TRANSIENT ANALYSIS

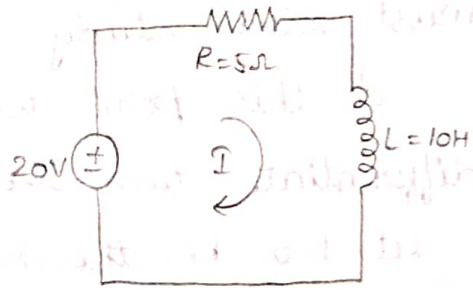
1. What are different ways of defining time Constant.

A. Time Constant can be defined in two ways. They are:

1. Time constant (τ) is defined as the time required for the current to acquire the steady state Value if the rate of rise of current remains the same at $t=0$.
2. It can also be defined as the time required to reach 63.2% of steady state response
The rate of increase of current is slow when the system has long time constant

2. A D.C Voltage of 20V is applied in a R-L circuit where $R = 5\Omega$ and $L = 10H$. Find the time Constant.

Sol Given:- Voltage (D.C), $V = 20V$
Resistance, $R = 5\Omega$
Inductance, $L = 10H$



Let I be the steady state current flowing through the circuit

Time Constant, $T = \frac{L}{R}$

$= \frac{10}{5}$

$T = 2 Sec$

3. A D.C Voltage of 20V is applied in a R-L Circuit where $R = 5\Omega$ and $L = 10H$. Find the maximum Value of Stored energy

Sol Given:- Voltage = 20V

$R = 5\Omega, \quad L = 10H$

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

$$= \frac{20}{5}$$

$$I = 4A$$

$\therefore$ Maximum Value of energy stored is

$$W = \frac{1}{2} L I^2$$

$$= \frac{1}{2} \times 10 \times 4^2$$

$$W = 80J$$

4. Explain about Initial Conditions

In order to evaluate the arbitary constants of the natural response of the differential equation, we must stead study the Initial Conditions.

At this point we Introduce a notation to differentiate two states of network.

Let $t=0$ be the reference time.

At this reference time 1 or more switches are operated

Let us assume that switches act in zero time.

* To differentiate between the time, immediately before and after (closing) operation of switch, we will use $-$ and $+$ signs.
* So conditions existing just before the switch is operated as $t=0^-$ and conditions after as $t=0^+$

Resistor: If there is a change in Voltage, the current through resistance will change Instantaneously. Similarly if the current changes, the Voltage across resistance changes Instantaneously.

Inductor: The current cannot change instantaneously in a system. If a current through an Inductor before switching is zero then the current through Inductor after switching is also zero

$$i_L(0^-) = i_L(0^+) = 0$$

Capacitor: The Voltage across capacitor cannot change Instantaneously.

If the Voltage across the capacitor before switching is zero then the Voltage across the capacitor after switching is also zero

$$V_C(0^-) = V_C(0^+) = 0$$

5. Explain why the Voltage across Capacitor cannot change Instantaneously.

Sol Voltage across capacitor is given by

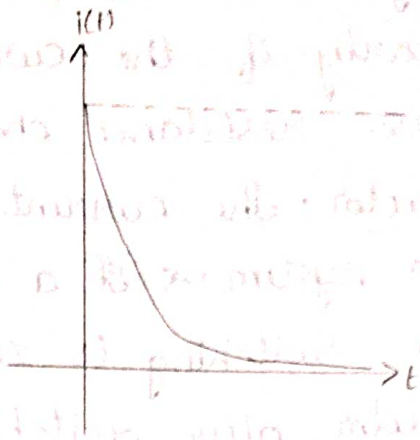
$$V = \frac{1}{C}\int i\,dt$$

Hence, a small change in Voltage across a capacitor with in zero time gives an infinite current through the capacitor, which is physically Impossible.

In a fixed capacitance, the Voltage cannot change abruptly.

6. Draw the time response of the current in a series RC circuit.

$$i(t) = \frac{V}{R}\left[e^{-1/RCt}\right]$$



at $t = RC$

$$i(t) = \frac{V}{R}\left[e^{-1/RC(RC)}\right]$$

$$= \frac{V}{R}\left[e^{-1}\right]$$

$$= \frac{V}{R}\left[0.3678\right]$$

$$i(t) = 0.367\frac{V}{R}$$

$$\tau = RC$$

7 Write equation for Voltage in a RLC series circuit

Voltage across RLC series circuit is $V = R\,i(t)$

In over damped case

$$V = R\left[\frac{Ve^{\frac{-R}{2L}t}}{\sqrt{R^2-\frac{4L}{C}}}\left(e^{\left(\frac{1}{2L}\sqrt{R^2-\frac{4L}{C}}\right)t} - e^{\left(-\frac{1}{2L}\sqrt{R^2-\frac{4L}{C}}\right)t}\right)\right]$$

In critically damped case

$$V = R\left[\frac{V}{L}te^{\frac{-R}{2L}t}\right]$$

In over damped case:

$$V = R\left[\frac{2V}{\sqrt{R^2-\frac{4L}{C}}}\,e^{\frac{-R}{2L}t}\sin\left(\frac{1}{2L}\sqrt{R^2-\frac{4L}{C}}\right)t\right.$$

8. What is Transient state?

A. If a network contains energy storage elements, with change in excitation, the current and Voltages change from one state to other state. The behaviour of the Voltage (or) current when it is changed from one state to another state is called Transient state.

9. What is natural Response.

A It is the general solution of differential equation representing the circuit when the input is set to be zero.

* It depends on the circuit elements and initial energy stored with in the circuit.
* Mathematically, this part of solution is called as Complementary function.

10. What is meant by natural frequency?

If the damping is made zero then the response oscillates with natural frequency with-out any opposition Such a frequency is called natural frequency of Oscillation, denoted as ω_n.

11. Define Damping ratio:

It is the ratio of actual resistance R in the circuit to the critical resistance R_c. It is denoted by greek letter zeta (ζ)

(or)

* The inverse of Time constant is called damping ratio

$$\text{Damping ratio} = \frac{R}{L}$$

12. Write down few applications of RL, RC and RLC circuits

The applications of RL, RC and RLC circuits are

* Coupling circuits,
* phase-shift circuits.
* Filters
* Resonant circuits
* Ac bridge circuits
* Transformers.

