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Best Quality Classroom Topper Hand Written Notes to Crack GATE, IES, PSU's & Other Government Competitive/ Entrance Exams

MADE EASY
ELECTRONICS ENGINEERING
E.M.I
By- Raghuvender Kulkarni Sir

- Theory
- Explanation
- Derivation
- Example
- Shortcuts
- Previous Years Question With Solution

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Books Preferred:-

Electrical &
Electronic measure-
ment by
AK SAWNEY.

- i) Instrumentation part
 - Error Analysis
 - Transducer
- ii) Electrical Measure-
ments
(I, V, Power, Energy
R, L, C, F, Q)

iii) Electronic
Measurement
→ Digital Voltmeter
→ CRO.

Electronic Instru-
mentation by
H S KALSI/
HELFRIC + COOPER.

*Ways of framing Questions:-

60% to 70%
questions.

i) Single Stand Alone Standard (SSSQ) (N/T).

ii) Combination of options (COOP) (T).

based on Advantages, disadvantages, characteristics, properties
application, utility.

iii) ~~Match~~ Matching list Questions (MLQ). (T)

Material from which manufactured, Range, Proportionality
utility, application, Definitions.

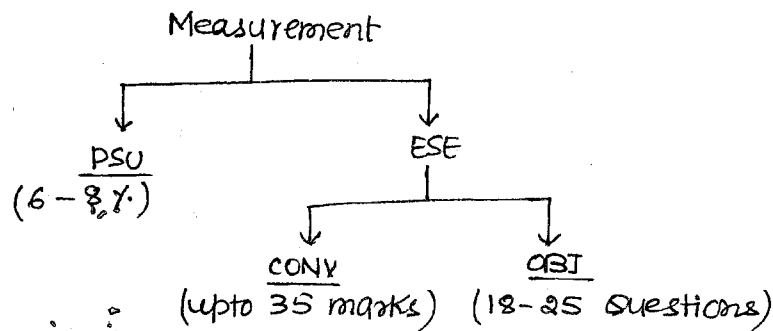
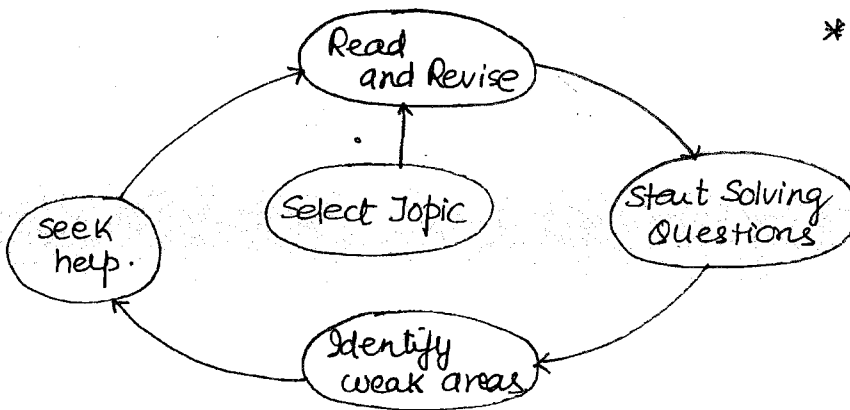
iv) Assertion and Reason Questions (ARQ) (T).

Hence, thus, because.

* ECE Questions.

* EE Questions.

* IN Questions.



*INTRODUCTION TO MEASUREMENTS:

* Measurement is a process of comparison between a standard and an unknown resulting in knowing the mag. of unknown in terms of the standard.

* Instrument is a device which is used for this comparison.

Note: .

* less power consumption in the instrument higher the Accuracy.

* The two essential characteristics of an instrument are:

a) its operational power consumptions should be negligible
It is an Indicator of Accuracy.

b) The instrument should not change the Ambient/Initial conditions of the circuit in which it has been introduced.
- It is an Indicator of Sensitivity.

*Note: .

* Where ACCURACY is defined as the CLOSENESS with which the measured value approaches the true value.

* SENSITIVITY is defined as the Rate of change of output with respect to the input.

Mathematically

$$\text{Sensitivity} = \frac{\text{output}}{\text{input}}$$

3-4 Questions.
in ESE/PSU.

*ERROR ANALYSIS:

TOPICS:

- i) Introduction (classification of errors, objectives).
etc.
- ii) Limiting errors
- iii) Combination of Quantity
- iv) Known Errors (Conv. portion).
- v) Statistical analysis of Data.
- vi) Uncertainty Analysis.

*INTRODUCTION:

* The Accuracy of an instrument or a measurement system is always specified in terms of its error. It is defined as the DEVIATION of the measured value from the True value.

* Mathematically

$$\text{ERROR} = \text{Measured Value} - \text{True Value}$$

* ERROR is expressed in terms of units, it is the ABSOLUTE ERROR, and when expressed as a % it is a RELATIVE ERROR.

* In industry, error analysis is done to minimize the error and to find this we have to classify the errors.

