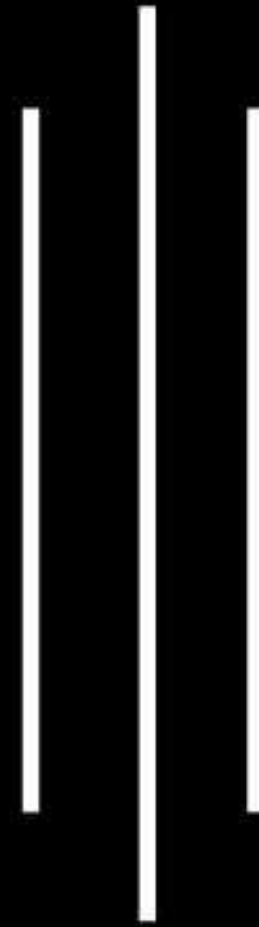
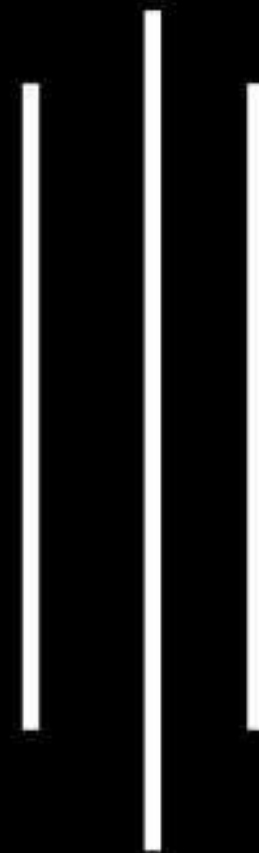


Pre-University Examination subject wise paper collection



Instrumentation



Provided By:

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POKHARA UNIVERSITY

Bachelor
Degree: BE
Subject: Instrumentation

Semester : Spring

Year : 2023
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

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

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What are the components of an instrumentation system? Explain each component in brief along with the suitable diagram. 7
b) Bridge circuits are used for the measurement of unknown parameters. Explain? Derive the necessary expression to measure the value of unknown inductance using bridge circuit. 8
2. a) A bridge has the following components: arm AB, $R = 900 \Omega$ in parallel with $C = 500 \mu F$; BC, $R = 1000 \Omega$ in parallel with $C = 200 \mu F$; CD, $L = 0.5 H$ in series with $R = 500 \Omega$. Find the constants of arm DA to balance the bridge. Also determine the parameters (R , L or C) of unknown arm DA connected in the bridge arm. Assume frequency $f = 1 KHz$. 7
b) Induction type Energy meter and electrodynamic type wattmeter are very important instruments in this digital era. Explain both with its block diagram and working principle. 8
3. a) How can the range of an ammeter be extended? Design an Ayrton Shunt to provide an ammeter with current ranges 1 A, 5 A and 10 A. The configuration consists of a d'Arsonval movement with an internal resistance $R_m = 50 \Omega$ and full scale deflection current of 1 mA. 8
OR
Why Electronic multimeter is more applicable than normal meter? Explain in brief about electronic multimeter.
b) Explain the single channel and multichannel Data Acquisition System (DAS) with their block diagrams. 7
4. a) Define Instrumentation amplifier. Explain the working principle of an instrumentation amplifier. 8

OR

Sketch the circuit of summing amplifier using Op-Amp to get $2V_1 - 3V_3$.

- b) What will be the successive approximation digital output analog input of 3.12 V from a 4-bit converter given that V_{ref} = 5V. Also draw the circuit.
5. a) Draw and explain R-2R ladder network Digital to Analog Converters. List its advantages over binary weighted Resistance Network DAC.
- b) Define wave analyser and contrast it with spectrum analyser. Draw and explain the heterodyne wave analyser in detail.
6. a) Discuss about the different types of counter errors in the digital instrumentation.
- b) Define oscilloscope and list its uses. Draw and explain the Digital storage oscilloscope in detail.
7. Write short notes on: (Any two)
- a) Transducer and Inverse Transducer
- b) Probes and Connectors
- c) Potentiometer type recorder

3. 8 x 1/2

3. 4

NEPAL COLLEGE OF INFORMATION TECHNOLOGY
ASSESSMENT: SPRING

Level: Bachelor
Programme: BE CE II (M/D)
Course: Instrumentation
Time: 3 Hrs

Year: 2024
Full Marks: 100
Pass Marks: 45

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

The figure in the margin indicates full marks.

