

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Instrumentation

Semester: Fall

Year : 2019  
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.*

- a) Explain the various components of a generalized Instrumentation System with the help of a block diagram. 7
- b) Three resistances have the following ratings:  $R_1 = 20 \Omega \pm 0.1$ ;  $R_2 = 20 \Omega \pm 0.1$ ;  $R_3 = 60 \Omega \pm 0.25$  8
- Determine the magnitude and limiting error in ohms, if the resistances are connected in series. Also obtain percentage relative error in the resultant.
2. a) An ac bridge has the following components: arm AB,  $R = 1000 \Omega$  in parallel with  $C = 0.5 \mu F$ ; BC,  $R = 1000 \Omega$  in parallel with  $C = 0.5 \mu F$ ; CD,  $L = 30 mH$  in series with  $R = 200 \Omega$ . Find the constants of arm DA to balance the bridge. Express the result as a pure R in series or parallel with a pure C or L Assume frequency  $f = 1000$  Hz. 8
- b) What is the use of Wein Bridge? Derive an expression for to calculate unknown electrical parameter frequency in terms of known parameter of Wein Bridge circuit. 7
3. a) A capacitive transducer uses two quartz diaphragms of area  $750 \text{ mm}^2$  separated by a distance of  $3.5 \text{ mm}$ . A pressure of  $900 \text{ kN/m}^2$  when applied to the top diaphragm produces a deflection of  $0.6 \text{ mm}$ . The capacitance is  $370 \text{ pF}$  when no pressure is applied to the diaphragms. Find the value of capacitance after the application of pressure of  $900 \text{ kN/m}^2$ . 8
- b) Define gauge factor. Derive an expression for gauge factor of a strain gauge. 7
4. a) "Error of a potentiometric device is always negative except at two extreme points." Justify it with necessary derivations. 7
- b) Explain successive approximation type analog to digital converter 8

used in instrumentation system with a numerical example.

- a) Consider a 6 bit digital to analog converter with a resistance of  $320\text{ k}\Omega$  in the LSB position. The converter is designed with weighted resistor network. The reference voltage is 10 V. The output of the resistor network is connected to an Op-Amp with a feedback resistor of  $5\text{ k}\Omega$ . What is the analog output of the binary input of 111010?
- b) Describe the different data transmission methods. Explain the block diagram of general telemetry system.
6. a) Give the functional details of a type of recorder which can be employed for plotting the Stress versus Strain curve for brittle material.
- b) What is data acquisition system? Briefly explain about the digital acquisition system.
7. Write short notes on: (Any two)
- Isolation amplifier
  - Classification of transducers
  - Static parameters

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Instrumentation

Semester: Spring

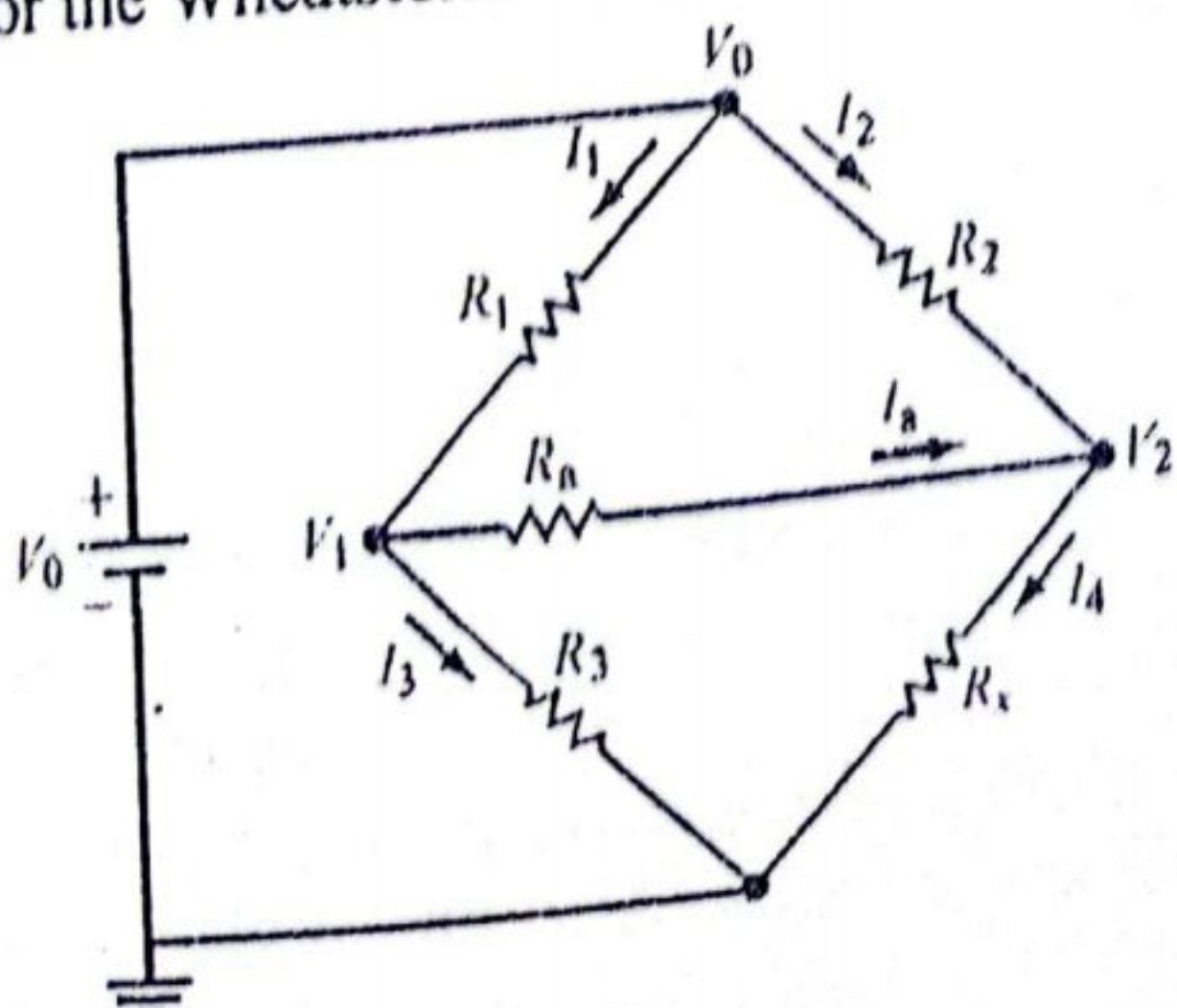
Year : 2019  
Full Marks: 100  
Pass Marks: 45  
Time : 3 hrs.

