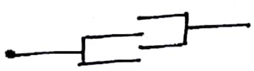
condensor - 

Factors affecting capacitor $C = k \frac{A}{d}$

No: of plate $(n-1)$

In capacitor → positive lead → long

If leads are same size - negative side diff. colour

Energy stored in capacitor, $E = \frac{1}{2} CV^2$

Capacitor allows AC blocks DC
fully charge - open circuit ; fully discharge - short circuit

Capacitor in DC - filter, short circuit.

Capacitor in AC - charging and discharging

" " in AC motor - phase shift.

unit of capacitor is Farad

*Without decimal pico F(10^{-12})

*With decimal micro F(10^{-6}).

Time constant
charge and discharge capacitor
$\tau = RC$
Time taken to charge 99% is 5τ
(Pg 16-51)

A parallel plate capacitor is made by stacking 'n' equally spaced plates connected alternatively. If the capacitance b/w any two adjacent plates is 'C' then the resultant capacitance Ans: $(n-1)C$

If 'n' plates how many capacitors $(n-1)C$
If 'n' capacitors " " plates $(n+1)C$

Troubles in capacitor:

(i) ohmeter reads zero and stays there - short circuit

(ii) It shows charging but final resistance less than normal } - leaky capacitor

(iii) If the capacitor shows no charging but reads high resistance } - open circuit.

Hysteresis loss ∝ frequency

eddy current loss ∝ square of frequency.

in capacitance current will lead the voltage by 90°

Inductors is also known as choke

in inductance voltage will lead the current by 90°

Series:

(i) Same current flows through all part of circuit.

(ii) Difference resistors have their individual voltage drop

(iii) Voltage drops are additive

(iv) Applied voltage equals the sum of different voltage drops

(v) Resistors are additive

(vi) Powers are additive.

Parallel:

(i) Same voltage acts across all parts of the circuits

(ii) Different resistors have their individual current

(iii) Branch current are additive

(iv) conductance are additive

(v) Powers are additive.

dynamic electricity, it is in motion
Static electricity it is in rest.

Factors affecting capacitance

* Distance ~~resistance~~ b/w plates

* Area of plate

* Dielectric of capacitors. (

Types of capacitors

electrolyte capacitor ← Fast (withstand High voltage → 1-1500 micro farad its value range

mica capacitor (50 micro micro farad to 0.02 micro farad its range

paper

ceramic — most used (withstand high freq)

Transformer:

The primary reason why open circuit test is performed on Low voltage winding of the transformer.

Ans: draws sufficiently large on load current for convenient reading.

Max. efficiency in transformer; Cu loss = Iron loss

The main purpose of performing open circuit test on transformer is to measure core loss.

$$\frac{E_2}{E_1} = \frac{N_2}{N_1} = \frac{I_1}{I_2}$$

No load on transformer - magnetising current at no load loss

No load test on transformer is carried out to measure core loss (i/p of trans when no load measure core loss)

Cu loss found in short circuit test

Hysteresis loss $\propto$ freq   Eddy current loss $\propto (freq)^2$

Permittivity

While discussing phenomenon a certain property of medium is called permittivity.

Absolute permittivity $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m

Relative " , $\varepsilon_r = 1$ (Air)

$$\varepsilon = \varepsilon_0 \varepsilon_r \text{ F/m}$$

Cu loss, full load = $\frac{1}{4}$ no load, half load.

$B = \frac{\phi}{A}$

3 main source - Batteries, thermocouples, photocells

phase angle (θ) - angular dist b/w voltage & current.

phase angle is the difference in degrees of rotation b/w two alternating current or voltage or b/w voltage & current.

Transformers are rated in kVA?

As seen cu loss of transformer depend I, iron loss on voltage, Hence total transformer loss depends on VA and not on phase angle b/w voltage & current i.e, it is independent of load power factor that is why trans. rated in kVA not in kW

Ideal transformer:

(i) Winding has no resistance.

(ii) Core has no loss

(iii) Core has infinite permeability.

~~Transformer~~

Star and delta connection.

