



# ELEMENTS OF ELECTRICAL ENGINEERING

## Course Code : UE25EE141A/B

### FACULTY CONTRIBUTED:

Department of EEE, RR Campus

Prof . Jyothi T N

Prof. Vadhira<sup>J</sup> K P P

Prof. Kruthika N

Prof. Suma S

Prof. Pushpa K R

Prof. Sangeeta Modi

Department of ECE, EC Campus

Prof. Lokesh L

Prof. Dhanashree G Bhate

Dr. Renuka R Kajur

Prof. Rajesh Chandrashekhar

Prof. Sangam Kumar G H

# ELEMENTS OF ELECTRICAL ENGINEERING

---



## Generation of Balanced Three Phase EMFs

Jyothi T.N

Department of Electrical & Electronics Engineering

## Balanced Three Phase system of EMFs

---

- A balanced three phase system of EMFs is a set of three EMFs which are equal in amplitude (or) magnitude and displaced in phase from one another by  $120^\circ$

- For instance,

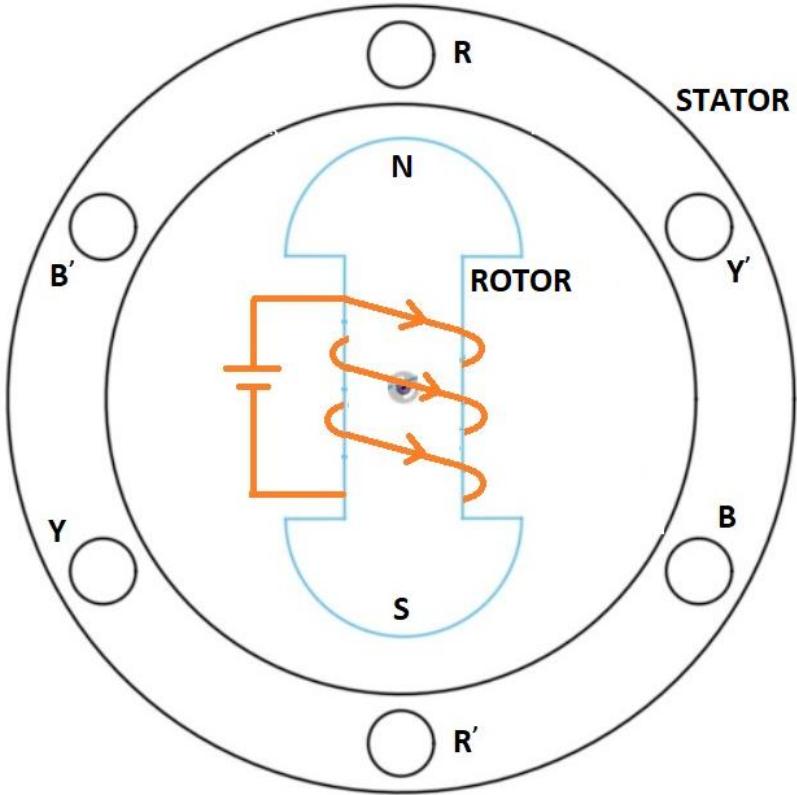
$$e_1(t) = E_m \sin(\omega t)$$

$$e_2(t) = E_m \sin(\omega t - 120^\circ)$$

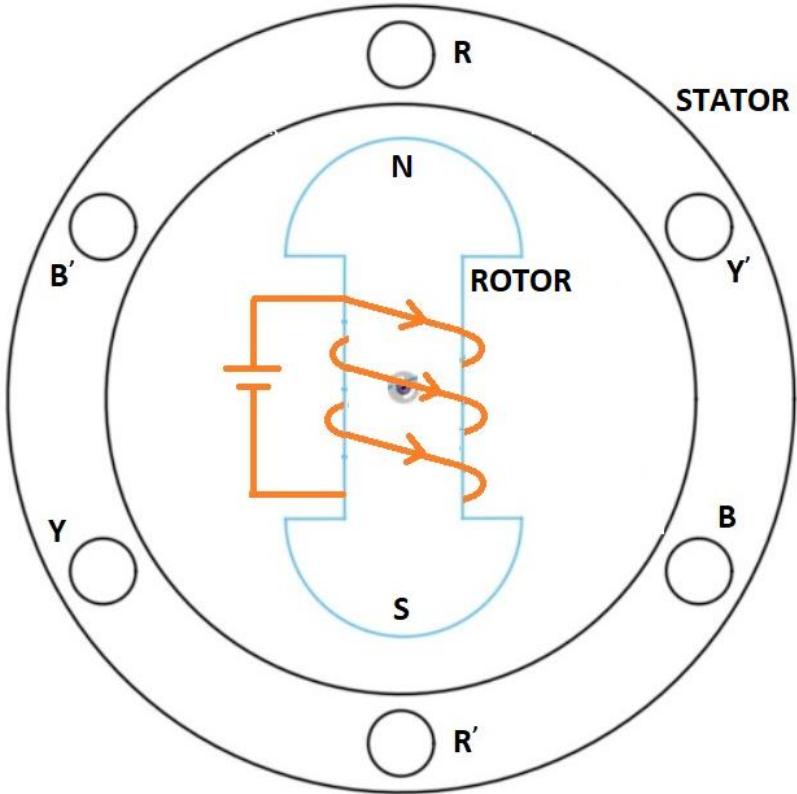
$$e_3(t) = E_m \sin(\omega t - 240^\circ)$$

represent balanced three phase system of EMFs.

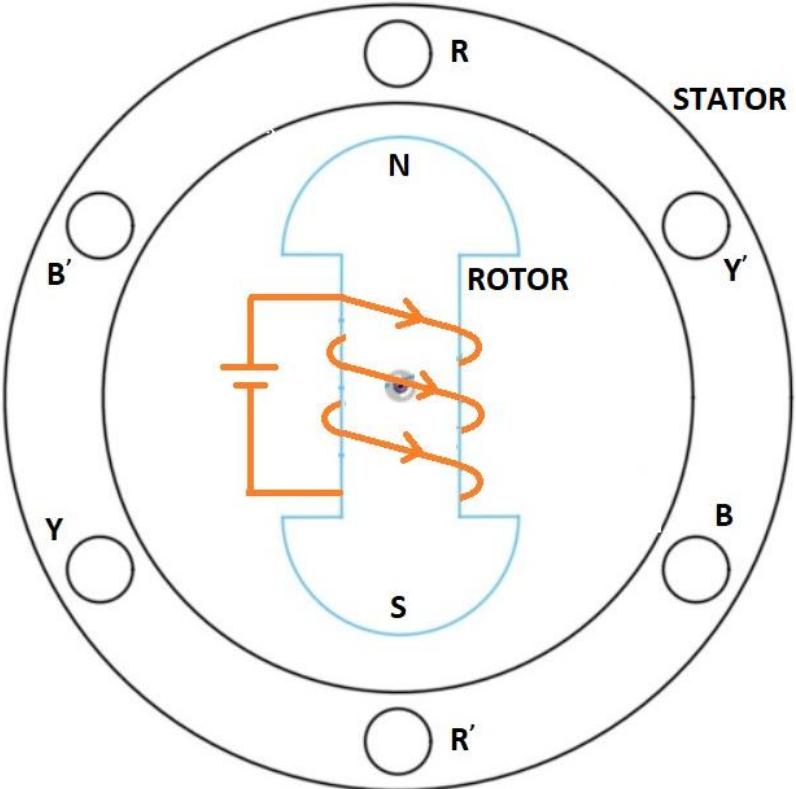
- A balanced three phase system of EMFs is generated in a machine called ‘Three Phase Generator’, also called ‘Alternator’.



