

Comprehensive Course on Electrical Measurement

Introduction of Measurements and Types of Error

- ✓ → JF/AE - ✓
- ✓ gate - 3- S Marlys
- ✓ ESE - 40 Marlys
- ✓ ↪ Mains → 60 Marlys - 80
- ✓ PSU →

Khemendra

Electrical Measurement

Direct Measurement : Comparing unknown quantity with the known quantity

Indirect Measurement : Either the current or voltage is converted to the mechanical deflecting system. so that by means of pointers f Scale Reading can be taken.

Error :

600 Rpm
f_T

True value

570 Rpm
A_M

Measured value .



$$\text{error} = \text{O/P} - \text{Input} = 570 - 600 = -30$$

Static characteristic

Accuracy :- Closeness with an instrument Reading approaches to true value

Precision :- Measure of Reproducibility

Sensitivity :- Ratio of change in output to change in input.

$$\text{Sensitivity} \propto \frac{\theta}{I} \propto \frac{\text{Torque}}{\text{Weight}} \rightarrow T/w \rightarrow \text{Ratio}$$

Resolution ; The Small change in the input Quantity which can be detected with its certainty.

Dead zone ; Largest change in the input Quantity for which there is No output in the instrument.

Dead time ; Time Required by measuring System to begin to Respond to a change in input.

Absolute Instrument

These instruments give the magnitude of quantity under measurement in terms of physical constants.

Eg → Tangent Galvanometer

→ Rayleigh Current Balance.

→

Secondary Instruments :- Calibrated on the basis of

Absolute Instrument.

$$\text{Error} = A_m - A_T \quad \begin{array}{l} \text{if } A_m > A_T \rightarrow \text{positive error} \\ \text{If } A_m < A_T \rightarrow \text{negative error} \end{array}$$

% Relative Static
error = $\frac{\delta A}{A_T} \times 100\% = \frac{A_m - A_T}{A_T} \times 100\%$

