ELEMENTS OF ELECTRICAL ENGINEERING
Course Code : UE25EE141A/B

PES UNIVERSITY

FACULTY CONTRIBUTED:

Department of EEE, RR Campus

Prof . Jyothi T N
Prof. Vadhiraj 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 Chandrashekar
Prof. Sangam Kumar G H

Balanced Star Connected Three Phase System – Numerical Examples

Jyothi T.N
Department of Electrical & Electronics Engineering

Numerical Example 1

Question:

A balanced 3Φ, star connected load of 100KW takes a leading current of 80A when connected to a 3Φ, 1.1KV, 50Hz supply. Find the resistance, impedance and the capacitance of the load per phase. Also calculate the power factor of the load.

Solution :

Given Data:

Line voltage, V_L = 1.1KV ; f = 50Hz

Line current, I_L = 80A

Three phase Active Power, $P_{3\text{-phase}}$ = 100KW

Numerical Example 1 (contd..)

Calculations:

Since star connected system,

Phase current, $I_{ph} = I_L = 80A$

And Phase voltage, $V_{ph} = \frac{V_L}{\sqrt{3}} = 635.08V$

Impedance per phase, $Z = \frac{V_{ph}}{I_{ph}} = 7.94\Omega$

$P_{3\text{-phase}} = 100KW = 3*I_{ph}^2*R$; Hence, $R = 5.21\Omega$

Capacitive reactance per phase, $X_C = \sqrt{(Z^2 - R^2)} = 5.99\Omega$

Hence, Capacitance per phase, $C = \frac{1}{\omega X_C} = 531.25\mu F$

Powerfactor of the load, $\cos\phi = \frac{R}{Z} = 0.656$ Lead

Numerical Example 1 (contd..)

Alternative solution:

Since star connected system, Phase current, $I_{ph} = I_L = 80A$

And Phase voltage, $V_{ph} = \frac{V_L}{\sqrt{3}} = 635.08V$

Impedance per phase, $Z = \frac{V_{ph}}{I_{ph}} = 7.94\Omega$

$P_{3\text{-phase}} = 100KW = \sqrt{3} * V_L * I_L * \cos(\phi)$

Hence, Powerfactor of the load, $\cos\phi = 0.656$ Lead

Resistance per phase, $R = Z * \cos\phi = 5.21\Omega$

Capacitive reactance per phase, $X_C = \sqrt{(Z^2 - R^2)} = 5.99\Omega$

Hence, Capacitance per phase, $C = \frac{1}{\omega X_C} = 531.25\mu F$

Numerical Example 2

1. A balanced 3ϕ star connected load is supplied from a symmetrical 3ϕ 400V system. The current in each phase is 30A and lags by 30° behind the voltage.Find i) Impedance in each phase ii)total power drawn. Draw phasor diagram.

Text Book & References

Text Book:

1. "Basic Electrical Engineering" S.K Bhattacharya, 1st Edition Pearson India Education Services Pvt. Ltd., 2017
2. "Basic Electrical Engineering", D. C. Kulshreshta, 2nd 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, 10th Edition McGraw Hill, 2023

2. "Electrical and Electronic Technology" E. Hughes (Revised by J. Hiley, K. Brown & I.M Smith), 12th Edition, Pearson Education, 2016.

THANK YOU

Jyothi T N

Department of Electrical & Electronics Engineering

jyothitn@pes.edu