13. What is the time constant for RL and RC circuits?

Time constant is defined as the time taken to reach certain percent of final Value, so this is known as Time constant.

Time constant for RL circuit $= L/R$

Time constant for RC circuit $= 1/RC$

14. How does an Inductor act at $t=0^+$ and $t=\infty$?

A An Inductor will act as open circuit at $t=0^+$ and It will act as a short circuit at $t=\infty$

15. Obtain the natural frequency and time Constant of an RLC series circuit with $R=1K$, $L=100mH$ and $C=0.1F$

16. When do we get Transient response?

Whenever a circuit is switched from one condition to another either by a change in the applied source (or) change in the circuit elements there is a Transitional period during which the branch currents and Voltage change from their Values to new ones, this period is called Transient

17. Distinguish between steady state and Transient response of an electric circuit.

S.No	Steady state Response	Transient Response
1.	Amplitude will not change	Amplitude may change
2.	Frequency will not change	Frequency may change
3.	Constant Voltage and current with time	change from one steady state to another.
4.	Algebraic equations are used	Integro - differential equations are used

18. What are the causes of Transient behaviour occuring in a circuit.

A The causes of Transient behaviour are

(a) It may be due to the sudden change of applied Voltage.

(b) When the Voltage source is shorted.

(c) When a circuit is connected or disconnected and

(d) Due to storage elements in the circuit.

UNIT-II

1. Define Resonance ?

(A) Resonance is the phenomenon at which both Voltage and current are in phase.

→ At Resonance total circuit acts as resistive circuit.

→ Power Factor of the circuit is Equal to one

2. Define Resonant Frequency ?

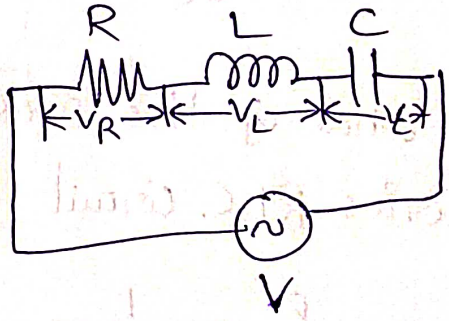
(A) The frequency with which resonance occurs are known as Resonant Frequency

(or)

The frequency at which Capacitive reactance (X_c) is Equal to inductive reactance (X_L) i.e $X_C = X_L$ is called resonant frequency

Units : Hz

3) Derive the Expression for Resonant frequency ?



(A)

$$\therefore X_L - X_C = 0$$

$$X_L = X_C$$

$$\omega L = \frac{1}{\omega C}$$

$$\omega^2 LC = 1$$

$$\omega^2 = \frac{1}{LC} \Rightarrow (2\pi f)^2 = \frac{1}{LC}$$

$$f_r^2 = \frac{1}{4\pi^2 LC}$$

$$\boxed{f_r = \frac{1}{2\pi\sqrt{LC}}}$$

'f_r' is a Known as Resonant frequency

(4) Define Bandwidth of RLC CKt ?

(A) The bandwidth of any system is the range of frequencies for which the currents (or) output Voltage is Equal to 70.7% of its Value at the resonant frequency and it is denoted by B.W

Band width is defined as the frequency difference between f_2 and f_1

$$\boxed{BW = f_2 - f_1}$$

(5) Define Quality Factor ?

(A) The Quality Factor Q is the ratio of the reactive Power in the inductor (or) Capacitor to the true Power in the Resistance in series with the coil (or) Capacitor

$$Q = 2\pi \times \frac{\text{Maximum Energy stored}}{\text{Energy dissipated Per cycle}}$$

(6) what is the resonant frequency and bandwidth of a series RLC circuit whose $R = 50\Omega$, $L = 40mH$ and $C = 1\mu F$

(A)

$$f_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2 \times 3.14\sqrt{40 \times 10^{-3} \times 1 \times 10^{-6}}} =$$

$$B.W = \frac{R}{2\pi L} = \frac{50}{2 \times 3.14 \times 40 \times 10^{-3}}$$

(7) Determine the Quality Factor of a coil for the Series circuit consisting $R = 10\Omega$, $L = 0.1H$, $C = 10\mu F$

(A) $Q = \frac{f_r}{BW}$

$f_r = \frac{1}{2\pi\sqrt{LC}}$

$B.W = \frac{R}{2\pi L}$

(8) Compare Series and Parallel resonant

(A)

Series	Parallel
1. Power factor is unity	1. Power Factor is unity
2. The net reactance is zero at resonance	2. Net impedance at resonance of the Parallel ckt is Maximum
3. At resonance the circuit has got minimum impedance and Maximum admittance	3. The admittance is minimum and the net Susceptance is zero at Resonance.
4. $f_r = \frac{1}{2\pi\sqrt{LC}}$	4. $f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$

(9) Derive the Resonant frequency for Tank circuit

(A) $Y = \frac{R_L}{R_L^2 + X_L^2} + j\left[\frac{1}{X_C} - \frac{X_L}{R_L^2 + X_L^2}\right]$

$\frac{1}{X_C} = \frac{X_L}{R_L^2 + X_L^2}$

$\omega_C = \frac{\omega L}{R_L^2 + \omega^2 L^2}$

$R_L^2 + \omega^2 L^2 = \frac{L}{C}$

$\therefore \omega^2 L^2 = \frac{L}{C} - R_L^2$

$\omega^2 = \frac{1}{LC} - \frac{R_L^2}{L^2}$

$\omega = \sqrt{\frac{1}{LC} - \frac{R_L^2}{L^2}}$

$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R_L^2}{L^2}}$

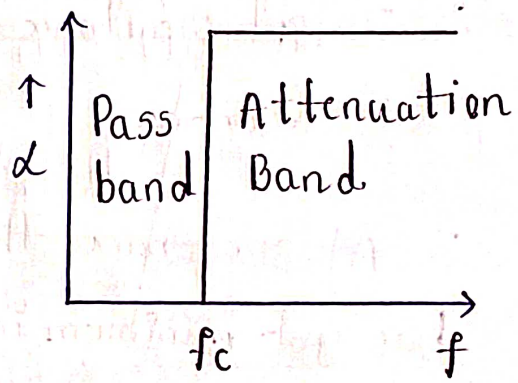
(10) Define constant K filters?