Star connection also known as wye connection

delta " " " " mesh connection

delta connection

(i) Line voltage = phase voltage

(ii) line current = √3 phase current ($\sqrt{3} = 1.73$)

Power = $\sqrt{3}\, V_L I_L \cos\phi$

(iii) Line currents are 120° apart

(iv) line currents are 30° behind the respective phase current

(v) Angle b/w line current & corresponding line voltage $(30+\phi)$ with current lagging.

Star :

(i) line voltages are 120° apart

(ii) line voltages are 30° ahead of their respective voltage.

(iii) The angle b/w line current and corresponding line voltage (30+ϕ) with current lagging.

(iv) line current = phase current

(v) line ~~current~~ voltage = √3 phase voltage.

Battery

Primary cell ⊕⊖-

During discharge both cells will be ...

Lead acid

+ve plate PbO_2 (Anode).

-ve plate Pb (Cathode).

electrolyte -> Sulphuric acid (H_2SO_4)

30% acid + 70% water by volume.

Seprators: fiberglass, rubber (or) other insulating material.

OCV 2.2V

CCV 2V

Incase of spilage - cleaning bicarbonate of soda.

Specific gravity -> hydrometer

highstate = 1.3 - 1.275

medium = 1.275 - 1.240

low = 1.240 - 1.200

1.270 ...

Neutralizing agent:

Bo bicarbonate of soda.

usually constant voltage.

Quick constant current

No correction necessary.

while charging:-

Generally constant voltage.

Rapidly - " current.

Ni-Cd

+ve Ni O.OH (Nickel hydroxide)

-ve cd. (cadium)

~~-ve~~ KOH

electrolyte - potassium hydroxide

20-34% conc. electrolyte to 70% water by weight

Seprators: wooven nylon layer of cellophane.

OCV 1.25V

CCV 1.2V

Incase of spilage Vinegar and boric acid.

Specifgravity reads by hydrometer.

SG. 1.3

Neutralizing agent

Ammonia or boric acid

usually const current

Quick const voltage.

while charging:-

Battery.

Lead acid

(i) Specific gravity ~~doesn't go beyo~~ using hydrometer

(ii) Voltage does not go beyond level of 2.4V

(iii) Over gassing

in colour. Cathode - ~~chocolate brown~~ pearl grey

anode - chocolate brown.

Ni-cd:

Specific gravity constant. ~~so m~~

Specific gravity is measured by discharge test

Grid material - lead and antimony.

To correct cell imbalance during reconditioning, the battery is discharged to zero capacity and then recharged it is called deep cycle.

Lead acid:

After charging of the battery (anode) +ve plate - choclate brown colour

(cathod) -ve plate - pearl grey colour

In electrodes white power is formed due to oxidation.

S.G of dil. H_2SO_4 - 1.21 (or near)

cell straps cells are connected in series by use of it

Normal - constant voltage

Quick charging - constant current

expander - prevent loss of porosity

Const. voltage - reduce the time of charge it increase the capacity by app 20% but reduce the efficiency by 10%

(lead acid) Constant voltage - very low internal resistance

(Ni-cd) Constant current - very high internal resistance, supplies constant current a wide range of load resistance.

Ni-cd: Formation of white crystal of potassium carbonate on a properly serviced Ni-cd battery installed in a/c indicates overcharged

Voltage remain constant over a major part of discharge cycle

+ first while installing

- last for removing.

~~katho~~ anode cathode

Daniel - copper and zinc

Lechlanche - carbon and zinc

an cat

Trickle charging is used for long term storage
It will ensure battery in fully charged condition.
polarization at anode, sulphate @ cathode.
Float charging - method of charging which the
charge and battery are always connected to each other
supply current to load.
Storge of Leadacid - fully charged, if it is discharge sulphation occurs.
" of Ni-cd - fully charged or fully discharge.
Generator:
Value of an induced emf in generators
(i) No: of wires moving through the magnetic field
(ii) Strength of magnetic field.
(iii) Speed of rotation

Galvanometer - measures current (identified by 0 at centre)
Compensating windings are connected in series (poles ul armat)
embedded in slot of pole face

Series DC generator not used in ak
parallel dc generators used where constant load.
flat compound generators gives constant voltage
on no load and full load.