*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.*

- a) Draw the generalized elaborated block diagram of instrumentation system. Discuss the various components of instrumentation system with necessary explanations. 7
- b) Two resistors have values  $R_1 = 47 \Omega \pm 2\%$  and  $R_2 = 82 \Omega \pm 5\%$  Calculate: 8
- i) The magnitude of error in each resistor
  - ii) The limiting error in ohms and in percent when the resistors are connected in series and
  - iii) iii. The value of the equivalent resistor and expected error in percent when the resistors are connected in parallel.
- a) Show that Hay's Bridge can be used to measure the value of unknown inductance of a coil having high quality factor.
- b) A strain gauge having a resistance of  $200\Omega$  and gauge factor 2.5 is connected in series with a blast resistance of  $400\Omega$  across 24V. Determine the change in o/p voltage when a stress of  $140 \text{ MN/m}^2$  is applied. The modulus of elasticity is  $200 \text{ GN/m}^2$ .
- a) For the Wheatstone Bridge Circuit of figure below,



solve the following problems:

- i) If  $R_1 = 1 \Omega$ ,  $R_2 = 2 \Omega$ , and  $R_x = 3 \Omega$ , to what value should  $R_3$  be adjusted so as to achieve a balanced condition?
- ii) If  $V_0 = 6 \text{ V}$ ,  $R_a = 0.1 \Omega$ , and  $R_x$  were then to deviate by a small amount to  $R_x = 3.01 \Omega$ , what would be the reading on the ammeter?
- 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,  $V_{out} = V_{in} \times \frac{\alpha K}{K(1-K)+\alpha}$

(where,  $\alpha = \frac{R_L}{R_p}$ ). What should be done to make this transducer linear?

4. a) Define thermistor. Explain the laws of thermocouple. How is thermopile formed?
- b) An 8-bit DAC has reference voltage of 10V. It uses R-2R ladder network. Find the minimum value of resistance R such that the analog voltage of operational amplifier having feedback resistance  $10K\Omega$  does not exceed 9.5V
5. a) Define transmission medium? State its type with example. Also, clarify the modes of data transmission in a system.
- b) Describe the components of Strip chart recorder with suitable diagram. What are the applications of strip chart recorder?
- a) Define data acquisition system. Explain the function of different components of digital data acquisition system.
- b) What are the features that makes instrumentation amplifier superior over OPAMP. Draw instrumentation amplifier circuit and derive an expression for voltage gain of an instrumentation amplifier.
- Write short notes on: (Any two)
- a) Wien Bridge and its application
  - b) Errors in transducer
  - c) IEEE Standards

# POKHARA UNIVERSITY

Level: Bachelor  
Programme: BE  
Course: Instrumentation

Semester: Fall

Year : 2020  
Full Marks: 100  
Pass Marks: 45  
Time : 3 hrs.