(A) A T (or) π Section in which series and shunt arm impedances Z_1 and Z_2 satisfy the relationship $Z_1 Z_2 = R_0^2$ where R_0 is a Real constant is called constant K filters.

R_0 is real resistance which is frequency independent R_0 is known as design/load impedance/resistance of the section

11. Define Low pass filter?

A low pass filter is one which passes without attenuation all frequencies up to the cut-off frequency f_c, and attenuates all other frequencies greater than f_c.



Condition for pass band

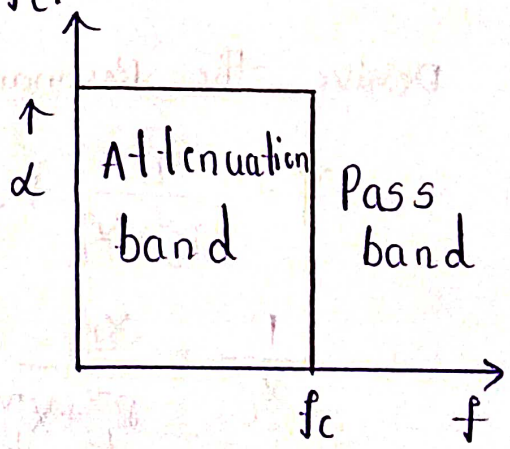
$f_c > f > 0$.

Condition for stop band.

$\infty \geq f \geq f_c$

12. Define high pass filter?

A high pass filter attenuates all frequencies ~~up to the cut-off freq~~ below a designated cut-off frequency, f_c, and passes all frequencies above f_c.



Condition for pass band

$f_c < f < \infty$

Condition for stop band

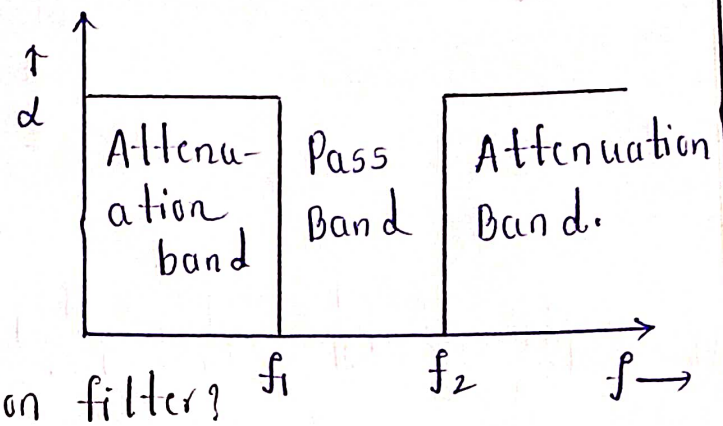
$0 < f < f_c$

13. Define Band Pass Filter ?

A band pass filter passes frequencies between two designated cut-off frequencies and attenuates all other frequencies.

Condition for pass band is $-1 < \frac{Z_1}{4Z_2} < 0$

~~$f_c > f > 0$~~

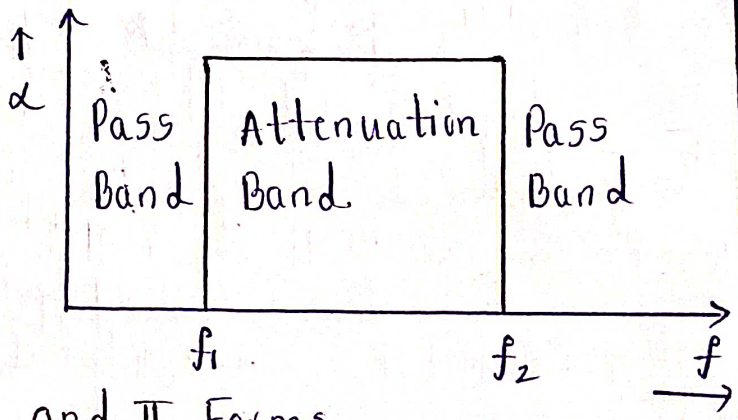


14. Define Bandstop/Elimination filter?

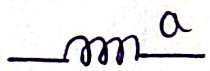
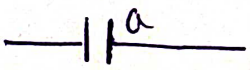
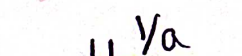
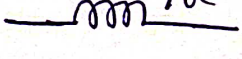
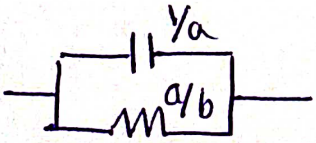
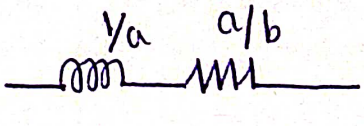
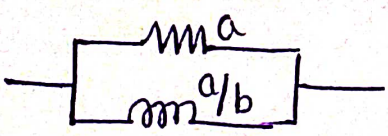
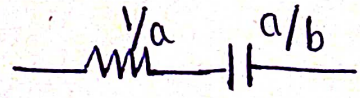
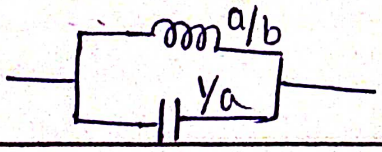
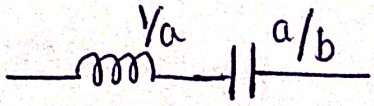
A Band Elimination filter passes all frequencies lying outside a certain range, while it attenuates all frequencies between two designated frequencies.