Armature parallel to field no emf or zero.
" perpendicular to field maximum emf.

Compound generator:
(i) Flat compound - both full load and no load voltage is const
(ii) Over " - full load ↑, no load ↓
(iii) Under compound - full load ↓, no load ↑
(iv) Cummulative - both series ul shunt
(v) differential - series opposes shunt.
(vi) shunt compound generators ... field ul armature.

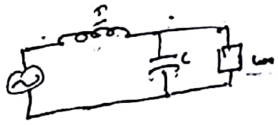
Black - neutral

Green - ground

In DC motor, max power } $E_b = V/2$
max. efficiency } or half.

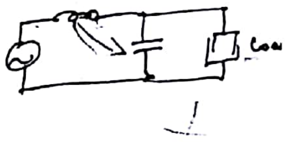
Filter: (10-116)

Lowpass

Inductance L in series with load 

Capacitor C in parallel with load.

Highpass.

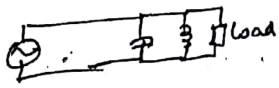
Inductance in parallel with load. 

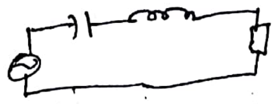
Capacitor in series with load.

Bandpass:

Both capacitor and Inductor in series with load

" " " " in parall with load.





Bandstop:

Both C and L are in parallel with each other but series with load

" " " are series with each other but parallel with load.

Attenuate: removing frequency.

Decimal System:

~~A filters performance~~ The system of logarithmic measurement is widely used in audio, radio, TV and instrument industry for comparing two voltages and current or power level. These levels are measured in a unit called bel (B) or decibel (dB) which is 1/10th of a bel.

Active filter: circuit uses operational amplifier ie IC's
Passive filter: " uses only L, C, R

Cutoff frequency:

The cutoff frequency f_c of the filter is the freq at which the output voltage is reduced to 70.7% of its max value.

A passive filter has attenuation of -3dB at cut off f. freq.

Armature reaction:

distorting and demagnetizing effects will increase with increase in armature current.

(i) demagnetize or weakens the main flux
(ii) Cross magnetises or distorts it.

Magnetic loss is also known as iron loss or core loss

Stray loss = magnetic loss + mechanical loss.

Hysteresis loss: This loss is due to reversal of magnetisation of armature core.

In armature:

Total loss
- Cu loss
  - Armature Cu loss
  - Shunt Cu loss
  - Series Cu loss
- Iron loss
  - Hysteresis
  - Eddy current
- Mechanical loss
  - friction
  - windage

Power factor:

Types of impedance	Phase angle for current	Power factor.
Resistance	0°	1
Inductance	90° lag	0
Capacitance	90° lead	0
R and L	$0 < \phi < 90°$ lag	$1 > Pf > 0$ lag
R and C	$0 < \phi < 90°$ lead	$1 > Pf > 0$. lead.
RLC	b/w 0° and 90° lead or lag	b/w 0 and unity lead or lag.

Comparison of series and parallel resonance:

Item	Series	Parallel
Impedance at resonance	minimum	maximum
Current at resonance	max = $\frac{V}{R}$	max = $\frac{V}{(L/CR)}$
Effective impedance	R	L/CR
Power factor at resonance	unity	unity
Resonant frequency	$\frac{1}{2\pi\sqrt{LC}}$	$\frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$
It magnifies	voltage	current
Magnification is	$\frac{\omega L}{R}$	$\frac{\omega L}{R}$

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Effective or RMS value, $V_{rms} = 0.707 \times V_P$.

Peak value, $V_P = 1.414 \times V_{rms}$

Average value of current = $0.63 \times$ max value.

Apparant Power (S) = Rms Voltage $\times$ Rms current
(V A)

$S = I^2 Z$

Active power (P or W):

The power which is actually dissipated in a circuit resistance.

unit: watts.

$P = I^2 R = VI \cos\phi$.

Reactive power: (Q)

Power developed in inductive circuit.

$Q = VI \sin\phi$

Unit - VAR volt amp reactive.

$$\text{Power Factor} = \frac{\text{True power}}{\text{apparant power}}$$

$$Pf = \frac{\text{Resistance}}{\text{impedance}}$$

Pf = cosine of angle of lead or lag.

