

SIXTH SEMESTER B.TECH. (ELECTRONICS & INSTRUMENTATION ENGG.) ONLINE GRADE IMPROVEMENT/MAKE-UP EXAMINATIONS, AUGUST - 2021

SUBJECT: Industrial Automation [ICE 3252]

TIME: 2 HOURS

05-08-2021

MAX.MARKS: 40

Instructions to candidates: Answer any FOUR FULL questions.

Missing data may be suitably assumed.

- 1A Explain with a neat circuit diagram and necessary mathematical analysis zero span adjustment for a 5 4-20 mA transmitter. Hence explain the concept of zero span interaction.
- 1B How is a 4-20 mA transmitter wired to the Analog Input terminal of a PLC. Explain with neat 5 diagrams. Compare the use of pneumatics, voltage and current signals in signal transmission. What additional advantages HART provides in this application?
- 2A Derive the difference equation u(k) vs. e(k) for a PID control using the trapezoidal rule for the 6 integration term. Find the change in output at third sample for the following data: $K_p=2$, sampling time=0.5 s, reset rate =2 s⁻¹, derivative time= 5 s, $e_1=0$, $e_2=1$ and $e_3=2$. What will be the answer if the backward rectangular rule of integration is used. Compare and comment on which one you would use and why? (symbols having their usual meanings u is controller output, e is the error and k denotes sampling instant)
- 2B Amongst the forward, backward, and rectangular rules of discrete integration in a DDC algorithm, 4 which do you think will be most efficient and why; explain mathematically.

3A Describe the following and mention their advantages and disadvantages

- i) RS 232 protocol
- ii) Fieldbus protocol
- 3B Write a structured text program to sort a set of ten integer numbers and then find the median value. 5
- 4A A hazardous chemical manufacturing factory is to be automated with a customized PLC-SCADA 5 system. There are nine departments and each department has anywhere between 250-900 sensors. Given a choice between Ethernet, MODBUS, HART, and simple 4-20 mA communication protocols, which would you use and why?
- 4B Generate a 16 bit CRC code for 0409H word with polynomial= A001H.
- 5A You are required to automate water filling in an overhead domestic water tank. Design the system 5 with a choice of suitable sensors, transmitters, and controllers. Represent and explain the control algorithm as ladder logic.

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5B Differentiate MOV with MVM and write the Boolean and decimal values before and after the 5 execution in each of the registers with respect to the logic represented in Fig. 5B. [consider the following decimal values in these registers before execution. int_1 – (9995d), int_2 – (21722d), int_3 – (9564d), int_4 – (14987d), int_5 – (-5979d), int_6 – (7265d)]



- 6A How is a DCS system different from a PLC-SCADA integrated system in factory automation. 5 Which do you think is more challenging from (i) commissioning point of view (ii) maintenance point of view. Explain.
- 6B Develop a ladder logic for the control of four-way traffic signal

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