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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 19EI5PCPCS **Max Marks: 100**
Course: Process Control Systems **Date: 23.02.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

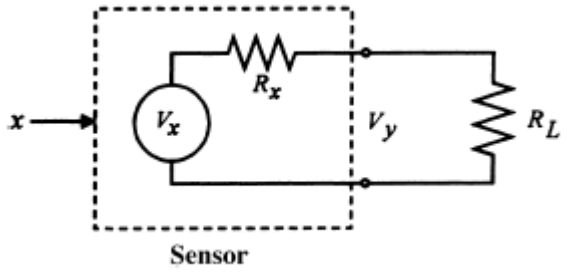
UNIT - I

1 a) Describe all the blocks and signals that are involved in the general Process control block diagram. Also, compare the physical diagram with block diagram. **10**

b) Discuss the different types of control valves and their characteristic curve for each type used in process control systems. **10**

UNIT - II

2 a) In an analog signal conditioning circuit shown, explain the effects of loading with a suitable example. **10**



Derive the expression for the voltage across load and also comment on the effect of loading in the circuit

b) Temperature is to be measured in the range of $250°C$ to $450°C$ with an accuracy of ±2%. The sensor is a resistance that varies linearly from 280 Ω to 1060 Ω for this temperature range. Power dissipated in the sensor must be kept below 5 mW. Develop an analog signal conditioning that provides an output voltage varying linearly from -5V to +5V for this temperature range. The load is a high-impedance recorder. **10**

OR

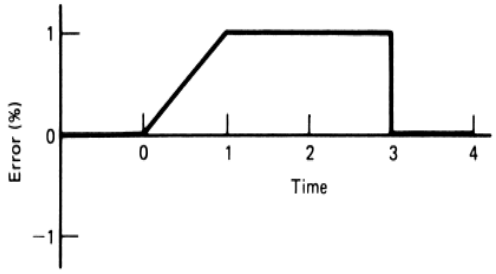
3 a) Describe process control characteristics with suitable example for each **06**

b) A controller outputs a(4 to 20) mA signal to control motor speed from 140 to 600 rpm with Linear dependence. **04**

Calculate (i) current corresponding to 310 rpm, and

(ii) The value of (i) expressed as the percent of control output.

c) The error signal given in figure below is applied to a proportional integral (PI) controller K_p =5, K_I=0.5 s^{-1} and $P_I(0)$ =20%. Analyze the performance of the controller and draw the resulting controller output. **10**



UNIT - III

4 a) Illustrate with a circuit diagram and appropriate equations the design of three mode controller in PID Mode using op amps. **10**

b) Develop a two position digital controller using comparator and Flip flops and describe the operation of the circuit. **10**

OR

5 a) A proportional-derivative controller has a (0.4 to 2.0)V input measurement range, a (0 to 5)V output, Kp = 5%/% and K_D = 0.08% per (%/min). The period of the fastest expected signal change is 1.5 s. Implement this controller with an op amp circuit. **10**

b) Temperature is measured with a response of 15 mV/ºC. Develop a two-position controller that turns a 115-Vac fan ON if the temperature reaches 70°C and OFF when it falls to 40°C. **10**

UNIT - IV

6 a) Illustrate with a block diagram, the general features of a Cascade process control System. **06**

b) In an application of the Ziegler-Nichols method, a process begins oscillation with a 30% proportional band in an 11.5-min period. Obtain the nominal three-mode controller settings **06**

c) Define Optimum Control and explain stability, minimum deviation and minimum duration with appropriate examples. **08**

UNIT - V

7 a) Classify the Hazardous areas based on class/division system in a process industry **10**

b) Summarize the Dual Redundant and Triple Redundant Shut down systems and their architecture in detail. **10**

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