Condition for stopband is $-\infty < \frac{Z_1}{4Z_2} < -1$

~~$\infty > f > f_c$~~



15. Determine FOSTER-I and II Forms.

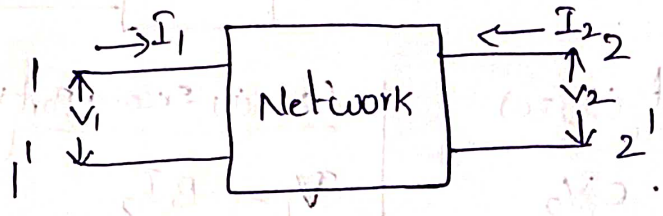
FOSTER-I $Z(s)$	FOSTER-II $Y(s)$
as 	as 
$\frac{a}{s}$ 	$\frac{a}{s}$ 
$\frac{a}{s+b}$ 	$\frac{a}{s+b}$ 
$\frac{as}{a+b}$ 	$\frac{as}{a+b}$ 
$\frac{as}{s^2+b}$ 	$\frac{as}{s^2+b}$ 

UNIT-3

Two - Port Networks

1. write short notes on Two-Port Network?

Ans



one such network having only one Pair of terminals (1-1') called as Single port Network.

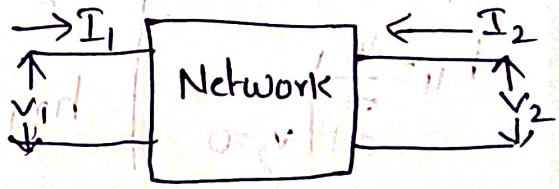
one such network having Two Pair of terminals (1-1') & (2-2') called as Two Port Network.

one pair terminals represents the input and other pair terminals represents the output.

2. write Equations of Z-Parameters?

Ans.

$$V_1 = Z_{11}I_1 + Z_{12}I_2$$
$$V_2 = Z_{21}I_1 + Z_{22}I_2$$



Case(i) second Port ($I_2=0$)

$$V_1 = Z_{11}I_1 \Rightarrow Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0}$$
$$V_2 = Z_{21}I_1 \Rightarrow Z_{21} = \frac{V_2}{I_1}\Big|_{I_2=0}$$

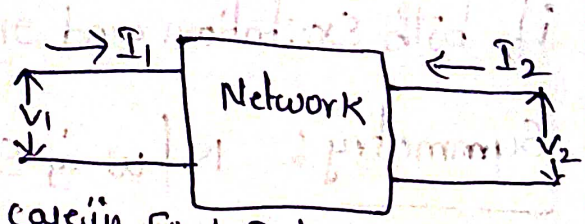
Case(ii) First Port ($I_1=0$)

$$V_1 = Z_{12}I_2 \Rightarrow Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0}$$
$$V_2 = Z_{22}I_2 \Rightarrow Z_{22} = \frac{V_2}{I_2}\Big|_{I_1=0}$$

3. write Equations of Y Parameters

Ans:

$$I_1 = Y_{11}V_1 + Y_{12}V_2$$
$$I_2 = Y_{21}V_1 + Y_{22}V_2$$



Case(i) Second Port Voltage is zero ($V_2=0$)

$$I_1 = Y_{11}V_1$$
$$Y_{11} = \frac{I_1}{V_1}\Big|_{V_2=0}$$
$$I_2 = Y_{21}V_1 \Rightarrow Y_{21} = \frac{I_2}{V_1}\Big|_{V_2=0}$$

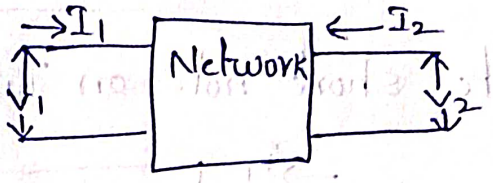
Case(ii) First Port Voltage is zero ($V_1=0$)

$$I_1 = Y_{12}V_2 \Rightarrow Y_{12} = \frac{I_1}{V_2}\Big|_{V_1=0}$$
$$I_2 = Y_{22}V_2 \Rightarrow Y_{22} = \frac{I_2}{V_2}\Big|_{V_1=0}$$

(4) write the Equations of ABCD Parameters

Ans:

$$V_1 = AV_2 - BI_2$$
$$I_1 = CV_2 - DI_2$$



Case(i) second Port current ($I_2=0$) zero

$V_1 = AV_2$

$A = \left.\frac{V_1}{V_2}\right|_{I_2=0}$

$I_1 = CV_2$

$C = \left.\frac{I_1}{V_2}\right|_{I_2=0}$

Case(ii) second Port Voltage ($V_2=0$) zero

$V_1 = -BI_2$

$-B = \left.\frac{V_1}{I_2}\right|_{V_2=0}$

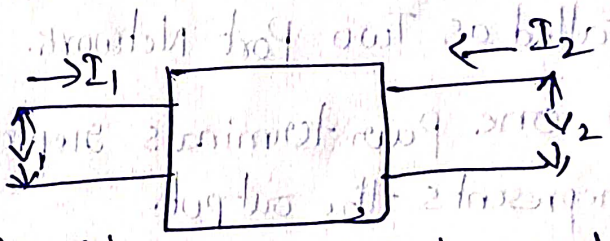
$I_1 = -DI_2$

$-D = \left.\frac{I_1}{I_2}\right|_{V_2=0}$

(5) write the Equations of h Parameters

Ans:

$$V_1 = h_{11}I_1 + h_{12}V_2$$
$$I_2 = h_{21}I_1 + h_{22}V_2$$



Case(i): second Port Voltage is zero ($V_2=0$)

$V_1 = h_{11}I_1$

$h_{11} = \left.\frac{V_1}{I_1}\right|_{V_2=0}$

$I_2 = h_{21}I_1$

$h_{21} = \left.\frac{I_2}{I_1}\right|_{V_2=0}$

Case(ii) First Port current is zero ($I_1=0$)

$V_1 = h_{12}V_2$

$h_{12} = \left.\frac{V_1}{V_2}\right|_{I_1=0}$

$I_2 = h_{22}V_2$

$h_{22} = \left.\frac{I_2}{V_2}\right|_{I_1=0}$

(6) write the Condition for reciprocity and Symmetry

(i) Z Parameters

Reciprocity: Ratio of response to Excitation is Same Even if both Excitation and response are interchanged.