% Limiting error

Correction factor = - Error
=

+30

$$600 \text{ rpm} \rightarrow 570 \text{ rpm} \quad \underline{-30}$$

A_m

Guaranteed Accuracy Error

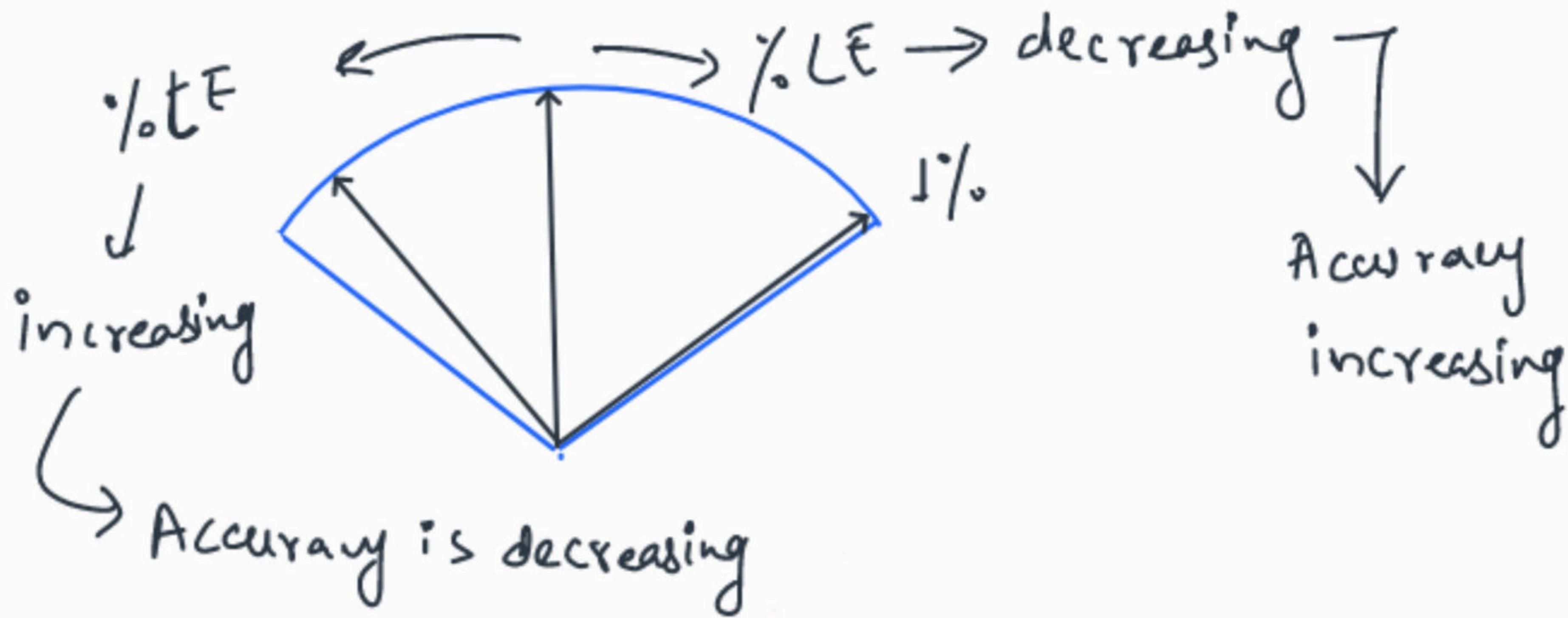


Calculated wrt the full Scale Deflection. It is given by the Manufacturer

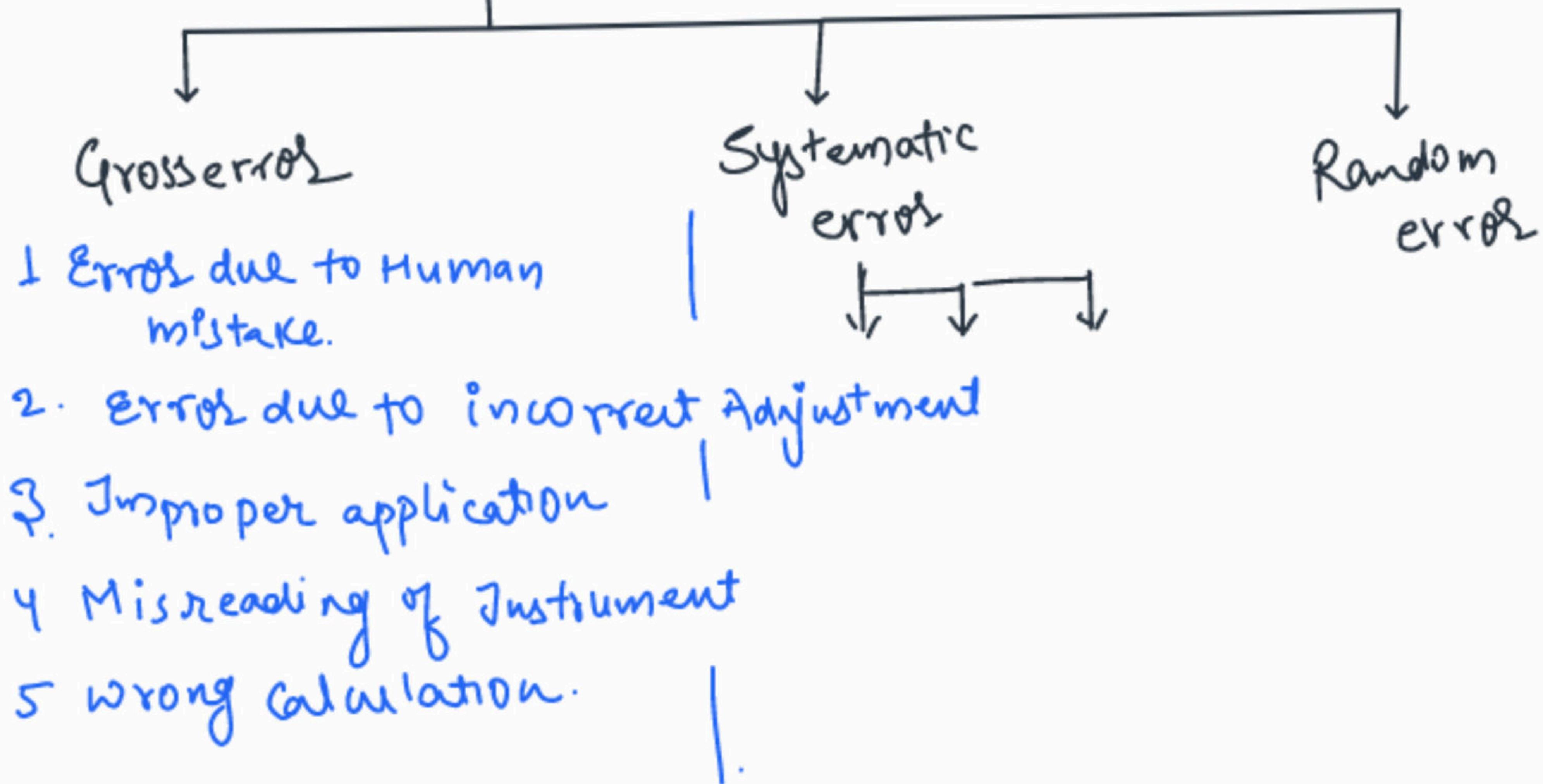
$$\text{Ammeter} \rightarrow 100\text{A}, \text{GAE} = 1\%. \Rightarrow \frac{1}{100} \times 100 = 1\text{A}$$

AT	Constant error	% L.E
50A	1A	$\frac{1}{50} \times 100 = 2\%$
25A	1A	4%
10A	1A	10%
5A	1A	20%

$$\text{Accuracy} = (1 - \gamma \cdot t^E)$$



Type of Error



Systematic error

1. Constructional / Instrumental Error

- Shortcoming of Instrument
- error due to defective part
- Misuse of Instrument

2 → Environmental error

- Temp. error
- Humidity

(iii) parallax error

↳ Reduced by placing mirror over the Scale.