Attempt all the Questions.

1. a) Differentiate between intelligent versus dumb instrumentation.
Explain the functional block diagram of instrumentation system.

7

- b) With necessary expressions, explain any one of the type of AC bridge circuit.

8

2. a) A resistance of strain gauge is used to measure stress on steel. The steel is stressed to 140 kgf/cm^2 . Assume Young's Modulus of steel $2.1 \times 10^6 \text{ kgf/cm}^2$. Calculate the percentage change of resistance of strain gauge assuming gauge factor equal to 2.0.

7

- b) What is D' Arsonval principle? How is this principle used to create ammeter and voltmeter?

8

3. a) Explain the working principle of energy meter with necessary diagram.

8

- b) A moving coil ammeter has fixed shunt of 0.02Ω with a coil resistance of $R_m = 1000 \Omega$ and a potential difference of 500 mV across it, full scale deflection is obtained.

- i) Find shunt current at full scale deflection.
- ii) Calculate the value of R_m to give full scale deflection when shunted current is 10A.
- iii) Find the value of R_m for 40% deflection with shunted current of 100 A.

7

Arpan Adhikari
26 July 2024

4. a) Differentiate between amplification and attenuation. Design op-amp circuit to give output $V_o = 2V_1 - 3V_2 + 4V_3 - 5V_3$. 7

Q b) What is Data acquisition system(DAS)? Explain the configurations of DAS with its diagram. 8

5.a) What are the drawbacks of WRN DAC? Draw R-2R ladder DAC and explain its operation with necessary derivations. 7

b) What will be the 6-bit successive approximation digital output for an analog input 3.3V if $E_R = 5V$. 8

6. a) Explain Delta-sigma ADC in detail with its block diagram. 7

b) Define instrument transformer. Explain its types in detail. 8

7. Write short notes on(Any Two): 2*5

a) Measurement of low resistance

b) PWM DAC

c) Wagners ground connection

Arpan Adhikari
26 July 2024

NEPAL ENGINEERING COLLEGE

Level: Bachelor

Semester: Spring

Year : 2024

Programme: BE (Computer 1)

Full Marks: 100

Course: Instrumentation

Pass Marks: 45

Time : 3hrs.

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

Figures in the margin indicate full marks.

Attempt all the questions.

- a) What is an instrumentation system? Explain the generalized block diagram of an instrumentation system with their function and example. 7
- b) A POT having total resistance $R_p \Omega$ and a dc excitation voltage V_{in} is to be used with a measurement system having an input resistance $R_L \Omega$. Show that the measured output voltage V_{out} is related to the fractional displacement of the wiper as, 8
- $$V_{out} = V_{in} \times \frac{\alpha K}{K(1-K) + \alpha}$$
- Where, $\alpha = \frac{R_L}{R_p}$. What should be done to make this transducer linear?
- a) How can we extend range of voltmeters? A moving coil instrument has a resistance of 2Ω and it reads up to 250 V when a resistance of 5000Ω is connected in series with it. Find the current range of the instrument when it is used as an ammeter with the coil connected across a shunt resistance of $2 \text{ m}\Omega$. 8
- b) Elucidate the working principle of Dynamometer Type Wattmeter with necessary sketch. 7
- a) What is Isolation Amplifier? Explain how the Op-Amp can be used as summer and integrator with necessary diagrams and equations. 8
- b) What do you mean by Data Acquisition System? Briefly explain about the digital data acquisition system. 7
- a) What is an Quantization Error? Describe in details the successive approximation method of analog to digital conversion. 8
- b) An 8-bit DAC has a reference voltage of 10 V . It uses a R-2R ladder network. Find the minimum value of resistance R such that the analog voltage of operational amplifier having feedback resistance $10 \text{ K}\Omega$ does not exceed 9.5 V . 7

**NEPAL ENGINEERING COLLEGE
(ASSESSMENT)**

Level: Bachelor

Year : 2024

Program: B.E.(Computer-2)

Full Marks: 100

Course: Instrumentation.