Symmetry: N/w is Said to be symmetrical if the i/p and o/p Ports can be interchanged without altering the Port Voltage & Currents.

Z-Parameters:

Condition for reciprocity = $\frac{V_1}{I_2} = \frac{V_2}{I_1}$

$Z_{12} = Z_{21}$

Condition for symmetry is $\frac{V_1}{I_1} = \frac{V_2}{I_2}$

$Z_{11} = Z_{22}$

Y-Parameters

Condition for reciprocity = $Y_{12} = Y_{21}$

Condition for symmetry = $Y_{11} = Y_{22}$

ABCD Parameters

Condition for reciprocity $AD - BC = 1$

Condition for symmetry $A = D$

h Parameters

Condition for reciprocity $h_{12} = -h_{21}$

Condition for symmetry $h_{11}h_{22} - h_{12}h_{21} = 1$

(7) List Z Parameters interms of other Parameters

Ans:

	Y	ABCD	h
Z_{11} Z_{12}	$Z_{11} = \frac{Y_{22}}{\Delta Y}$ $Z_{12} = \frac{-Y_{12}}{\Delta Y}$	$Z_{11} = \frac{A}{C}$ $Z_{12} = \frac{\Delta T}{C}$	$Z_{11} = \frac{\Delta h}{h_{22}}$
Z_{21} Z_{22}	$Z_{21} = \frac{-Y_{21}}{\Delta Y}$ $Z_{22} = \frac{Y_{11}}{\Delta Y}$	$Z_{21} = 1/C$ $Z_{22} = D/C$	$Z_{12} = \frac{h_{12}}{h_{22}}$ $Z_{21} = \frac{-h_{21}}{h_{22}}$ $Z_{22} = \frac{1}{h_{22}}$

Y Parameters interms of other Parameters

	Z	ABCD	h
Y	$Y_{11}=\frac{Z_{22}}{\Delta Z}$ $Y_{12}=\frac{-Z_{12}}{\Delta Z}$	$Y_{11}=\frac{D}{B}$ $Y_{12}=\frac{-\Delta T}{B}$	$Y_{11}=\frac{1}{h_{11}}$ $Y_{12}=\frac{-h_{12}}{h_{11}}$
	$Y_{21}=\frac{-Z_{21}}{\Delta Z}$ $Y_{22}=\frac{Z_{11}}{\Delta Z}$	$Y_{21}=\frac{-1}{B}$ $Y_{22}=\frac{A}{B}$	$Y_{21}=\frac{h_{21}}{h_{11}}$ $Y_{22}=\frac{\Delta h}{h_{11}}$

ABCD Parameters interms of other Parameters

	Z	Y	h
ABCD	$A=\frac{Z_{11}}{Z_{21}}$ $B=\frac{\Delta Z}{Z_{21}}$	$A=\frac{-Y_{22}}{Y_{21}}$ $B=\frac{-1}{Y_{21}}$	$A=\frac{\Delta h}{h_{21}}$ $B=\frac{h_{11}}{h_{21}}$
	$C=\frac{1}{Z_{21}}$ $D=\frac{Z_{22}}{Z_{21}}$	$C=\frac{\Delta Y}{Y_{21}}$ $D=\frac{-Y_{11}}{Y_{21}}$	$C=\frac{-h_{22}}{h_{21}}$ $D=\frac{-1}{h_{21}}$

h Parameters interms of other Paramters

	Z	Y	ABCD
h	$h_{11}=\frac{\Delta Z}{Z_{22}}$ $h_{12}=\frac{Z_{12}}{Z_{22}}$	$h_{11}=\frac{1}{Y_{11}}$ $h_{12}=\frac{-Y_{12}}{Y_{11}}$	$h_{11}=\frac{B}{D}$ $h_{12}=\frac{\Delta T}{D}$
	$h_{21}=\frac{-Z_{21}}{Z_{22}}$ $h_{22}=\frac{1}{Z_{22}}$	$h_{21}=\frac{Y_{21}}{Y_{11}}$ $h_{22}=\frac{\Delta Y}{Y_{11}}$	$h_{21}=\frac{-1}{D}$ $h_{22}=\frac{C}{D}$

The Y Parameters of a two-Port Network are $Y_{11}=0.6\,\mho$ $Y_{22}=1.2$ $Y_{12}=-0.3\,\mho$ Determine ABCD Parameters

$Y_{11}=0.6\,\mho$

$Y_{22}=1.2\,\mho$

$Y_{12}=-0.3\,\mho$

$Y_{12}=Y_{21}=-0.3$ (reciprocal N/w)

$\boxed{AD-BC=1}$

$$A=\frac{-Y_{22}}{Y_{21}}=\frac{-(1.2)}{-0.3}=4$$

$$B=\frac{-1}{Y_{21}}=\frac{-1}{-0.3}=3.33$$

$$C=\frac{-\Delta Y}{Y_{21}}=\frac{-[0.6\times1.2-(-0.3)(-0.3)]}{-0.3}=2.1$$

$$D=\frac{-Y_{11}}{Y_{21}}=\left[\frac{-0.6}{-0.3}\right]=2$$

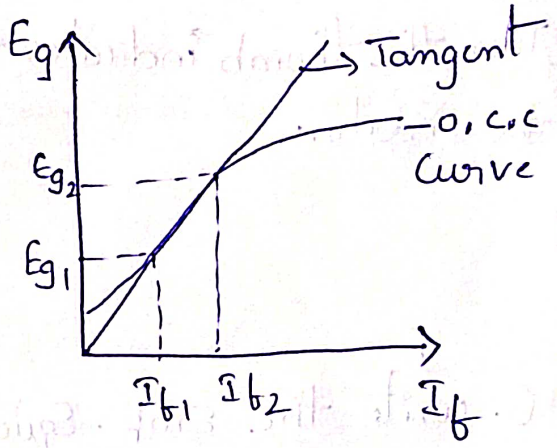
UNIT-4

1. Define Critical field Resistance of a DC Shunt Generator

A) The Critical field Resistance is defined as the Maximum field circuit resistance with which the shunt Generator would Just Excite. The Voltage build up in a shunt Generator depends upon field circuit Resistance.

$$R_c = \frac{\Delta E_g}{\Delta I_f}$$

$$R_c = \frac{E_{g_2} - E_{g_1}}{I_{f_2} - I_{f_1}}$$



2. what is the function of interpoles in DC Machine.