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*Attempt all the questions.*

- |  |   |
|--|---|
| a) What are the basis blocks of generalized instrumentation system? Draw the various blocks and explain their function.  | 7 |
| b) Temperature was measured in eight locations in a room, and the values obtained were 28.2, 16.5, 32.1, 29.7, 27.1, 19.0, 22.0 and 10.0 °C. Assuming that the random errors are present. Calculate  | 8 |
| (i) Arithmetic mean  |   |
| (ii) Standard Deviation  |   |
| (iii) Probable error of readings?  |   |
| Q. a) What is the use of Maxwell Bridge? Derive the expression for unknown components and what are its limitation.   | 7 |
| 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 $0.012\text{Vm/N}$ . 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 | 8 |
| i. The output voltage.   |   |
| ii. Charge sensitivity.  |   |
| iii. Strain.   |   |
| iv. Charge generated.  |   |
| v. The capacitance pickup.   |   |
| 3. a) Discuss "Seebeck effect" for temperature measurement. What are the laws governed by Thermocouple for temperature measurement. List out the error that get occurred in Thermocouple during temperature measurement.   | 7 |
| b) Design an Instrumentation System to measure Pressure of COCA-COLA following through Factory pipe line to yields the results of pressure as Analog read output.  | 8 |

4. a) Define gauge factor. A strain gauge having resistance of 600 ohm and gauge factor 2.0 is connected in series with a blast resistance of 1000 ohm across 50 volt. Determine the change in output when a stress of 150 MN per square meter is applied. The modulus of elasticity is 250 GN per square meter.
- b) Which is the fastest ADC? Explain successive approximation technique for A/D signal conversion.

OR,

A D/A converter has 6 bits and reference voltage of 10V. Calculate the minimum value of resistance( $R$ ) such that the maximum value of output current does not exceed 10mA. Find also the smallest quantized value of output current.

5. a) What is an instrumentation amplifier? How does it differ from a single Op-Amp differential amplifier? Derive an expression for output voltage of a difference amplifier.
- b) Define data acquisition? Explain one of the recent trend used for data acquisition.
6. a) Explain about X-Y recorder and Strip chart recorder.
- b) Define telemetry. What are its types? Compare the wire channels used in telemetry.
7. Write short notes on: (Any two)
- Classification of transducers
  - Filter and its types
  - Measurement standards



POKHARA UNIVERSITY  
Semester - Spring

Year : 2020

Full Marks : 70

Pass Marks: 31.5

Time : 2 hrs.

Level : Bachelor  
Program : BE  
Course : Instrumentation

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

Attempt all the questions.

Section - A: (5×10=50)

- Q.N. 1 How you students differentiate "Intelligent Instrumentation" with "Dumb Instrumentation"? Draw Generalized Block Diagram of Instrumentation System and Discuss its various components with necessary explanation. 3+7

OR

For Quality factor  $Q > 10$ , Which Bridge Circuit; you would use "Maxwell" or "Hay"? Justify your answer for the chosen one with valid reasons. 2+8

An A.C. Bridge has following constants: Arm AB;  $R = 1000\Omega$  in parallel with  $C = 0.159\mu F$ ; Arm BC;  $R = 1000\Omega$ , Arm CD;  $R = 500\Omega$ ; Arm DA;  $C = 0.636\mu F$  in series an unknown Resistance. Analytically compute the

- The frequency at which Bridge becomes at Balance.
- The value of Resistance in Arm DA to yield this balance.

- Q.N. 2 Why Instrumentation amplifier assumed to be superior over OPAMP? Draw Instrumentation amplifier circuit and derive an expression for voltage gain to obtain the result as 3+7

$$Av = \{R_4/R_3\} [1 + 2(R_2/R_1)].$$

- Q.N. 3 What is the significance of "DAC and ADC" in Instrumentation system? You students are asked to Convert an Analog voltage 19.1 V into its equivalent Digital voltage using Successive Approximation Tabulation Techniques to yield valid result. 2+8

- Q.N. 4 How you students relate "X-T Plotter" with "X-Y Plotter"? Suppose there becomes requirement to plots two variables with respect to each other. Which plotter; you student choose X-T or X-Y? Justify your answer with diagram and necessary explanations. 2+8

- Q.N. 5 Which "Data Acquisition System" you students would be prefer to use "Digital DAS" or "Modern Digital DAS"? Justify your answer with neat diagram and valid reasons. Discuss the applications of Analog data acquisition system and Digital data acquisition system. 7+3

### Section - B: (1×20=20)

Q. N. 6

10+10

a) For Transmission scheme, you students are facilitates with three provision  
i) Transmission line, ii) Optical Fiber, and iii) Electromagnetic wave. Which transmission scheme would you select for communication purpose? Justify your answer with valid as well as genuine reasons.