AC is more dangerous than DC
(1.414 × RMS).

Alternator BLT 2-1425.

(i) Armature reation unity (i) powerfactor
Cross magnetizing flux.
(mainly secondary distortion)

(ii) Armature reaction of alternator at lagging zero (Inductors) powerfactor:
Purely demagnetize and armature flux directly weakens main field flux, current more for armature

(iii) The armature reaction of an alternator will be completly magnetizing when load powe factor is zero Leading (capacitors)

Alternator on load: BLT-2 1422
Load and terminal voltage inversely prop
as load increase terminal voltage decre.
(i) Armature resistance
(ii) Armature leakage reactance
(iii) Armature Reaction

Form factor: $\frac{\text{Ratio of RMS value}}{\text{average value}} = \frac{0.707}{0.637} = 1.11$

Permanent magnets have high reluctance, high coercive force

Battery low internal resistance, no load voltage, will be greater than on load voltage.

Core loss is always constant.

Rest Battery covered in hydrogen during polarization
Anode.

built upon cathode sulphation.

Ac motor

Induction:

4 parts.
Single phase - Not self starting, cannot change direction

Shaded pole - Inductor is used

half portion is winded.

It has salient poles.

advantage:

Self starting but very low starting torque

disadvantage:

Cannot change direction

low starting torque

Very little overload capacity

Low efficiency

Low power factor.

Split phase: Capacitor is used

Capacitor gives lead effect by 90° (phase shift)

Centrifugal switch - when the motor rpm attained 25 % of rated speed, centrifugal switch automatically disconnects.

Capacitor (C.S) is connect with ~~start~~ starting winding.

direction can be changed by interchanging the leads.

Self starting ....
Each phase 120° apart

high p.f
very high overload capacity

rotating magnetic field.

by rotating magnetic field torque is produced.

The speed of rotating magnetic field is known as synchronous speed.

Rotor is of squirrel cage type.

Copper or aluminium bars welded to heavy ring of high conductivity on either end.

Due to ~~rotor~~ squirrel cage induction motor is self starting.

The speed of rotor is known as Non-synchronous speed.

Synchronous speed should never be equal to the non-synchr. (if equal motor will not start)

$$Slip = \frac{\text{Synchro (stator)} - \text{Non-synchro (Rotor)}}{\text{Synchro (stator)}} \times 100\%$$

direction of rotation:

Interchange any two leads, the motor direction will change.

if one broken 1/3

if two broken 2/3

3phase Synchronous motor:

* Single phase Synchro. m. used for clocks and other small precesion equipment.

Synchro. motor very little starting torque.

It has rotating magnetic field.

Rotor is not of squirell cage type, so it is not self starting.

No slip.

Starting devices is used to rotate the rotor up to 90 percent of stator speed (synchro speed).

Rotor has a permanent magnet.

generally DC source is given to rotor (AC can also be used)

Alternator

Brushless alternator - No brushes so no arcing.

No sparking a high altitude

less maintenance.

It has 3 parts - pilot exciter, exciter and main generator assembly (system)

Alternator - rated in kVA

(i) Pilot exciter - mounted on the main generator rotor shaft and is connected in series with main generator fields. It is rectified and controlled

(ii) Exciter - permanent magnets mounted on the main generator stator b/w the exciter poles. It provides stability, voltage correction, temperature correction. Thermistor is used in the mech to electrical.

principle - electromagnetic induction:

motor | generator.

(torqe) | emf is zero at parallel. (+

(torqe) | emf is maximum at perpendicular.

dc generators 3 parts.

dc motor 4 parts.

Yoke is also known as field frame.

Purpose of yoke

(i) Protection

(ii) It completes magnetic circuit b/w poles.

Both electromagnet and permanent magnet.

Advantage of electromagnet:

* In electromagnet, the magnetic property (field) can be increased or decreased.

* If we need more magnetic property (field) than the size perm. magnet will be very large but in case of electromagnet it is not like this.

Armature:

It is used as an iron conductor in mag. field

Armature should be laminated to prevent eddy curr.