A) The function of interpoles is to improve commutation and to reduce armature reaction.

It is Made up of cast steel.

3. what is the role of commutator in DC Generator?

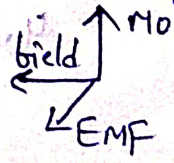
A) The role of commutator to convert AC into DC in DC Generator and to collect current from (or) for Armature winding and to convert alternating Torque into unidirectional Torque in dc Motor

It is Made up of Copper segments separated by Mica insulation

4. Define Fleming's right hand rule?

The direction of induced Emf is given by fleming's right hand rule. Hold out the right hand with the fore finger middle finger and thumb at right angles to each other.

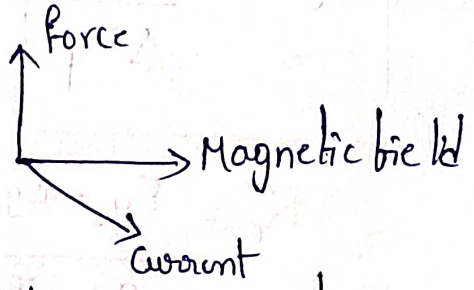
If fore finger represents the direction of the lines of flux
Thumb Points in the direction of Motion
middle finger Point in the direction of induced Emf.



5. Define Fleming's left hand rule?

A) The direction of force on a current carrying conductor in a magnetic field can be determined by the Fleming left hand rule.

if fore finger represents the direction of the magnetic flux and the middle finger indicates the direction of current Then the thumb indicates the direction of the force experienced by the conductor.



6. write the Emf. Equation of DC Generator?

A) $$E_g = \frac{\phi Z N}{60} \times \frac{P}{A}$$

Here E_g is generated Emf

ϕ is flux per pole

N is speed

P is no. of poles

A is no. of parallel paths

Z is Armature conductors

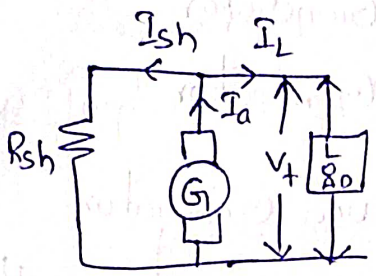
7. write the ~~Em~~ applications of DC Generators?

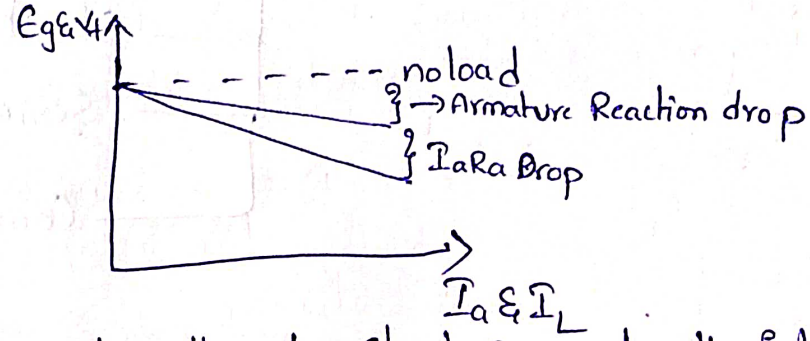
1. separately excited generators operate in a stable condition with any variation in field excitation.
2. They are generally used for Testing Purpose in the Laboratories
3. They are used for general lighting and to charge battery
4. In series arc lightening this type of generators are mainly used.

(8) Draw the performance characteristics of DC Shunt Generator

(2)

A)





Internal characteristics : consider the d.c shunt Generator the internal characteristics is E Vs Ia

External characteristics: the External characteristics is terminal Voltage V_t and load current I_L

$$V = E - I_a R_a$$
$$V = E - (I_L + I_{sh}) R_a$$

(9) State the Conditions to be satisfied to build the EMF in DC Generator?

A) Conditions for built up of a Generator :

1. There must be some residual Magnetism in generator Poles
2. The field winding Must be properly connected to the armature so as to aid the residual flux
3. The resistance of the field circuit Must be less than the Critical field resistance, and (if Excited on open circuit)
4. The generator Must be run at a speed above the Critical Speed.

(10) what are the different Types of dc Generators according to the ways in which fields are Excited?

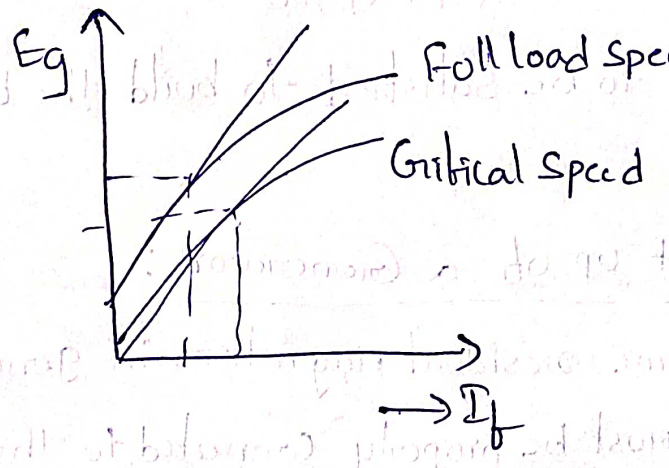
A) DC Generators are categorized into Three Main types based on the Methods of field Excitation

1. Permanent Magnet
2. Separately Excited

3. Self Excited
- Shunt Generator
- Series Generator
- Compound Generator
  - Short shunt
  - long shunt

(11) what is the Critical Speed of DC shunt Generator?

(A) The Critical speed of the the DC Generator is the Minimum Speed below which it fails to Excite. it is the speed at which the given shunt field resistance represents the Critical Speed



(12) what do you mean by back Emf?