Time : 3Hrs

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

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Differentiate between Intelligent versus Dumb Instrumentation. Draw generalized block diagram for Instrumentation system, and discuss its various components with necessary explanations. [7]
b) What is D'Arsonval movement? Draw PMMC instrument diagram and derive Torque equation for PMMC instrument. List out the advantages and disadvantages for PMMC instrument. [8]
2. a) Differentiate between Maxwell's versus Hays bridge. Derive the components of unknown arm for the bridge circuit suitable for measuring $Q > 10$. List out the advantages and disadvantages for the Maxwell's bridge circuit. [7]
b) What is Seebeck effect? Discuss the law governed in Thermocouple with neat diagram. List out different sources of error occurred in Thermocouple. [8]
3. a) For a strain Gauge, Prove that $K = (1 + 2\mu)$ [7]
Where K = Gauge factor of the Coil.
 μ = Poisson's Ratio.
b) A Quartz piezoelectric pickup has dimension of $10\text{mm} \times 10\text{mm} \times 2.5\text{mm}$ and a voltage sensitivity of 0.012Vm/N . The relative permittivity of the quartz is 1600 and modulus of elasticity of the quartz is $12 \times 10^{10}\text{N/m}^2$. The force applied to the pickup is 20N. Analytically compute
a) The output voltage.
b) Charge sensitivity.
c) Strain.
d) Charge generated.
e) The capacitance pickup
4. a) Design an Instrumentation System to measure Pressure of COCA-COLA following through Factory pipe line to yields the results of pressure as Analog read out. [7]
b) Differentiate between Isolation versus Instrumentation Amplifier. Draw Instrumentation amplifier circuit and derive an expression for voltage gain $A_v = \{R_4/R_3\} [1 + 2(R_2/R_1)]$. [8]

5. a) Design successive approximation method that becomes capable to convert Analog Voltage 19.3V into its equivalent digital voltage. Design part must include circuit Diagram as well as successive tabular steps involved during transformation from ADC to DAC. [7]
- b) Differentiate between Serial versus Parallel Transmission. How data are transmitted via optical fiber? List out the advantages of optical fiber and losses that get occurred in optical fiber. [8]
6. a) Differentiate between X-T and X-Y Plotter. How actual recording takes place in Magnetic Tape Recorder? Discuss its operating mechanism with Tape Transport mechanism, Record Head and Reproduce Head. [7]
- b) Differentiate between DAS versus TS (Telemetry system). Draw generalized block diagram of digital "Data Acquisition System" and discuss its various components with necessary explanation. [8]
7. Write short notes (on any two) (2*5)
- a) **RTD**
 - b) **IEEE**
 - c) **LVDT**

National Academy of Science and Technology

(Affiliated to Pokhara University)

Dhangadhi, Kailali

Pre-University Examination

Level: Bachelor

Semester :- II_Spring

Year : 2024

Programme: B.E Computer

Full Marks : 100

Course: Instrumentation

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What are the basic blocks of a generalized instrumentation system. Explain their function with example. [7]
- b) What is PMMC. Explain D'Arsonval Principle in brief. [8]

2. a) How frequency is measured using Wein Bridge? Explain with necessary derivation [7]
- b) A 1000 Hz bridge has the following constants arm
AB, $R = 1000 \Omega$ in parallel with $C = 0.5 \mu F$;
BC, $R = 1000 \Omega$ in series with $C = 0.5 \mu F$;
CD, $L = 30 \text{ mH}$ in series with $R = 200 \Omega$.
Find the constants of arm DA to balance the bridge. [8]

