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May 2024

B.Tech. (EIC) (Sixth Semester)

Computer Based Instrumentation and Control

(EIEL-604)

Time : 3 *Hours*] [*Maximum Marks :* 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) What do you mean by Computer based plant automation ? Differentiate between On line and Off line computer based plant automation. **1.5**

(b) What do you mean by undersampling ? What are its effects and their remedy ? **1.5**

(c) Differentiate between Simplex and Duplex serial communication. **1.5**

(d) What rules must be followed during tunning of Proportional and Integral (PI) Controller ? **1.5**

(e) Explain which type of controller mode builds up corrective action proportional to the length of time the disturbances persists ? What are the two key characteristics of this control mode ? **1.5**

(f) What will be the output equation of Position and Velocity algorithm ? Differentiate them and give significance of each term. **1.5**

(g) Explain controller drift. Explain the effect of controller drift on the performance of Final control element. **1.5**

(h) Write down the instruction set of PLC for Timer and Counter operation. Also give their Boolean mnemonics. **1.5**

(i) What are advantages and disadvantages of Simulation ? How can we offset the disadvantages of simulation ? **1.5**

(j) What points must be considered during automation of an industrial plant ? **1.5**

Part B

2. (a) What are different levels of automation. Explain them. Also differentiate computer based and classical approach of plant automation. **8**

(b) Differentiate among dedicated computer control, centralised and distributes computer control system. Give advantaged and disadvantages of each relative to other. **7**

3. (a) What do you mean by Multiplexing and why is it needed ? Explain TDM and FDM. Give one example of each. Also explain why sync pulses are needed in TDM. **8**

(b) What are various data transfer mode for serial communication ? With proper diagram, specify the sequence of action for : **7**

(i) Transmission of a data word by a processor to a serial input device through a MODEM.

(ii) Receiving a data word by a processor from a serial input device through a MODEM.

4. (a) Derive an expression for velocity algorithm of DDC system. Explain, how is it related with position algorithm and for what purposes these are used ? **8**

(b) What are various methods to control position of Final control element ? Give advantages, disadvantages and applications of each mode. **7**

5. (a) Write down functional block diagram instruction set of PLC for the following group of operations : **8**

(i) Data transfer

(ii) Data Manipulation

(iii) Flow Control and

(iv) PID control.

(b) List the conditions for drawing the ladder logic. Draw and explain ladder diagram of PLC that will allow three switches in a room to control a single light source. Switching on any three switches turns the light ON, but all the three switches have to be off to turn OFF the light source. Also write down their corresponding Boolean Mnemonics. **7**

6. (a) Define modeling and simulation of a plant. By taking an example, explain various steps to model and simulate a plant. How can a model of plant be validated ? **10**

(b) What are advantages of Hierarchical Structure ? Explain hierarchical structure of distributed control systems by describing functions performed at each level. **5**

7. (a) What are the requirements of an Industrial Automation ? By considering example of cement plant, explain various steps for automation of an industrial plant. **10**

(b) What is an inferential control configuration. Compare it with simple feedback control configuration ? Which one is preferable and why ? **5**