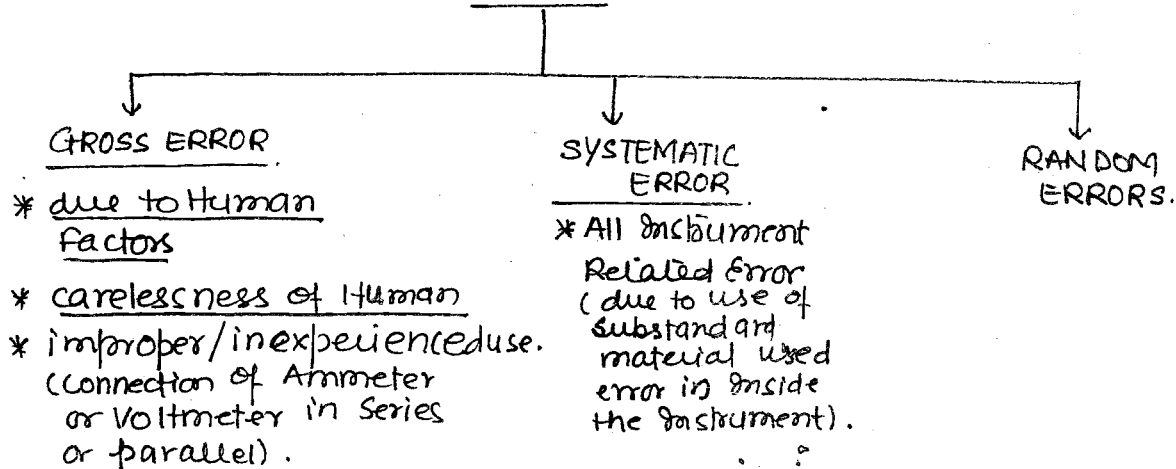
* Errors are classified on the basis on their

- source
- mode of propagation
- Probability of occurrence
- magnitude

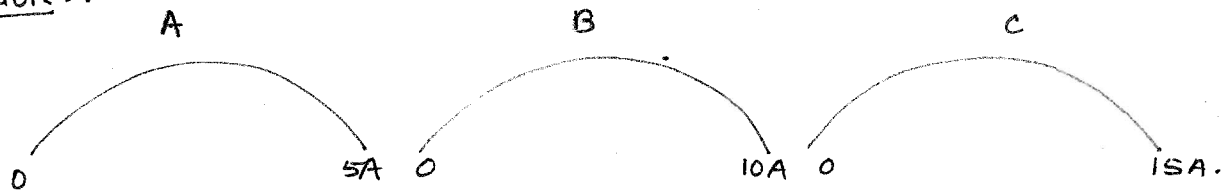
as

- Gross Errors (NPCR) → (Not Permanent, Constant or Repetitive).
- Systematic Error.
- Random Error.

ERRORS



Note!.



$$SV = \frac{180^\circ}{5}$$

$$= 36^\circ/A.$$

$$= \frac{1}{36} \text{th of } 1A$$

(more sensitive)
to current
measurement

→ Introduces small
error.

$$SV = \frac{180^\circ}{10}$$

$$= 18^\circ/A.$$

$$= \frac{1}{18} \text{th of } 1A$$

* Inexperienced person
will use meter C whereas
experienced person will
use meter A for the
measurement.

↓
leading to GROSS
ERROR by Amateur Person.

$$SV = \frac{180^\circ}{15A}$$

$$= 12^\circ/A.$$

$$= \frac{1}{12} \text{th of } 1A.$$

(less sensitive)
to current
measurement

→ Introduces large
error

ERRORS

GROSS ERROR

SYSTEMATIC ERROR

All Instrument related Error

RANDOM ERRORS

Observational Errors

* Occur due to
improper
observational
methodology

* Eg:.

ERROR due to
PARALLAX.

* It is NPCR
Not (Permanent
constant,
Repetitive)

* can be minimised
by carefulness.

Instrumental Error.

* Source is the
instrument and
error getting spread
inside the instru-
ment only

* Due to substandard
material or Design.

* This type of Error
is PCR.
(Permanent, Const,
Repetitive).

Environmental Error

* Due to external
factors such as
stray EM fields
temp. etc.

* This type of
Error is
NPCR.

* Non (Permanent
const, Repetitive)

* Occur due
to Unknown
causes.

* They are
very small
magnitude
error.

* They can be
known after
taking Repe-
titive Reading

* can be
compensated/
calculated by
statistical
methods
such as MEAN
STANDARD
DEVIATION.

Can be minimi-
sed by statis-
tical methods.

*The analysis of Systematic Error is an Indicator of the ACCURACY of an Instrument, whereas the analysis of Random Errors is an Indicator of the Instruments PRECISION, there :.

*** PRECISION :. It is defined as the ability of an Instrument to give the same reading when repeat measurements are made for a given value of the parameter under measurement.

OR.

PRECISION is the measure of Repetability or Reproducibility of an Instrument.

Note :.

* A Highly Precise Instrument need not necessarily be Accurate but a highly accurate Instrument is assumed to be precise.

*The two Important Indicators of Precision are :.

- a) Conformity to Truth
- b) Number of Significant digits in measurement.

Note :.

*Higher the number ^{of} the Significant digits, higher will be the Precision taken under the same units.

For Eg :.

deviation upto 0.1 V → 180 V ← Significant digits upto 4
deviation upto 0.01 V → 180.0 V ← comparatively less precision.
deviation upto 0.001 V → 180.00 V ← High Precision
0.000180 MV ← units are different.
Significant digits upto 5.