Two types:

(i) Gramme ring (not used because it cuts few lines of flux and very low voltage induced)

(ii) drum type (mostly used)

Armature winding are placed in the slots in the drum type.

drum type cuts more mag. field.

Lap winding is used for high current

Wave winding is used for high voltage.

Commutator:

flexible braided, copper conductor called pigtail.

Connect brush to external circuit.

· AC to DC

mica insulation to a depth equal to width of mica 0.020 inch

Armature reaction:

reduce the main field

distorts the magnetic field.

Compensating windings: neutralize the cross magnetic effect.

Inter poles: reduce sparking. - primary purpose.

cancelation of cross magnetisation - secondary purpose

Shape of brushes - rectangular.

Brush spring tension 32-36 ounce.

Commutator pressure 1½ to 2½ psi

Brush - carbon graphite, lite metalized.

	DC Generator	DC motor
Series-	Not used in A/c	high starting torque at variable speed
		engine starting, landing gear, flaps
	few turns of large wire	few turns of heavy wire.
parallel:	many turns of small wire.	Low starting torque
	Constant voltage.	Low speed.
Compound:	Used where voltage regulation is of prime importance	Series winding may either aid shunt or oppose the shunt winding

Cummulative : Variable speed

It is used for driving machines subj sudden change in load.

high starting torque. (less then series) (series can't be used easily)

Differential : increase in load, I increases, decrease total flux

max. eff
max. powe. } back emf, $E_b = V/2$

Intermittent duty - short period - 2min or less than
Continuous " - Long " - more then 2min

Cu loss @ full load = Cu loss @ half or no load/4

Capacity of battery depends upon. (i) Rate of discharge
(ii) Temperature
(iii) Density of electrolyte
(iv) Quantity of active material.

Doesnot depend upon rate of charge.

Squirrel cage rotor:

Skewed rotor slots: (It does not give starting torque)

*(i) It helps to make motor run quietly by reducing the magnetic hum and.

(ii) It helps in reducing the locking tendency of rotor i.e. the tendency of the rotor teeth to remain under the stator teeth due to direct magnetic attraction b/w two.

Lap winding - high current = No. of poles = No. brush
wave winding = high voltage ; No. of parallel brushes - 2

Slip in synchro motor @ Start 100 % ..

" " " during running 0 %.

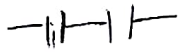
1 coloumb of charge in terms of force 9×10^9 N

absolute permittivity Farad/meter.

In sphere (charged conducting) zero is electric intensity

" " " " " " potential is constant.

One farad = $\frac{\text{one coloumb}}{\text{one volt}} = \frac{Q}{V}$



(n-1)

(n+1)

no: of plates (n+1) c

no of capacitors (n-1)

Active component - having its own power source.

passive component - " no own power.

Vacuum/Air:

$\mu_0 = 4\pi \times 10^{-7}$ Henry/meter

$\mu_r = 1$

$\mu_0 = 0$ for air and

μ_r has no unit

permitivity - ε_0

(A.P) $\varepsilon = \varepsilon_0 \varepsilon_r$ (R.P)

$\varepsilon_0 = 8.854 \times 10^{-12}$ C/m

$\varepsilon_r = 1$

permeability

(permea) $\mu = \mu_0$ (a.p) $\times \mu_r$ (R.P)

~~$\mu_0 = \mu_0$~~

~~$\mu_0 = 4\pi$~~

Incoming I = ~~out~~ outgoing current · V

In I - Out I = 0

K · Voltage law (closed circuit)

applied - ~~alge~~ algebric sum of ~~applied~~ voltage drop = 0

applied voltage = algebric sum of voltage drop.

High stability - wirewound resistor

Carbon resistor - noise.

5th band - temperature coefficient and reliability.

Gold in third band $\frac{10}{100}$

Silver in " " $\frac{1}{100}$

Gold in forth band 5%

Silver is forthand 10%

Inductors: ~~cross~~ cross sect area increase inductance incre

radius double ~~cross~~ se inductance 4 -

Armature reaction :-

Dis-advantage:

✓. It demagnetises (or) weakens the main flux.

✓. It cross magnetises (or) Distorts it.

