Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(EIE)/SEM-2/EIEM-203/2012

2012
PROCESS CONTROL SYSTEM DESIGN

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. a) Name the different experimental techniques for identification of process dynamics.

   b) What is meant by first moment of a process reaction curve ? Show analytically how by using this method the parameters of an overdamped system can be evaluated.

   3 + (3 + 8)

2. a) Describe the Ziegler-Nichlos Method of Tuning.

   b) Name the different types of Dynamic processes and give suitable example for each one of them. 4 + 10

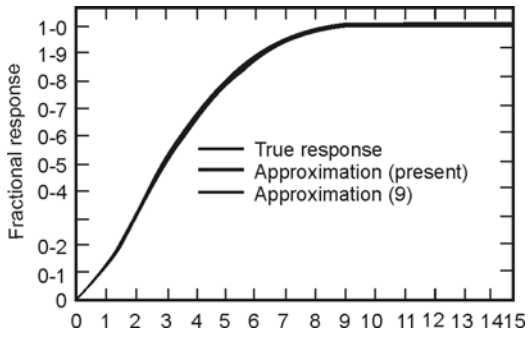
3. a) Derive the overall transfer function of a Spring – Mass – Damper system for application of a external force F and corresponding displacement $x(t)$.

b) The process transfer function of a third order system is given by :

$$G(s) = \frac{C(s)}{R(s)} = \frac{1}{(s+1)(5s+1)(0\cdot 2s+1)}$$

Where the time constants are expressed in minutes. The true response of $C(t)$ to a step change in input $X(t)$ is shown in the following figure. Approximate this process by a second order plus dead time model. Given that the first moment m_1 is computed to be 3·5 mins and the tangent line drawn at the point of inflexion of the plot has a slope M_i = 0·23 min^{-1}, and it intersects $C(t)$ = 1 line at t_m = 5·1 min.

(Use the relation : For λ = 0·32, η = 0·8)



Comparison of True Response with Approximate Response of an Overdamped Second Order System.

6 + 8

4. a) Name the different parts of a Distillation column with proper sketch.

b) Describe its principle of operation and derive the model of the Distillation column. 4 + 10

5. a) What are the significant advantages of a Distributed Control Network over a single centralized computer ?

   b) What are the main components of a typical DCN ? Explain briefly with a diagram.

   c) Draw the architectural & functional diagrams at a typical local controller in a DCN & specify some of its most important parameters.

   d) What is a data link & how its characteristics can be determined ? 2 + 4 + 5 + 3

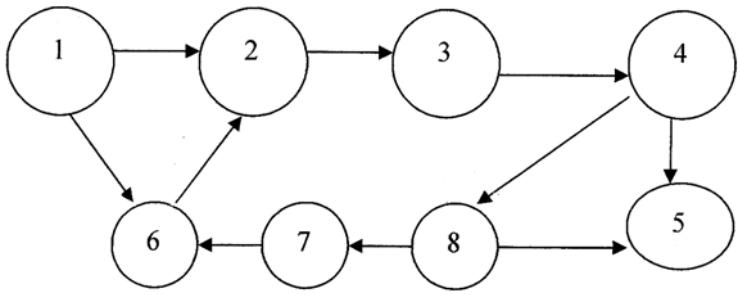
6. a) Discuss the merits & demerits of a fuzzy logic controller & convert an analog PI control action into a discrete one.

   b) Write a short note on different types of membership function. (2 + 4) + 8

7. Explain the design principle of a two input fuzzy PD controller with proper block diagram. 14

8. What is a diagraph ? What is a transition matrix ? Write the transition matrix for the following diagraph :

   3 + 3 + 8



9. a) What is a Data hold device & how is the order of such a device determined ? Justify your statement analytically.

   b) Obtain the transfer function of a zero order hold device.

   c) Show the input/output relationship of the zero-order hold appending sketches. 4 + 8 + 2