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

Question Paper Code: 31752

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Seventh Semester

Electronics and Instrumentation Engineering

01UEI702 - INSTRUMENTATION SYSTEM DESIGN

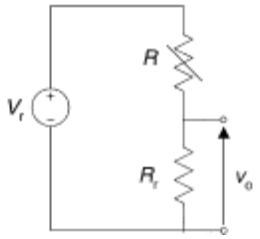
(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. The MGS 1100 CO gas sensor (Motorola) has 1000 *kΩ* in air, from 30 *kΩ* to 300 *kΩ* (150 *kΩ* typical) for CO concentration of 60 x 10^{-6} (R_{60}), and a ratio R_{60} / R_{400} = 2:5 (typical). If the allowable voltage across the sensing resistor and power dissipation in it are 5 *V* and 1 *mW*, design a voltage divider according to figure shown for such a sensor if the expected CO concentration range is from 0 to 400 x10^{-6}.



2. Draw the circuit diagram of differential amplifier based on single op-amp and four matched resistors.

3. Write the output equation for capacitance bridge analog linearization with a circuit diagram.

4. How the specific signal conditioner for capacitive sensors works?

5. Where do we on-off control use an controlling a process?

6. What is meant by integral windup?

7. Draw the orifice type flow meter and indicate the fluid flow.

8. How can you express the mass flow rate of gas?

9. Draw the Process and Instrumentation (PI) diagram of a flow process.

10. Mention the choice of temperature of a platinum RTD.

PART - B (5 x 16 = 80 Marks)

11. (a) How the Wheatstone bridge can be balanced? Explain the balance measurement techniques in detail. (16)

Or

(b) Design an instrumentation amplifier based on two op-amps and three op-amps separately. (16)

12. (a) Design an ac amplifier with power supply decoupling and explicate the step by step design procedure with diagrams and equations. (16)

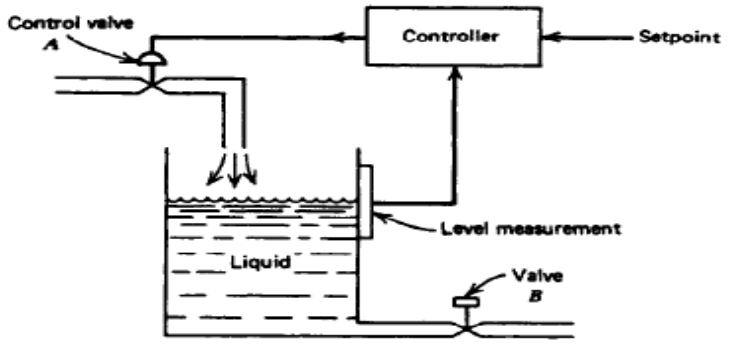
Or

(b) (Describe the application and working of LVDT used in signal conditioning with appropriate diagrams. (16)

13. (a) Explain the operations of P, PI and PID controllers in detail. Brief the characteristics of each controller. (16)

Or

(b) (i) Consider the proportional mode level-control system as shown in figure. Value *A* is linear, with a flow scale factor of 10 m^3/h. The controller output is nominally 50 % with a constant of Kp = 10 %. A load change occurs when flow through valve *B* changes from 500 m^3/h to 600 m^3/h. Calculate the new controller output and offset error. (8)



(ii) An integral controller is used for speed control with a set point of 12 *rpm* with a range of 10–15 *rpm*. The controller output is 22*%* initially. The constant K_i = -0.15*%* controller output per second percentage error. If the speed jumps to 13.5 *rpm*, calculate the controller output after 2s for constant e_p. (8)

14. (a) Explain the design consideration of rotameter in detail with necessary diagrams and equations. (16)

Or

(b) (i) Illustrate the operation of bourdon tube with a neat diagram. (8)

(ii) Write short notes on function of a temperature transmitter. (8)

15. (a) Draw the Process Instrumentation (PI) diagrams of the following: (i) Valves (ii) Compressors (iii) Pumps and Turbine and (iv) Line symbols. (16)

Or

(b) Draw the process flow diagram of a temperature control used in a boiler and brief its operations. (16)