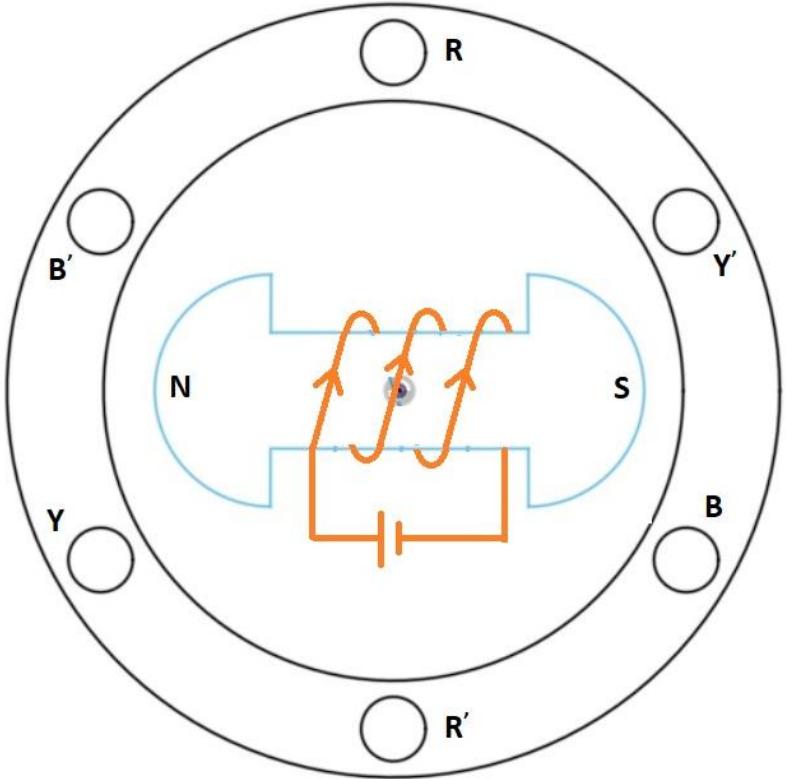
The '**Stator**' consists of three coils R, Y & B which are physically displaced from one another by  $120^\circ$



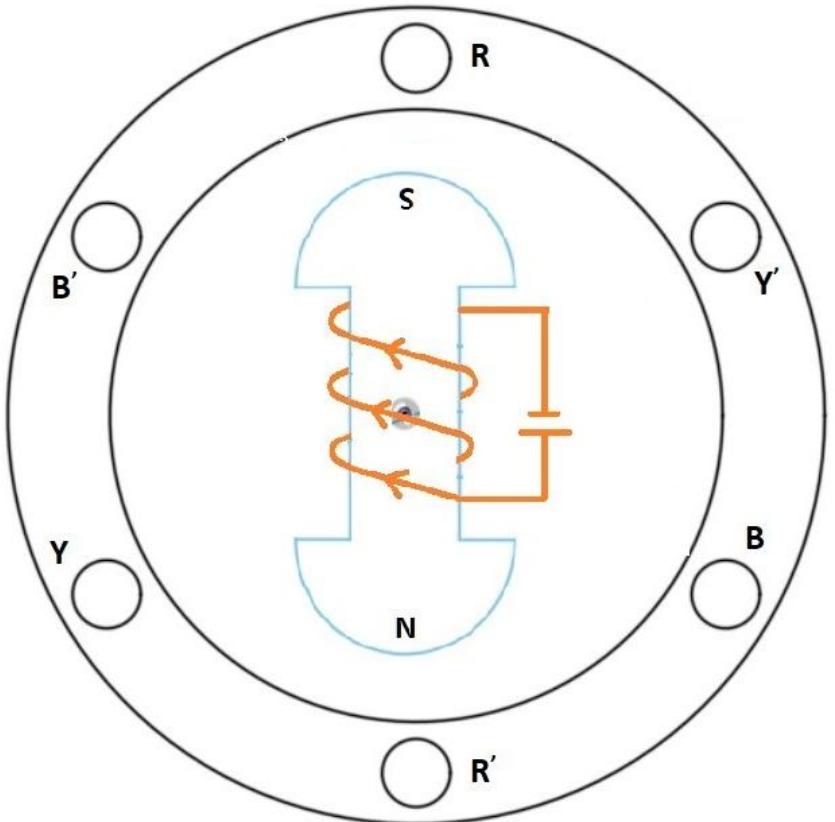
The '**Rotor**' consists of set of electromagnets excited by a field winding connected to a DC supply.