b) Design and Sketch the circuit for Summing Amplifier using OPAMP to get the output result as

$$V_{out} = 2V_1 + 8V_2 - 9V_3 + 12V_4$$

# POKHARA UNIVERSITY

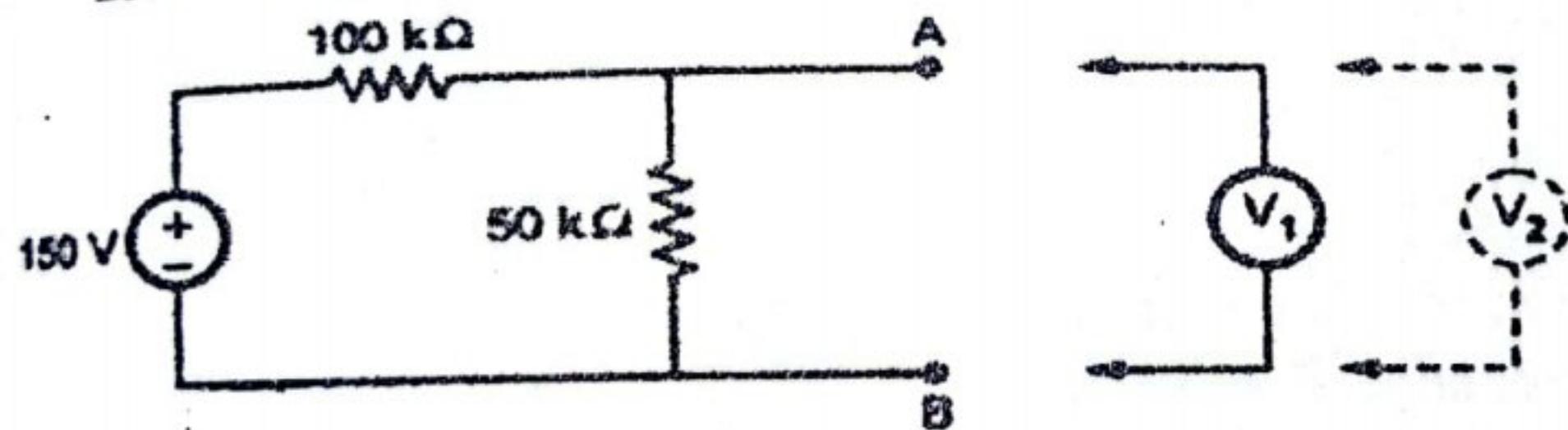
Level: Bachelor  
Programme:BE  
Course: Instrumentation

Semester: Fall

Year : 2021  
Full Marks: 100  
Pass Marks: 45  
Time : 3hrs.

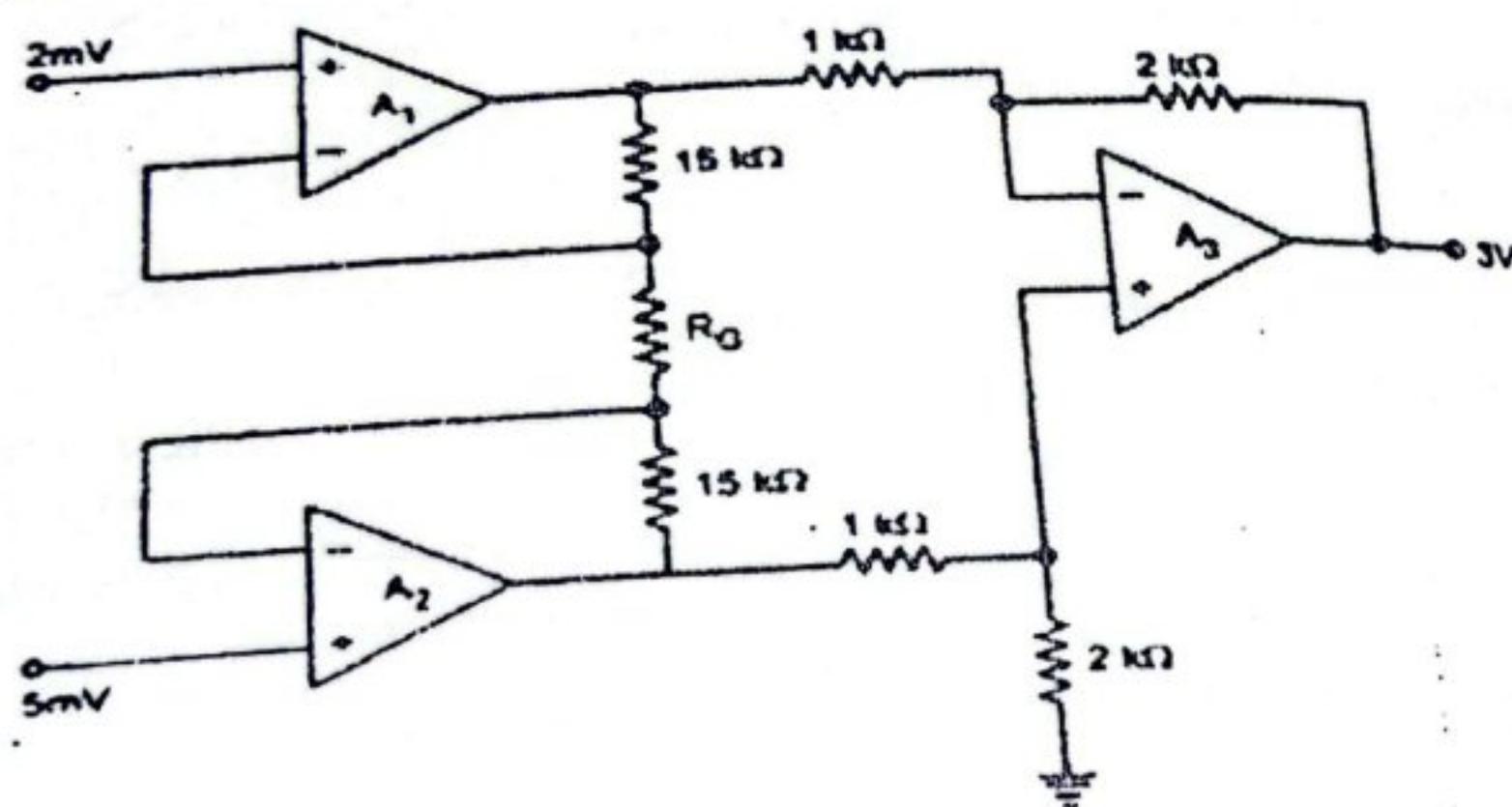
*Candidates are required to give their answers in their own words as far as practicable.  
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Attempt all the questions.*

