ELECTRONIC MEASUREMENTS & INSTRUMENTATION (SEMESTER - 4)

CS/B.TECH (EEE, ICE, EIE (OLD), ECE (OLD))/SEM-4/EI-402/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH (EEE, ICE, EIE (OLD), ECE (OLD))/SEM-4/EI-402/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

ELECTRONIC MEASUREMENTS & INSTRUMENTATION (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

.....
Head-Examiner/Co-Ordinator/Scrutineer

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) In a Q-meter, the value of shunt resistance connected across the oscillator is typically of the order of

a) Ω b) $m\Omega$

c) $\mu\Omega$ d) $k\Omega$. ☐

ii) A meter strain gauge has a gauge factor of 2. Its nominal resistance is 120 Ω. Its undergoes strain at 10^{-5} . The value of change of resistance in response to this strain is

a) 240 Ω b) 2×10^{-5} Ω

c) 2×10^{5} Ω d) $2{\cdot}4 \times 10^{-3}$ Ω. ☐

iii) In second order system, the frequency of damped oscillation is 20 rad/sec. The value of damping factor is 0·8. The natural frequency of oscillation is

a) 36 rad/sec b) 33·33 rad/sec

c) 28·63 rad/sec d) 12 rad/sec. ☐

iv) The most stable primary atomic standard for frequency is

a) Caesium beam standard b) Hydrogen maser standard

c) Quartz standard d) Rubidium vapour standard. ☐

v) A frequecy selective wave analyzer is used for measuring frequency components between

a) 20 Hz to 20 kHz b) 20 kHz to 20 MHz

c) 20 MHz to 20 GHz d) 20 Hz to 20 MHz. ☐

vi) A data acquisition system is used to

a) measure the signal b) record the signal

c) store the signal d) all of these. ☐

vii) A 3 – 1/2 digit voltmeter having a resolution of 10 mV can be used to measure maximum, voltage of

a) 100 V b) 200 V

c) 1000 V d) 5000 V. ☐

viii) A true *rms* reaiding voltmeter uses two thermocouple in order

a) to increase sensitivity

b) that the second thermocouple cancel out the non-linear effect of the first thermocouple

c) to prevent drift in the d.c. amplifier

d) all of these. ☐

ix) The resolution of a system refers to

a) smallest change in the measurand that can be measured

b) true value of the input

c) retardation of the response

d) none of these. ☐

x) Errors which may be variable both in magnitude and nature (positive or negative) are classified as

a) hysteresis errors b) random errors

c) systematic errors d) interaction errors. ☐

xi) An Op-Amp has an open loop gain of 2×10^5 Ω. It O/P exhibits the saturation at 10 V. The threshold differential voltage of the amplifier is

a) 25 μV b) 50 μV

c) 0·5 mV d) 10 V. ☐

xii) A 5 bit DAC has a current output. The digital input is 10100 and the output current corresponding to this is 10 mA. What will be the output current for the digital input of 11101 ?

a) 10·5 mA b) 14·5 mA

c) 29 mA d) None of these. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following questions. 3 × 5 = 15

2. Prove that mercury in glass thermometer is a 1st order instrument. 5

3. a) Which one is better with respect to resolution 3-bit ADC oir 8-bit ADC ?

b) Write down the output voltage expression of 4-bit R-2R ladder D/A converter. 2 + 3

4. a) Differentiate between repeatability and reproducibility.

b) What is dead zone ?

c) How many base and supplementary units exist in SI system ? 2 + 1 + 2

5. a) Correctness in measurement is associated with accuracy and not with the precision. Do you support the statement ? Explain.

b) What are the different signal sources. 3 + 2

6. a) Compare the different types of errors.

b) The resistance of a circuit found by measuring the current flowing and the power fed into the circuit. Find the limiting error in the measurement of resistance when the limiting errors in the measurement of power and current are ± 2·5% ± 1·5% ? 3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions. 3 × 15 = 45

7. a) What are the problems associated with the measurement of resistance, inductance, capacitance at high frequency ?

   b) How self-inductance of a coil can be measured using *Q*-meter method ?

   c) A coil of resistance 10 ohm is connected within the *Q* meter circuit. The resonance occurs at a frequency of 1 MHz with the tuning capacitor set a 65 pF. Calculate the percentage error introduced in the calculated value of *Q* if a resistance of 0·02 ohm is used across the oscillator circuit.

   d) The following set of ten readings was recorded during an experiment. Calculate the precision of 4th reading and repeatability.

Measurement Nos.	1	2	3	4	5	6	7	8	9	10
Quantity	98	102	101	97	100	103	98	106	107	99

3 + 6 + 4 + 2

8. a) Explain how the effects of modifying input are minimized using feedback system.

   b) Derive the equation for time response of a first order system when subjected to unit step input. Draw the response curve and find the steady state error.

   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 + 5 + 5

9. a) Draw the block diagram of ramp type DVM.

   b) Describe briefly a digital multimeter with the help of a block diagram.

   c) Give the comparison between analog and digital multimeters.

   d) A simple electrical strain gauge of resistance 120 Ω and having a gauge factor of 2 is bonded to steel having an elastic limit stress of 400 MN/m^2 and modulus of elasticity is 200 GN/m^2 . Calculate the change in resistance,

      i) due to a change in stress equal to 1/10 of the elastic range

      ii) due to change of emperature of 20°C if the material is advance alloy.

      The resistance temperature coefficient of advance alloy is 20×10^{-6} /°C.

3 + 6 + 2 + 4

10. a) What are the objectives of Data Acquisition System ?

b) With the help of block diagram, explain the working principle of wave analyzer that is suitable for high frequency (MHz) range.

c) Explain with a block diagram, the operation of dual slope type A/D converter.

3 + 6 + 6

11. Write short notes on any *three* of the following : 3 × 5

a) Sample and weld circuit

b) Linearisation technique

c) Multiplexing

d) Noise generator

e) Average value detector.

END