



Name :

Roll No. :

Invigilator's Signature :

**CS/B.Tech/EEE/ICE/(OLD)/SEM-4/EI-402/2013
2013**

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

i) Which is not desired characteristics of an instrument ?

- | | |
|----------------------|-------------------|
| a) Accuracy | b) Fidelity |
| c) Speed of response | d) None of these. |

ii) The smallest change in the input variable being measured, that will cause a change in the output signal of the instrument is termed as

- | | |
|---------------|---------------|
| a) Hysteresis | b) Drift |
| c) Resolution | d) Threshold. |



- iii) For a second order system, the settling time is $\pm 2\%$, band is
- a) $3/\xi\omega_n$ b) $5/\xi\omega_n$
c) $2/\xi\omega_n$ d) $4/\xi\omega_n$.
- iv) A 0-10A ammeter has a guaranteed accuracy of 1% of full-scale deflection. The limiting error while reading 2.5A is
- a) 1% b) 2%
c) 3% d) 4%.
- v) In an instrument, the smallest measurable input is known as
- a) Threshold b) Resolution
c) Dead zone d) Sensitivity.
- vi) Pirani gauge is used to measure
- a) Temperature b) High pressure
c) Low pressure d) Flow.
- vii) Two resistance $100\Omega \pm 5\Omega$ and $150\Omega \pm 15\Omega$ are connected in series. If the deviations are standard deviation, the resultant resistance can be expressed as
- a) $250\Omega \pm 20\Omega$ b) $250\Omega \pm 10\Omega$
c) $250\Omega \pm 15.8\Omega$ d) $250\Omega \pm 10.6\Omega$.

order of

- order of



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. a) Explain the terms 'accuracy' and 'precision' with respect to a measuring system. 2 + 2
b) Which is the more desirable parameter ? 1
3. a) Define Linear time invariant and Linear time variant systems with example. 1 + 1
b) Describe the technique used for linearizing a non-linear system for limited range about the operating point. 3
4. What is limiting error ?

A Wattmeter having a range of 500 W has an error of ± 1.5 per cent full scale deflection. If true power is 50 W, what would be the range of readings ? 1 + 4
5. a) State the advantages of the digital voltmeter over analog voltmeter. 2
b) What do you mean by 3-1/2 digit display ? 2
c) How are DVM classified ? 1
6. a) State sampling theorem. 1
b) Why is sample and hold circuit required in a DAS ?
Construct a suitable sample and hold (S & H) circuit and explain its function. 1 + 3



GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe a heterodyne wave analyzer with the help of its block diagram. 5
- b) How does a wave analyzer differ from a harmonic distortion analyzer ? 5
- c) What do you mean by sampling ? What is a sample-and-hold circuit ? What is the advantage of the use of sample-and-hold circuit ? $2 + 1 + 2$
8. Write short notes on any *three* of the following : 3×5
- a) DAS
- b) Multiplexing
- c) Log amplifier
- d) Reliability
- e) RMS meter.



9. a) Define and give examples of 'modifying input' and 'interfering input'. 5
- b) What are the names of the different standard inputs for studying the dynamic response of a system? Define and sketch them. 5
- c) Pressure is abruptly changed from 5 bar to 30 bar at $t = 0$. The transducer (being the first order) indicates a value of 20 bar after 30 seconds. Determine the time required to reach the pressure 95% of the final value. 5
10. a) Explain the difference between accuracy and precision in measurement. 3
- b) What are the different types of standards? 3
- c) Describe the international standard of Mass, Length and Time. 3
- d) Ten observations of resistance made in an experiment are $100.4 \, \Omega$, $99.2 \, \Omega$, $101.1 \, \Omega$, $100.5 \, \Omega$, $99.8 \, \Omega$, $102.0 \, \Omega$, $99.9 \, \Omega$, $101.7 \, \Omega$, $100.8 \, \Omega$ & $101.2 \, \Omega$. Calculate (i) Arithmetic mean, (ii) Average deviation, (iii) Standard deviation, and (iv) Variance. 6



11. a) Draw the block diagram of a digital multi-meter (DMM) and explain its operation. 5

- b) Define gauge factor. Calculate the gauge factor for a resistance wire strain gauge. 1 + 5

- c) A capacitive transducer uses two quartz diaphragms of area 750 mm^2 separated by a distance of 3.5 mm . A pressure of 900 kN/m^2 when applied to the top diaphragm produces a deflection of 0.6 mm . The capacitance is 370 pF when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of 900 kN/m^2 . 4

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