① In DC generator, armature Reaction is produced actually by;

a) its field current. b) Armature conductors.

c) Field pole winding. ⓓ load current in armature.

② In a DC generator, the effect of armature reaction on the main pole flux is to,

a) Reduce it. b) Distort it.

c) Reverse it. ⓓ both (a) & (b).

③ The primary Reason for providing compensating winding in DC generator is to:

a) compensate for decrease in main flux. b) neutralize armature mmf.

ⓒ neutralize cross magnetising flux. d) maintain uniform flux distribution

④ The most likely causes of sparking at the brushes in DC machine is:

a) open coil in armature. b) Defective interpoles.

c) incorrect brush spring pressure. ⓓ All the above.

⑤ The commutation process in DC generator basically involves

a) passage of current, from moving armature to a stationary level.

(b) Reversal of current in an armature coil as it crosses MNA.

c) conversion of AC to DC.

d) suppression of Reactance voltage.

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(1) If the Residual magnetism of Shunt generator is destroyed accidentally, it may be restored by connecting its shunt field.

a) to each. b) to an A.C source.

c) in reverse. (d) D.C. source.

(2) An ideal D.C Generator is one that has ______ voltage regulation.

a) Low, (b) zero. c) Positive. d) negative.

(3) The ______ Generator has poorest voltage.

(a) series. b) shunt. c) compound. d) high.

(4) what is the best way of minimizing eddy current in an armature Lamination.

(5) what causes sparking at the brushes?

Ans: It is due to self induction of the coil undergoing commutation.

(6) what are the two kinds of sparking produced in a generator?

Ans: (i) Due to bad adjustment of brushes.

... condition of the commutator.

Scanned by CamScanner

(7) What causes ... ?

Ans: (i) Eddy current.

(ii) moisture which almost short circuits the armature.

(iii) un equal strength of the magnetic poles.

(iv) operation above rated voltage & below normal speed.

Note:

Speed can be controlled by varying?

*. Flux pole ϕ (Flux control).

*. Resistance of Armature circuit (Rheostatic control).

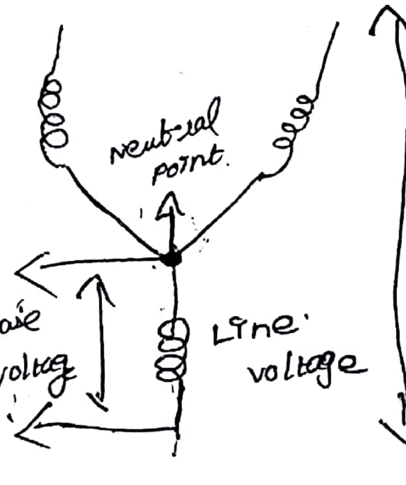
*. Applied voltage (Voltage control).

Star connection.

Line current = Phase current.

Line voltage = $\sqrt{3}$ Phase voltage ($\sqrt{3} = 1.73$).

Power = $\sqrt{3}\ V_L\ I_L \cos\theta$.



Delta connection.

Line voltage = Phase voltage.

Line current = $\sqrt{3}$ Phase current.

Ac motor.

Principle. -> EMI. [Electric to mechanical]

In Ac motor do not use brush & commutator

Rated by,

* HP output (746 watt) (1 HP)
* Full load current
* operating voltage
* speed of rotation
* Frequency
* No. of phases.

number plate in motor;

* No. of poles
* speed of motors.

Types of motor;

(Rep) ① Induction motor.
(Attw) ② synchronous "
(1, 2, 3 phases on both)

① **Induction motor:**

✓. squirel cage motor. (make by Al, Co)

✓. single phase motor.

* pulsating o/p.
* Deflection by 180° (Rep)

✓. Shaded poles. (low initial torque) (low eff)

✓. split sphase - (10-157)

* switch is off (25% o/p)
* Rate of phase 90°.
* Running winding - starting winding

O/P = 30%. *. 3-phase => change the I/P lead

O/P = 30%. *. 2-phase => change the (1 phase magnets).

*. 1-phase => change the I/P lead.

*. Shaded poles => It cannot be change.

Synchronous motor :-

✓. Rotor winding - DC input.

✓. stator winding - AC input.