(A) → when the Motor armature rotates, the armature conductors cut the flux, and as a result an Emf is induced in them.

→ The direction of this Emf induced is opposite to that of the applied Voltage V. so it called Back Emf (or) Counter Emf represented by E_b.

$$E_b = \frac{\phi Z N}{60} \times \frac{P}{A}.$$

(13) List the applications of DC Series Motor

(A) 1. DC Series Motor is also called as Variable Speed Motor

2. It is used where large starting Torque is required for accelerating heavy Masses.

3. where load is subjected to heavy fluctuations Electric Traction cranes, elevators, fans, blowers, hair driers, air compressors etc.

(14) Explain why a dc Series Motor should never run in no-load condition? (3)

(A) In case of DC Series Motor armature current is decided by the load. No load, the armature current drawn by the Motor is very small.

In case of DC Series Motor

$$\boxed{\phi \propto I_a}$$

on No load as I_a is Small hence flux produced is also very Small.

According to Speed Equation

$$\boxed{N \propto \frac{1}{\phi}}$$ as E_b is constant

So on a very light load (or) No load condition as flux is very small, the Motor tries to run at dangerously high speed. which May damage the Motor Mechanically.

This is the reason why DC Series Motor should never be started on No load conditions.

(15) what are the draw backs of Three Point starter?

(A) 1. The Main draw back of the 3 Point starter is, it Experiences from a Major drawback of Motors by a huge difference of Speed with a modification of the field Rheostart

2. To amplify the Motor speed, the field resistance Must be amplified So the flow of current throughout the shunt field is decreased

3. whenever adding high resistance to get a high speed will maketh field current very low.

(16) state the need for starter for DC Motor, how it helps to improve the operation of Motor.

(A) For protection of Motor against the flow of Excessive Current during starting Period, it is necessary to insert high resistance in series with the armature circuit.

(17) How to control the speed of DC Motor above rated speed.

(A) Thus the Speed of a DC Motor can be controlled in three ways

1. By Varying the supply Voltage
2. By Varying the flux, and by Varying the current through the field winding
3. By Varying the armature Voltage, and by Varying the armature resistance.

(18) what is the significance of back Emf?

(A) 1. Back EMF represents that Portion of the Supply Voltage which Multiplied by the Current equals the Mechanical work produced

2. The Back EMF plays a self regulating role by limiting Current and energy flow through the Motor.

(19) what is difference btw Motor and Generator

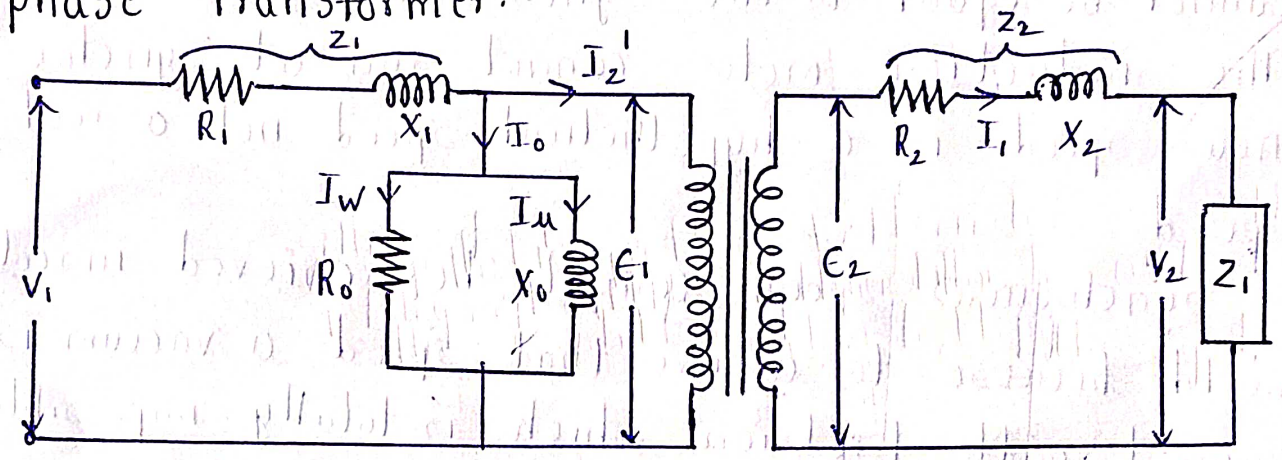
(A)

~~Generator~~ Motor	~~Motor~~ Generator	Example	Examples
1. It converts Electrical to Mechanical Energy	1. It converts Mechanical to electrical	Fans, Cars	Power stations
2. Electric Motor Follows Fleming's left-hand rule.	2. Electric generator follows Fleming's right hand rule.		
3. current supplied to the Armature winding	3. Current produced in the Armature winding		

5. AC MACHINES

1. Draw the Equivalent circuit of a single phase Transformer.

A.



R_1 = Primary winding Resistance

R_2 = Secondary winding Resistance

I_0 = No load current

I_μ = Magnetizing component

I_W = working component

E_1 = Primary EMF , E_2 = Secondary EMF

R_0 and X_0 combination is Exciting circuit

2. write the emf equation of a single phase Transformer.

A. The EMF equation is $E_1 = 4.44 f N_1 \phi_m$ volts.

where E_1 = rms induced emf

f = frequency

N_1 = no. of Turns in primary winding

ϕ_m = flux generated

3. Explain why speed of an Induction motor cannot be equal to the synchronous speed.

A. The induction motor cannot run at synchronous speed is a hypothetical speed not a real speed.

Synchronous speed cannot be achieved in real world because to achieve that speed a vaccum is required with frictrion which is totally impossible in real world.

4. List out the applications of 3-Ø induction motor

A. Applications of 3-Ø induction motor

1. Used in Grinding machines
2. Used in Pumps and submersible
3. Used in Conveyors
4. Used in Flour mills
5. Compressors
6. And other low mechanical power applications.