3. a The measurements of the voltage across a resistor were recorded as 51.7, 52, 51.8, 52, 52.1, 51.9, 52, 51.9, 52.5 and 51.8 V, respectively. Assume that only random errors are present, calculate:
i) Arithmetic mean
ii) Average deviation from mean
iii) Standard deviation
iv) Probable error [8]
- b) Explain the measurement of unknown capacitance by using standard bridge circuit [7]

OR

Define Strain gauge. Derive the expression between gauge factor & Poisson's ratio.

4. a) What is wattmeter? Explain Induction Type Wattmeter in brief. [7]
- b) Derive the necessary expression for instrumental amplifier. [8]

5. a) What is ADC. Explain with block diagram the Successive Approximation Type ADC. [7]

b. Why analog signals are converted into digital signals. Explain R-2R Ladder DAC with its circuit diagram. [8]

OR

Convert 9.4 Volt analog voltage into corresponding digital data bit with 4 bit of digital output.

6. a) Explain in brief about Working principle of Heterodyne type Wave Analyzer: [8]

b) What is an oscilloscope? Explain with its block diagram and all the components. [7]

7. Write short notes on :(Any two) [2x5=10]

- a) Probes and Connectors
- b) Magnetic Tape Recorder.
- c) Digital Multimeter

Date: 2081/02/31			
Level	BE	Full Marks	50
Programme	BCE	Time	
Semester	II	1.5 hrs	

Subject: - Instrumentation

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define Instrumentation system and also explain the components of generalized instrumentation system in brief with the help of block diagram. [7]
- b) Define signals. Explain the different types of signals used in instrumentation system. [8]
2. a) Describe about the various performance parameters of instrumentation system. [8]

OR

Derive the expression for the gauge factor of strain gauge: $G_f = 1 + 2\gamma$.

- b) A 1000 Hz bridge circuit has the following constants:
 Arm AB: $R = 1200 \text{ ohm}$ in parallel with $C = 0.5 \text{ micro Farad}$
 Arm BC: $R = 1000 \text{ ohm}$ in series with $C = 0.5 \text{ micro Farad}$
 Arm CD: $L = 30 \text{ mH}$ in series with $R = 200 \text{ ohm}$
 Find the constants of arm DA to balance the bridge. [7]

3. a) Explain the working principle of LVDT. [5]
- b) A resistance strain gauge with a gauge factor of 2 is fasten to a steel member subjected to a stress of 1050 kg/cm^2 . The modulus of elasticity of a steel is approximately $2.1 \times 10^6 \text{ kg/cm}^2$. Calculate the change in resistance of the strain gauge element due to the applied stress. [5]
- c) Derive the expression for unknown components in Maxwell bridge. [5]
4. Write short notes on: (any one) [5]
 - a. Environmental errors
 - b. IEEE standard

$$\sigma_f = \frac{S}{\epsilon} = 2.1$$

Date:	2081/04/10		
Level	III	Full Marks	50
Programme	BCE	Time	
Semester	II		1.5 hrs

Subject: - Instrumentation

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

Attempt All questions.

The figures in the margin indicate Full Marks.

Assume suitable data if necessary.

- a) Prove that the differential arrangement of parallel plate capacitor eliminates the non-linearity between input and output. [7]
- b) How can the range of an ammeter be extended? Design an Aryton Shunt to provide an ammeter with current ranges 2 A, 6 A and 12 A. The configuration consists of a d'Arsonval movement with an internal resistance $R_m = 60 \Omega$ and full scale deflection current of 2 mA. [8]

Describe the working principle of induction type wattmeter along with its construction. [7]

What will be the successive approximation digital output for a analog input of 3.12 V from a 4-bit converter given that $V_{ref} = 8V$. Also draw the circuit. [8]

Define DAS. Explain about the analog and digital type DAS.