- a) Draw the generic block diagram of an instrumentation system. Explain the type of signal obtained in each stage. 7
- b) For the network shown below ( $R_1 = 100\text{ k}\Omega$  and  $R_2 = 50\text{ k}\Omega$ ) find the voltage reading on voltmeter (V), if voltmeter sensitivity is  $1\text{ k}\Omega/\text{Volt}$ . If the voltmeter is replaced by another voltmeter having sensitivity  $25\text{ k}\Omega/\text{Volt}$ , Find the new reading. Comment on answer. 8



- a) State the conditions for DC bridge balanced with necessary derivation. Compare the result with AC bridge. 8
- b) An ac bridge is in balance with the following constants: arm AB,  $R=450\Omega$ ; arm BC,  $R=300\Omega$  in series with  $C= 0.265\mu\text{F}$ ; arm CD, unknown; arm DA,  $R=200\Omega$  in series with  $L= 15.9\text{mH}$ . Find the constants of arm CD. Assume oscillator frequency is 1KHz. 7
- a) Error of a potentiometric device is always negative except at two extreme points. Justify. 7
- b) The output of an LVDT is connected to a 5 volt voltmeter through an amplifier whose amplification factor is 250. An output of 2mV appears across the terminals of LVDT when the core moves through a distance of 0.5 mm. Calculate the sensitivity of the LVDT and that of the whole set up. The milli voltmeter scale has 100 divisions. The scale can be read to 1/5 of a division. Calculate the resolution of the instrument in mm. 8

4. a) A compressive force is applied to a structural member. The strain is 5 micro-strains. Two separate strain gauges are attached to the structural member, one is a nickel wire strain gauge having a gauge factor of -10 and other is nichrome wire strain gauge having a gauge factor of 3. Calculate the value of resistance of the gauges after they are strained. The resistance of strain gauges before being strained is 200 ohm.
- b) Find the suitable value of  $R_G$  to provide the output of 3V, from the circuit shown in the figure below:



5. a) Define isolation amplifier. State the importance of signal conditioning in instrumentation.

- b) Define telemetry. What are its types? Compare the wire channels used in telemetry.

6. a) Define recorder. Why recording is important? If VI characteristics of a diode is required to be recorded, which recorder would you prefer. Explain its operation with necessary diagram.
- b) Define data acquisition? Explain any one modern trend used for data acquisition.

7. Write short notes on: (Any two)

- a) Maxwell's bridge  
b) Observation of interference in Instrumentation  
c) Signal conditioning

POKHARA UNIVERSITY

Level: Bachelor

Programme: BE

Course: Instrumentation

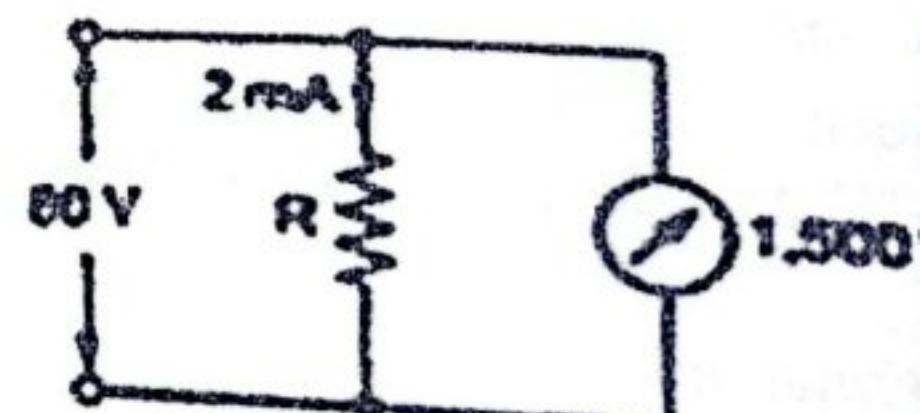
Semester: Spring

Candidates are required to give their answers in as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Differentiate between Intelligent versus Dumb generalized block diagram for Instrumentation various components with necessary explanations
- b) A Voltmeter having a sensitivity of  $15\text{k}\Omega/\text{V}$  reads when connected across an unknown resistor, resistance is 2mA. Calculate the % error due to