✓. when little load is applied - lag the rotating rotor, then it will start slowly.

✓. when high load is applied - opposite it lag, then it will stop rotating (over loaded).

synchronous - Induction (Rotating field).

*. It has low intial torque (so we use any other mean) then it Remove.

*. synchronous - not a self starting motor.

*. mag field of rotor (lock) mag field of stator.

Frequency, $F = \frac{PN}{120}$ → rpm

$I \cdot R = \frac{OCV - CCV}{I \text{ load}}$

Current, $I = \frac{Q}{t}$ - charge

Potential, $E = \frac{\varepsilon}{Q}$ - energy.

Potential, $V = IR$

Power, $P = \frac{\varepsilon}{t}$ - energy, - time

$P = VI, I^2R, V^2/R$

Frequency, $F = \frac{1}{t}$ - time

$V_{rms} = 0.707 \times V_p$ - Peak voltage.

$V_p = 1.414 \times V_{rms}$

Average value $= 0.63 \times$ max. value

$\tau = RC$, τ - time constant

$\tau = \frac{L}{R}$

capacitance, $C = \frac{q}{E}$ - charge, - voltage

Energy, $E = \frac{1}{2} CV^2$

$C = K \cdot \frac{A}{d}$

$R = \frac{\rho l}{A}$

capacitive reactance, $X_c = \frac{1}{2\pi f C}$

Inductive reactance, $X_L = 2\pi f L$

force ...

Inductance, $L = -N \frac{d\phi}{dt}$, N ↓ No. of turns

$F = NI$

Series,

Impedance, $Z = \sqrt{R^2 + X_L^2}$

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

Parallel,

$Z = \frac{R X_c}{\sqrt{R^2 + X_c^2}}$

Resonant frequency, $f_n = \frac{1}{2\pi\sqrt{LC}}$

$P.F = \frac{\text{True Power}}{\text{Apparent Power}}$

$P.F = \frac{\text{Resistance}}{\text{Impedance}}$

P.F = cosine of angle lead or lag.

Apparent Power $= I^2 Z$

" = Rms voltage x Rms current

Active power / True " / Real " $= VI \cos\phi$ ($\cos\phi$ → (P.F))

Reactive power $= VI \sin\phi$

Transformer, $\frac{E_1}{E_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1}$

wheatstone, $R_x = \frac{R_1}{R_2} \times R_3$

mmf $= I \times N$ → turns (I → current)

$B = \frac{\phi}{A}$

magnetising force, $H = \frac{mmf}{l} = \frac{IN}{l}$

Permeability, $\mu = \frac{B}{H}$ - flux density

slip $= \frac{\text{synchronous} - \text{non synchronous}}{...} \times 100$

Potential - volt (V)

emf (E) - volt (V)

current (I) - Ampere (A)

Resistance (R) - ohm (Ω)

Resistivity - ohm-meter (Ωm)

Power (P) - watt (W)

Frequency, Resonace } - Hertz (Hz)

Inductance (L) - Henry (H)

Capacitance (C) - Farad (F)

charge (Q) - coloumb (C)

Energy (E) - Joule (J)

Impedance (Z), Inductive reactance (X_L), Capacitive reactance (X_C) } - ohm (Ω)

Magnetic flux (ϕ) - weber (W_b), maxwell

flux density (B) - Tesla (T)

mmf = Ampere turn (AT), gilbert

Reluctance - Ampere turn / weber, gilbert / maxwell.

Field intensity, flux density } - gauss ~~N / coloumb~~

work - Joule, Kilogram metre force

Electrical pressure - volt.

magnetising force (H) = $\frac{At}{m}$ m - metre

Permittivity (ε_0) - F/m

Permeability (μ_r) - No unit. μ_0 = H/m

slip - percentage (%)

conductance (G) - siemen

conductivity - siemen/metre

wavelength (λ) - metre (m)

Apparent power (S) - volt-amp

Active power (P (or) W) - watts.

Reactive power (Q) - volt-amp-reactive (VAR)

Electric intensity - N / coloumb, Volt / metre

Power level, Attenuation } decibel

Inductor.

No. of turns and current increases ∝ flux.