Position 1: Coil R facing centre of North Pole



Position 2: Coil R facing interpolar axis



Position 3: Coil R facing centre of South Pole

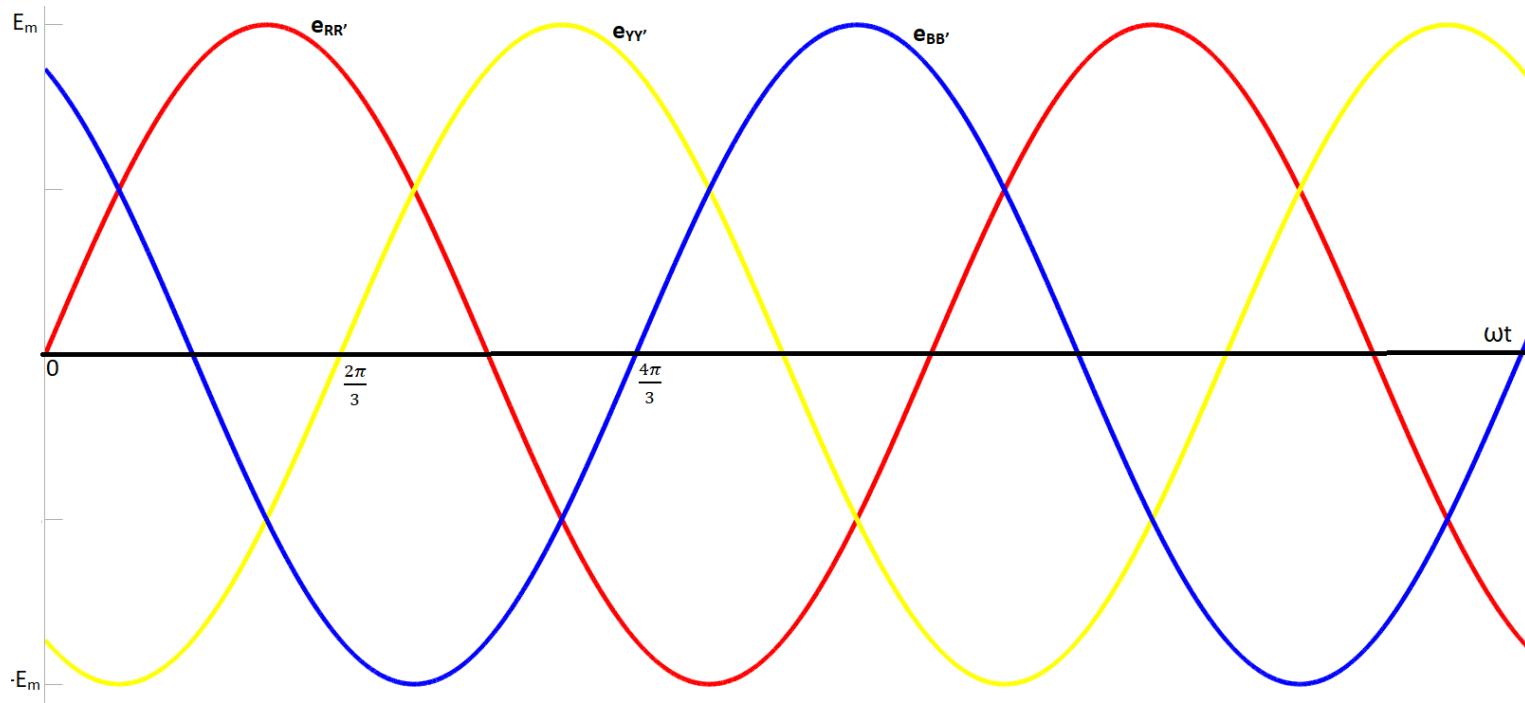
The shaft of the rotor is coupled to a prime mover such as steam turbine (or) hydro turbine (or) Diesel engine.

As rotor completes one revolution, one cycle of sinusoidal EMF is induced in R – coil.

In Y – coil, another sinusoidal EMF is induced which has same amplitude and frequency as that in R – coil but it lags R – coil EMF by  $120^\circ$

Similarly in B – coil, another sinusoidal EMF is induced which has same amplitude and frequency as that in R – coil but it lags R – coil EMF by  $240^\circ$

Thus, As rotor completes one revolution, balanced three phase system of EMFs are generated in the three coils placed in the stator.



### Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1<sup>st</sup> Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshtha, 2<sup>nd</sup> Edition, McGraw-Hill. 2019
3. "Special Electrical Machines" E G Janardanan, PHI Learning Pvt. Ltd., 2014

### Reference Books:

1. "Engineering Circuit Analysis" William Hayt, Jack Kemmerly, Jamie Phillips and Steven Durbin, 10<sup>th</sup> Edition McGraw Hill, 2023
2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12<sup>th</sup> Edition, Pearson Education, 2016.



**PES**  
UNIVERSITY

**THANK YOU**

---

**Jyothi T N**

Department of Electrical & Electronics Engineering

**jyothitn@pes.edu**