2. a) Differentiate between Maxwell's versus H components of unknown arm for the Hays bridge advantages and disadvantages for the Maxwell bridge
- b) State Wheatstone principle for circuit to be balanced. AB, R=1000Ω in parallel with C= 0.5μF BC, R=1000Ω in series with C= 0.5μF CD, L=30 mH in series with R= 200Ω

3. a) How does the capacitance of capacitive t overlapping area of the plates?

# POKHARA UNIVERSITY

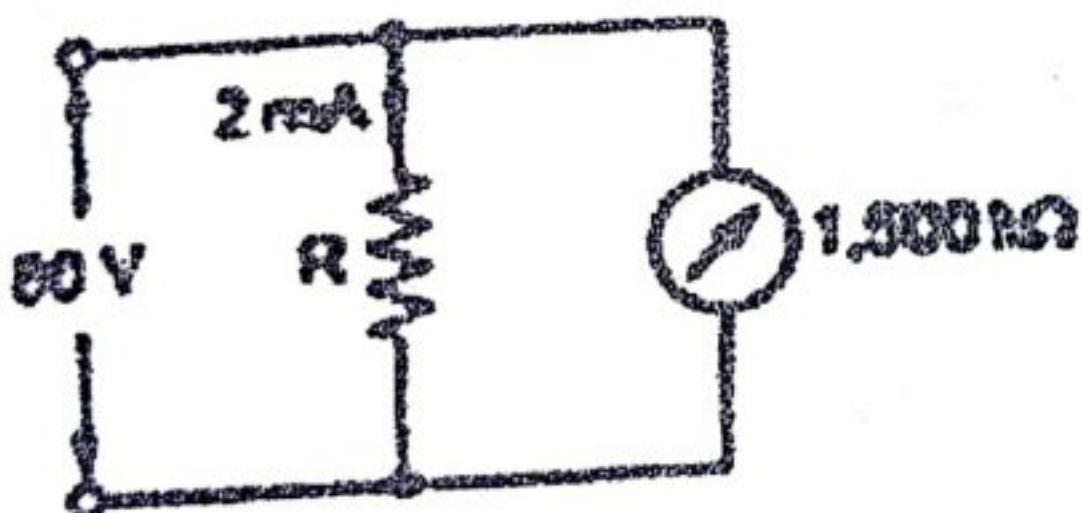
✓  
 Level: Bachelor  
 Programme: BE  
 Course: Instrumentation

Semester: Spring

Year : 2021  
 Full Marks: 100  
 Pass Marks: 45  
 Time : 3 hrs.

*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 8
- b) A Voltmeter having a sensitivity of  $15\text{k}\Omega/\text{V}$  reads 80V on a 100V scale, when connected across an unknown resistor. The current through the resistance is 2mA. Calculate the % error due to loading effect. 7



2. a) Differentiate between Maxwell's versus Hays bridge. Derive the components of unknown arm for the Hays bridge circuit. List out the advantages and disadvantages for the Maxwell's bridge circuit. 7
- b) State Wheatstone principle for circuit to be balance. A 1000Hz bridge 8 has following constants arms,
- AB,  $R=1000\Omega$  in parallel with  $C=0.5\mu\text{f}$   
 BC,  $R=1000\Omega$  in series with  $C=0.5\mu\text{f}$   
 CD,  $L=30\text{ mH}$  in series with  $R=200\Omega$   
 Find, the constants of arms DA to balance the bridge.
3. a) How does the capacitance of capacitive transducer vary with the overlapping area of the plates? 7

# POKHARA UNIVERSITY

Semester: Fall

Year : 2022

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Level: Bachelor  
Programme: BE  
Course: Instrumentation

