Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (LT)/SEM-2/MOLT-207/2010

2010

PROCESS CONTROL IN TANNERY OPERATIONS

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 Questions No. 1 & any *four* from the rest.

1. Answer all the following questions : 10

   a) Process control involves designing of controller & checking its stability for the whole system.

   True / False 1

   b) What is the difference between transducer and sensor ? 2

   c) Define 'accuracy' and 'precision' of a measuring instrument. 2

   d) How does pH sensor work ? 2

   e) Design a temperature measuring system using RTD as transducer. 3

2. a) State MIMO state-space equation used in Linear control system & implement it using block diagram. 7

b) Find the solution of the state space equation (in homogeneous condition). 8

3. a) Derive an equation for MIMO to SISO conversion. 9

b) Convert the SISO transfer function

$$\frac{Y(S)}{U(S)} = \frac{1}{S^2 + 2S + 5}$$ into its MIMO equivalence. 6

4. a) Determine the eigenvalue of the characteristic matrix

$$A = \begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix} .$$ 5

b) What is the use of diagonalization of matrix A ? 2

c) How is the diagonalization of matrix A carried out ? 8

5. a) What do you understand by the term 'Controllability' & what are the conditions to be satisfied for a system to be controllable ? 3

b) Verify whether the following system is controllable or not :

$$\dot{x}_1 = x_1 + x_2 + u$$

$$\dot{x}_2 = 2x_1 - x_2 \ .$$ 5

c) Define observability. State whether the following system is observable or not :

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = 2x_1 - 3x_2 + u$$

$$y = x_1 - x_2 \ .$$ 7

8. Write short notes on any *two* of the following : $2 \infty 7\frac{1}{2}$

a) A block diagram of process controller development in a leather tanning process

b) Flow meter, Humidity & displacement measuring transducer

c) Soft sensor.