



# ELEMENTS OF ELECTRICAL ENGINEERING

## Course Code : UE25EE141A/B

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# ELEMENTS OF ELECTRICAL ENGINEERING

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## Numerical Examples on Two Wattmeter Method

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### Question:

Two wattmeters are connected to measure input to a balanced three phase circuit indicate 2000W and 500W respectively. Find the power factor when

- i) Both readings are positive
- ii) Latter reading is obtained after reversing its CC

### Solution:

**Case 1:**  $W_1 = 2000\text{W}$ ;  $W_2 = 500\text{W}$

$$\text{Power factor} = \cos(\tan^{-1}(\sqrt{3} * \frac{(W_1 - W_2)}{(W_1 + W_2)})) = 0.693$$

**Case 2:**  $W_1 = 2000\text{W}$ ;  $W_2 = -500\text{W}$

$$\text{Power factor} = \cos(\tan^{-1}(\sqrt{3} * \frac{(W_1 - W_2)}{(W_1 + W_2)})) = 0.327$$

# ELEMENTS OF ELECTRICAL ENGINEERING

## Numerical Example 4

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**Question:**

**Two wattmeters connected to measure three phase power for star connected load read 3KW and 1KW respectively.**

**The line current is 10A. Calculate**

- a) Line and Phase Voltage
- b) Resistance and reactance per phase

**Solution:**

**Given Data: Star connected Load**

$$W_1 = 3\text{KW} \text{ & } W_2 = 1\text{KW}$$

$$\text{Line current, } I_L = 10\text{A}$$

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## Numerical Example 4

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### Calculations:

$$\text{Power factor} = \cos(Tan^{-1}(\sqrt{3} * \frac{(W_1 - W_2)}{(W_1 + W_2)})) = 0.756$$

$$P_{\text{3-phase}} = W_1 + W_2 = 4\text{KW} = \sqrt{3} * V_L * I_L * \cos\phi$$

Therefore, Line voltage,  $V_L = 305.48\text{V}$

→ Phase voltage,  $V_{ph} = \frac{V_L}{\sqrt{3}} = 176.37\text{V}$

$$\text{Impedance per phase, } Z = \frac{V_{ph}}{I_{ph}} = 17.64\Omega$$

$$\text{Resistance per phase, } R = Z * \cos\phi = 13.33\Omega$$

$$\text{Reactance per phase, } X = \sqrt{Z^2 - R^2} = 11.55\Omega$$

### 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.



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**THANK YOU**

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