Explain the working principle of R-2R ladder type DAC. List out its advantages over weighted resistor DAC. [8]

Write short notes on (any one):

Instrumentation Amplifier [7]

Binary Weighted DAC [5]

B.E. Computer, 2nd Semester

Full Marks: 100

Course: Instrumentation

Pass Marks: 45

Time: 3 hrs.

Attempt all questions.

- 1a. Define instrumentation system. Draw and explain their functions with example. [8]
- 1b. For Quality factor $Q > 10$, which bridge circuit; you would use "Maxwell" or "Hay"? Justify your answer for the chosen one with valid reasons. [8]
- 2a. Design an Ayrton shunt to provide an ammeter with current ranges of 1A, 5A and 10A. The movement with internal resistance of 50Ω and full scale deflection current of 1mA is used in the configuration. [8]
- 2b. In a balanced network, AB is a resistance of 100Ω in series with an inductor of 0.16H, BC and DA are non-inductive resistance of 500Ω each and CD consists of a resistance R in series with a capacity C. A potential difference of 3V at a frequency $5000/2\pi$ is applied between points A and C. Determine the values of R and C. [8]
- 3a. The output of an LVDT is connected to a 5V voltmeter through an amplifier whose amplification factor is 150. An output of 1mV appears across the terminals of LVDT, when the core moves through a distance of 0.6mm. Calculate the sensitivity of LVDT and that of whose set up. The milli-voltmeter scale has 100 divisions. The scale can be read to $1/3$ of a division. Calculate the resolution of the instrument in mm. [8]
- 3b. Define strain gauge? Prove that $G = 1 + 2\mu$ for strain gauge where constants has their usual meaning. [8]
- 4a. What is instrumentation amplifier? Derive the relation for the gain of Instrumentation amplifier. [8]
- 4b. Find the digital output of 8.217 volts input from a 4-bits Successive Approximation ADC with the reference voltage of 10V. [8]
- 5a. Write in brief about signal channel data acquisition system and multi-channel data acquisition system with suitable block diagram for each. [8]
- 5b. Explain in brief about working of cathode ray oscilloscope with suitable block diagram. [8]
- 6a. Draw suitable schematic diagram for 4×4 dot matrix display. Also explain the operation of strip chart recorder with suitable diagram. [8]
- 6b. Write short notes on (any three): [12]
- a. R-2R ladder network DAC
 - b. Two wattmeter method
 - c. recent trend for DAS
 - d. LCD

Lumbini Engineering, Management & Science College
Final Internal Assessment Exam

Level: Bachelors
Program: Computer 2nd sem.
Course: Instrumentation

Year: 2024
Full Mark: 100
Pass Mark: 45

- 1.a) Define instrumentation system. Explain the components of generalized instrumentation with block diagram. (7)
- b) The AC bridge ABCD has the details: The arm AB has resistance 100Ω in parallel with capacitance $80\mu\text{F}$. The BC has non-inductive resistance 120Ω . The AD has resistance of 75Ω . The arm DC is unknown and has resistance in series with inductance. By using balancing conditions, determine the values of unknown. (8)
- 2.a) Explain the construction, operation with application of Dynamometer type wattmeter. (7)
- b) Design an Ayrton shunts to provide currents 5A, 10A, 20A and multirange voltmeter with (0-10v), (0-100v) and (0-500v). The meter used in the configuration is 1mA and 50Ω internal resistance in the configurations. (8)
- 3.a) Define instrumentation amplifier. Derive the value of its gain and write down its importance. (7)
- b) Define DAS. Explain modern trends in DAS. (8)
- 4.a) Enlists type of ADC. Explain any two of them. (7)
- b) Explain UTP and shielded cables with construction and application. (8)
- 5.a) Define connectors and probes. Explain the type with merits and demerits. (7)
- b) Define wave analyzer. Explain the frequency selective wave analyzer with components. (8)

College

OR

Define frequency counter with operation and counter errors.