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

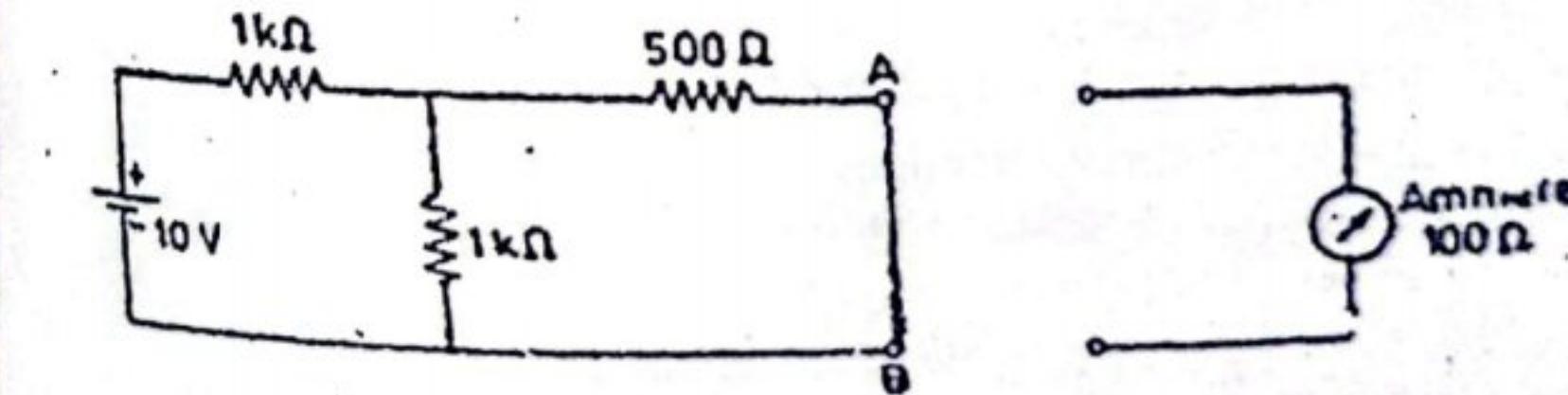
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Attempt all the questions.

- b) Explain the principle of operation of inductive transducer. A variable inductive transducer with inductance of  $5 \text{ mH}$  and numbers of turn is 50. When the numbers of turn changes to 60, find the value of inductance of coil?
- a) An excitation of 10 V is given to a strain gauge. It was observed that the full-scale output voltage was 30 mV. What is its sensitivity? Which temperature transducer: Thermocouple or RTD or Thermistor do you prefer for temperature measurement in term of linearity and why?
- b) Differentiate between Isolation versus Instrumentation Amplifier. Draw Instrumentation amplifier circuit and derive an expression for voltage gain  $A_v = \{R_4/R_3\} [1 + 2(R_2/R_1)]$ .
- a) Design successive approximation method that becomes capable to convert Analog Voltage 11.1V into its equivalent digital voltage. Design part must include circuit Diagram as well as successive tabular steps involved during transformation from ADC to DAC.
- 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.
- Q5.** a) Explain the principle of operation of Magnetic Tape Recorder. List out its areas of applications.  
b) Differentiate between DAS versus FSD. Draw generalized block diagram of digital "Data Acquisition System" and discuss its various components  
With necessary explanation.  
Write short notes on: (Any two)  
a) Selection of transducer  
b) Gaussian Probability curve  
c) PMMC

a) Explain the generalized block diagram of an instrumentation system with their function and example. 8

b) It is desired to measure the value of current in the 500 ohms resistor as shown in Fig. by connecting a 100 ohms ammeter. Find: (a) the actual value of current (b) measured value of current c) percentage error in the measurement and accuracy. 7



a) Define and list out static and dynamic characteristics of instrumentation systems. Explain any four static characteristics in brief. 8

b) The arms of Maxwell ABCD bridge are as follows: AB is an non inductive resistance of  $1000\Omega$  in parallel with a capacitance of  $0.5 \mu\text{F}$ , BC is an non inductive resistance of  $600\Omega$ , CD is an inductive impedance of unknown value and DA is non inductive resistance of  $400\Omega$ . If the balance is obtained under these condition, Find the value of unknown arm CD. 7

a) Explain the loading effect in potentiometer and write the methods of reducing loading effect. 8

b) A strain gauge having resistance of  $600 \Omega$  and gauge factor 2.0 is connected in series with a blast resistance of  $100\Omega$  across 50 volt. Determine the change in output when a stress of  $150 \text{ MN/m}^2$  is applied. The modulus of elasticity is  $250 \text{ MN/m}^2$ . 7

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Attempt all the questions.

4. a) A capacitive transducer is made up of two concentric cylindrical electrodes. The length of the electrodes is 25mm, the inner diameter of outer cylinder electrodes is 4.2 mm and the outer diameter of inner cylindrical electrode is 4mm. Determine the sensitivity of transducer. Determine also the dielectric stress when a voltage of 150V is applied across the electrodes. For a displacement of inner electrodes of 2.5 mm, determine the change in capacitance. Assume air as medium. The breakdown strength of air is 3kV/mm.
- b) Define virtual ground and CMRR in OP-AMP. Derive the gain of Non-inverting OP-AMP.
5. a) Find out the output voltage expression for differentiator and integrator circuit. Design an adder circuit using opamp to get output expression given by  $V_o = -3V_1 - 15V_2 - 120V_3$ .
- b) What are the various type of data transmission medium? Explain Synchronous and Asynchronous data transmission in brief.
6. a) Convert an analog signal having the magnitude 3.625 in a 4-bit digital word successive approximation ADC if the reference voltage is 8v.
- b) Explain widely spread modern trend in data acquisition techniques. Description should reflect Practical trends in measurement types and accessories.
7. Write short notes on: (Any two)
- a) Magnetic Data Recorder
- b) Calibration and error in transducer
- c) IEEE standards.

