[This question paper contains 4 printed pages.]

Your Roll No. .....

3219 **J**

MEE

Paper – EE.656

(Computer Control of Processes)

Time : 3 *Hours* *Maximum Marks* : 100

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any **five** *questions.*

Assume missing data suitably if missing.

All *questions carry equal marks.*

1. (a) Draw the line diagram/block diagram from process plant to computer system. Explain the functions of all the blocks. Discuss why there is a need of computer for process control ? 10

   (b) Write the functions of RTU. What are its hardware and software components ? Point out the differences between RTU and IED. 10

2. (a) What are the requirements of on-line real-time system ? Write the important features of real-time system. Considering an example, discuss the design of database in real-time system. 10

[P. T. O.

(b) Draw a typical hierarchical system for SCADA. Write the functions of each level. Also write the functions of data concentrator. 10

3. (a) Draw the block diagram for DDC system. Explain its principle of operation. 10

(b) Discuss the seven layered OSI model for networking. Explain the functions of header. 10

4. (a) What are the need of parallel processing in SCADA system ? Explain the architecture of T-9000 transputer. What are the languages used for programming a transputer? Write the important features of Occam. 10

(b) Draw the block diagram of transputerised workstation. Explain its principle of operation for SCADA system. 10

5. (a) What do you understand by NC and CNC machines ? Point out the components of NC machine. Also write their functions. How classification is made of NC machine tool systems? Explain them in brief. 10

(b) What are the languages used in programming of CNC machines ? 5

(c) Draw the line diagram of distributed manufacturing process and adaptive controlled manufacturing process. Explain their principle of operation. 5

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6. (a) Discuss the Mamdani and Takagi-Sugeno methods for processing the fuzzy sets of information for the control of process plant. 10

(b) Design the fuzzy logic control system for the control of a hot water heater. The hot water heater has a knob, Heat knob (0–10) on it to control the heating element power, the higher the value, the hotter it gets, with a value of zero indicating the heating element is turned off. There are two sensors in the hot water heater, one to mearure the temperature of water, which varies from 0 to 125°C, and the other to tell the level of water in the tank, which varies from 0 = empty to 10 = full. Assume that there is an automatic flow control that determines how much cold water (at temperature 10°C) flows into the tank from main water supply; whenever the level of water gets 40, the flow control turn on, and turns-off when the level of water gets above 95°C. Keep the water temperature as close to 80°C as possible inspite of changes in water flowing out of the tank and cold water flows into the tank. 10

7. (a) The processors, for a computer system controlling a process plant, are connected in a stand by mode using watchdog facility. The operating unit have to be shut down if both processers fail. If the failure

time for processor is exponentially distributed with $\lambda = 50 \times 10^{-6}$ /hour, what is the probability that a unit shut down will not caused by processor failure in 6000 hours. Assume the watchdog system have unit reliability. 10

(b) Derive the relation between availability, MTTR and failure rate. 5

(c) A control circuit consists of 5 silicon transistors, 3 silicon diodes, 10 composition resistors and 2 ceramic capacitors connected in series configuration. The hourly failure rate of each component is given below : 5

Silicon Transistor, $\lambda_t = 4 \times 10^{-5}$

Silicon diode, $\lambda_d = 3 \times 10^{-5}$

Composite resistor, $\lambda_r = 2 \times 10^{-4}$

Ceramic capacitor, $\lambda_c = 2 \times 10^{-4}$

Calculate the reliability of the circuit for 10 hours when components fellow exponential distribution.

8. Write the notes on the following : 10 + 10

(i) Petrinets

(ii) PLC

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