2024

Mark:100

Mark: 45

- 6.a) Explain storage & sampling type oscilloscopes. (7)
b) Explain construction, operation with application magnetic tape recorder. (8)

OR

Define display device. Explain seven segment and Dot matrix display.

ponents of
(7)

m AB has
tF. The BC
s resistance
sistance in
conditions,
(8)

7. Write short notes (any two) (5*2=10)
a) Electronic multimeter
b) Fiber optics
c) Keivin Bridge

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(7)
, 10A, 20A
-100v) and
s 1mA and
(8)

value of its
(7)
(8)

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POKHARA UNIVERSITY

Level: Bachelor

Internal-Exam

Year : 2024

Programme: BE(Computer Engg)

Full Marks: 100

Course: Instrumentation (new)

Pass Marks: 45

Time : 3hrs.

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

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Explain the component of instrumentation system and their functions with block diagram. 7
- b) Explain the various terms Accuracy, Precision Resolution 8
2. a) Explain the method for measurement of medium resistance 7
- or
- Explain and with suitable circuit diagram for measure low resistance bridge circuit and its application:
3. a) Explain the single phase Electrodynamometer power factor meter. 8
- b) Design an Ayrston shunt to provide an ammeter with current range of 1A, 5A, 10A. A basic meter of internal resistance of 50 ohms and a full scale deflection current is 1mA is to be used. 7
4. a) What is data Acquisition system and Explain the Multi channel data Acquisition system, 2+5
- b) Explain successive approximation type ADC used in instrumentation system. 8
5. a) Write the name of different type of Wave Analyzer and Explain any one of them. 8
- b) Briefly explain the Ramp type digital voltmeter with suitable diagram 7
6. a) Explain the Block diagram of Oscilloscope. 7
- b) Explain in brief about strip chart recorder along with application. 7
7. Write short notes on (Any two) 8
- a) Digital millimeter 2×5
- b) Wager's ground connection
- c) Advantage of Hay's Bridge

POKHARA ENGINEERING COLLEGE
PHIRKE -8, POKHARA

Sub: - Instrumentation.

Faculty: - II semester computer

Time: - 3 hrs.

Full Marks:-100

Pass Marks:-45

Attempt all questions.

1. a) Define instrumentation system. Explain in brief the components of instrumentation system with block diagram. 7
b) Design an Ayrton shunt to provide an ammeter with current ranges of 1A, 5A and 10A. The movement with internal resistance of 50Ω and full scale deflection of 1mA is used in the configuration. 8
2. a) An ac bridge has an arm AB $R=1000\Omega$ parallel with $C=0.159\mu F$; arm BC $R=1000\Omega$; arm CD $R=500\Omega$. Arm DA consists of a capacitor $C=0.636\mu F$ in series with a variable resistor R_s . Find the value of R_s and frequency to obtain bridge balance. 7
b) What will be result if the voltmeter is connected in series with the load? How can we measure the TRUE RMS with the volt meter? 8
3. a) What do you mean by 1 unit energy consumption? Explain the working principle of Electromechanical Type Induction Type Energy Meter with circuit Diagram. 7
b) Derive the expression of output voltage of instrumentation amplifier. 8
4. a) Explain the PC based Data Acquisition System with Block Diagram. 7
b) Convert an analog signal having the magnitude 3.625 in a 4-bit digital word successive approximation ADC if the reference voltage is 8v. 8
5. a) Explain the R-2R ladder DAC with diagram. 7
b) Write the advantage of digital voltmeter and write the types of digital voltmeter and explain any one of them. 8
6. a) Explain the working principle of Digital Storage Oscilloscope and write the application of Oscilloscope. 7
b) Explain Potentiometric Recorder and write its advantages. 8
7. Write short notes on (any two):- 5×2=10
 - i) Distortion Analyzer.
 - ii) Dot Matrix Display.
 - iii) Digital Multimeter.