- i) What are the components of an instrumentation system? Explain each component in brief along with the suitable diagram. 7
- ii) 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
- iii) 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  $f = 1 \text{ KHz}$ . 7
- iv) Induction type Energy meter and electrodynmo type wattmeter are very important instruments in this digital era. Explain both with its block diagram and working principle. 8
- v) 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. OR 8
- Why Electronic multimeter is more applicable than normal meter?  
Explain in brief about electronic multimeter. 7
- b) Explain the single channel and multichannel Data Acquisition System (DAS) with their block diagrams. 8
- a) Define Instrumentation amplifier. Explain the working principle of an instrumentation amplifier. 7

# POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2023

Programme: BE

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.*

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*Attempt all the questions.*

- a) Differentiate between intelligent versus dumb instrumentation. Draw generalized block diagram for instrumentation system and discuss its various components with necessary explanations. 7
- b) Explain Construction operation with application of transducer. 8
- a) The AC bridge ABCD has the details. The arm AB has resistance of 100  $\Omega$  in parallel with capacitance of 50  $\mu\text{F}$ . The BC has non inductive resistance of 70  $\Omega$ . The arm DC is unknown and has resistance in series with inductance. The arm AD has resistance 60  $\Omega$  by using the balancing conditions, determine the values of unknowns. 7

## OR

- b) Explain the methods for measurement of high resistances. 8
- b) What is D'Arsonval Principal? How is this principle used to create ammeter and voltmeter. Explain with circuit diagram and necessary equations of ammeter and voltmeter. 8
- a) Define instrument transformer. Explain the measurement of current and voltage by moving iron instrument. 7
- b) Differentiate between isolation versus Instrumentation Amplifier. 8
- a) Draw Instrumentation Amplifier circuit and derive its voltage gain. 7
- b) Differentiate between amplification and attenuation. Design OP-Amps circuit to give output. 8
- $$V_0 = 2V_1 - 3V_2 + 4V_3 - 5V_4$$
- b) Design successive approximation method that becomes capable to convert Analog Voltage 11.1 V into its equivalent digital voltage. Design part must include circuit diagram as well as successive tabular steps involved during transformation from ADC to DAC. 8
- 5. a) Define connectors. Explain types of probes used in measurement. 7
- b) What is spectrum analyser? Explain its components for measurement of RF signals with necessary block diagram. 8

6. a) What is digital voltmeter? Explain ramp type digital voltmeter.  
b) Explain construction, operation with application graphic recorders.

OR

Explain construction, operation of storage and sampling oscilloscopes.

7. Write short notes on: (Any two)

- a) Wager's ground connection
- b) Fiber optics
- c) LED and seven segment display

2x5

Candidates are required to give their answers in their own words as far as practicable.  
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Attempt all the questions.

1. a) What are the basic blocks of a generalized instrumentation system?  
Draw the various blocks and explain their functions.
- b) What is the Role of calibration during measurements. Discuss the various types of Errors in transducer occurred during measurement process and possible remedies for it inorder to perform possible accurate measurement
2. a) Describe the working of Hay's bridge for measurement of inductance. Why is this bridge suited for measurement of inductance of high Q coils?
- b) An AC bridge has the following components: arm AB,  $R = 1000 \Omega$  in parallel with  $C = 0.5 \mu F$ ; BC,  $R = 1000 \Omega$  in parallel with  $C = 0.5 \mu F$ ; CD,  $L = 30 mH$  in series with  $R = 200\Omega$ . Name the unknown components and its value of arm DA to balance the bridge. Assume frequency  $f = 1000$  Hz.
3. a) What is the use of Wattmeter? Discuss Induction type Wattmeter, it's working mechanism. List out the advantage & disadvantage of induction type Wattmeter.
- b) A capacitance 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 capacitor has capacitance  $370 pF$  when no pressure is applied to the diaphragms. Find the value of capacitance after the application of pressure of  $900 kN/m^2$ .
4. a) Differentiate between OPAMP versus Instrumentation Amplifier. Draw Instrumentation amplifier circuit and derive an expression for voltage gain  $A_v = \{R_4/R_3\} [1 + 2(R_2/R_1)]$ .
- b) Explain the principle operation of LVDT. List out its area of applications.

Page 2 of 2

Page 1 of 2

5. a) ✓ Discuss the significance of Wave analyzer in measurement. Draw the block diagram for "Frequency selective wave analyzer" and discuss its various components with necessary explanations. 7
- b) Find the successive approximation (SAR) ADC output for a 4-bit converter to a 3.217V input, if the reference voltage is 5V. 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. 8
- b) ✓ Explain briefly about the modern trends in data acquisition system. 7
7. Write short notes on: (Any two) 2x5
- a) Basic requirement of Transducer
  - b) Probable error
  - c) RS 232 Cables