5. Define voltage Regulation of an Alternator.

A. The voltage regulation of an alternator is defined as the ratio of the rise in ~~wh~~ voltage when full load is removed to the rated terminal voltage

$$\% \text{ Voltage Regulation} = \frac{E_0 - V}{V} \times 100$$

6. write the advantages of Synchronous machines compared to other AC Machines

A- Power factor of synchronous motor can be easily controlled by changing the excitation of motor.

For low speed (< 300rpm) applications, synchronous motors are more economical than induction motor.

The synchronous motors have high inductor starting torque as compared to induction motor

7. what is meant by electromagnetic torque?

A- Induced Torque Equation in a machine is defined as the Torque generated by "electric to mechanical power conversion." This Torque is known as electro magnetic Torque

8. what is basic difference between motor and Generator.

A Motor:

A Motor is a machine that converts "electrical energy to mechanical energy."

Generator:-

A Generator is a machine that converts "mechanical energy to electrical energy"

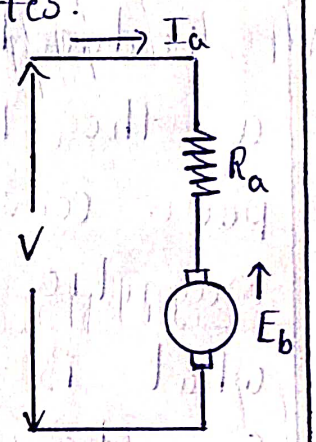
9. How will you change the direction of rotation of a D.C motor

A. In order to change the direction of rotation of a D.C motor, we can simply reverse the voltage causing the current to flow in the opposite direction, changing the force by 180° and the motor to be driven 'backwards'

10. what is back emf in D.C. motors.

Back EMF is the system in the coil of an electric motor that opposes the current flowing through the coil, when the armature rotates.

Back emf (E_b) is generated in the armature circuit in opposition to the applied voltage(V), r_a represents effective resistance I_a is the Input current to the motor



$$V = E_b + I_a R_a$$

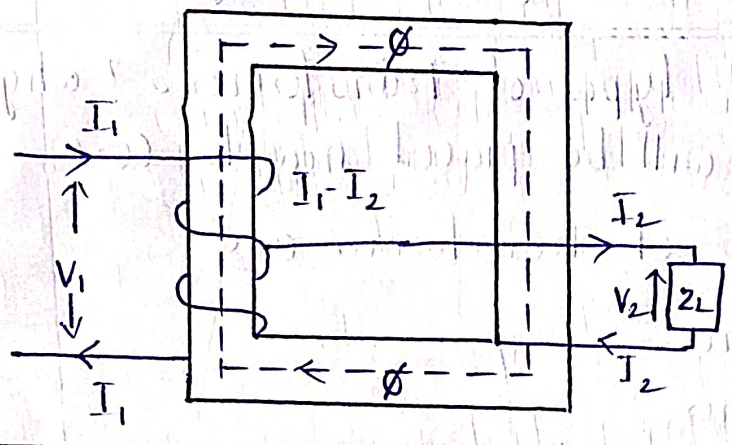
11. Define slip and give its expression.

slip in an AC inductor motor is defined as; As the speed of the rotor drops below the stator speed, the rotation rate of the magnetic field in the rotor increases, inducing more current in the rotor's winding and creating more torque. slip is required to produce torque

$$\text{slip } s = \frac{N_s - N}{N_s} = \frac{\text{Synchronous speed} - \text{Rotor speed}}{\text{Synchronous speed}}$$

12. What is Auto Transformer

A single phase is a one-winding transformer, It is a very efficient device and its percentage efficiency is as high as 99 per cent or more. Its regulation is also very good compared to a two-winding transformer.



13 Define Critical field resistance and Explain Briefly

The critical field resistance is defined as the maximum field circuit resistance (for a given speed) with which the shunt generator would just excite. The shunt generator build up only if the field circuit resistance is less than critical field resistance.

14d Define Frequency

A Frequency is the number of occurances of a repeating event per unit time.

15. what are the factors which affects the regulation of an alternator

A: The factors are

1. speed of the alternator
2. The quality of connections
3. The condition of the battery and the system load.

16. what are two general types of Transformers? why low voltage winding will be placed near to core?

A. The two general types of Transformer are

1. core type Transformer
2. shell type Transformer.

Low voltage winding will be placed near to core of the transformer, because insulation provided provided between Low voltage winding and core of transformer is quite less compared to the insulation provided between the high voltage winding and the core of transformer which result less in cost for insulation

17. what is distribution factor

It is defined as the ~~EMF~~ ratio of EMF induced in distributed winding to the EMF induced in the concentrated winding

$$k_d = \frac{\text{EMF induced in distributed winding}}{\text{EMF induced in concentrated winding}}$$

18. state differences between Squirrel Cage and slip ring induction motor.

Squirrel cage motor	slip ring Induction motor
1) It has low starting Torque	1) ~~High~~ It has High starting Torque
2) It has high starting current.	2) It has low starting current.
3) It has rough acceleration under heavy loads	3) It has smooth acceleration under heavy loads.

19. what is efficiency of Transformer

The ratio of a transformer's output power to its input power is known as Efficiency

$$\eta = \frac{\text{output power}}{\text{Input power}}$$

20. what is synchronous Impedance? How it can be measured?

A. synchronous Impedance(Z_s) is defined as the ratio of the open circuit voltage to the short circuit current.

when o.c.c and s.c.c are linear, synchronous impedance Z_s is constant. The flux under test conditions is the same as that under load conditions.

21. what is the aim of conducting OC and SC tests on 1-ø transformer?

A. Aim :-

To determine the regulation and efficiency by performing OC and SC tests on 1-ø transformer.

22. List out few applications of shaded pole motor.

A. Applications

1) used in Exhaust fans
2) used in Hair dryers, cooling fans
3) used in refridegerators, Air conditioners.
4) used in projectors.

23. why the 3-ø induction motor is called asynchronous motor?

A. 3-ø induction motor runs at speed less than synchronous speed. so it is called as asynchronous motor.

24. Is the field winding excited with AC or DC? why?

A. 3ø AC supply is applied to the armature winding. Field winding in alternators are used to produce the magnetic field needed to excite the generator. The field winding is Excited by a small DC supply.