Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M.Tech(LT)/SEM-2/MOLT-207/2013
2013
PROCESS CONTROL IN TANNERY OPERATIONS

Time Allotted : 3 Hours   *Full Marks :* 70

The figures in the margin indicate full marks.

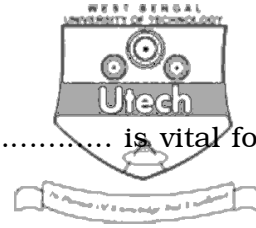*Candidates are required to give their answers in their own words as far as practicable.*

GROUP – A
(Objective Type Questions)

1. Answer the following :   10 × 1 = 10

    A. Fill the blanks of the following :

        a) Automation needs the knowledge of .... , ... and ....

        b) Control theory is basically a study on .... system.

        c) Interface between sensor system and computer are .... and ....

        d) .... is most important part of leather processing.

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e) Maintenance of .... and .... is vital for leather processing.

B. State *True* or *False* :

f) Automation can increase the quality and quantity of products in industry.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following :   3 × 5 = 15

2. How pH and temperature sensors used in leather industry are made ? $2 \times 2\frac{1}{2}$

3. How many types of controllers are used in industry ? Draw a Block diagram of PID controller.   1 + 4

4. What do you mean by stability of a system ? What are absolute and relative stability ? In How many ways stability can be analysed in linear control theory ?   2 + 1 + 2

5. What are the specifications a controller need to satisfy ? Explain them in short. What type of response is desired in the analysis of control system ?   4 + 1

6. What are the primary intentions of applying automation in leather industry ? What type of controllers may be used there ?   3 + 2
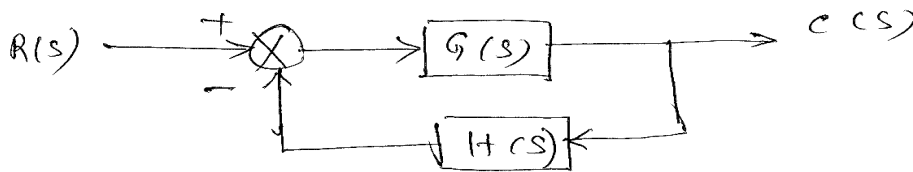
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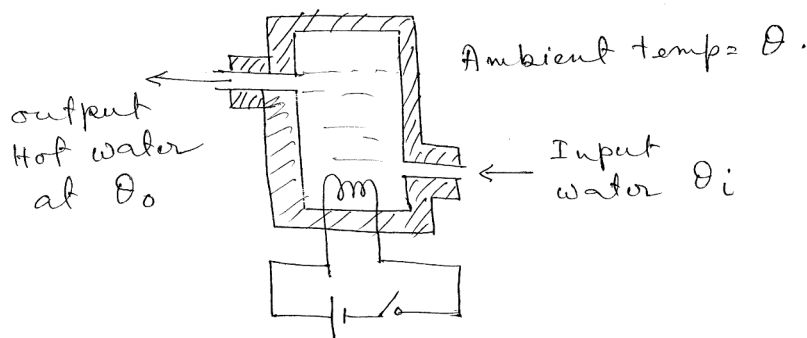## GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following : $3 \times 15 = 45$

7.   A process has a transfer function of $G(s) = \dfrac{10}{(s+3)(s+5)}$,

which has unity feedback system. A PI controller has been used there to maintain stability of the system, the value of proportionality constant $k_p = 1$. What should be the value of integral constant k_i to maintain stability of this system ?

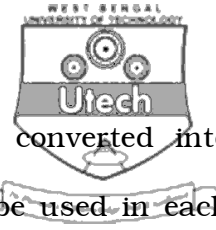8.   a)   Convert the following block diagram into a single block.

5

   b)   Derive a mathematical model for water heating system as shown below :

6

   c)   What is the output of this model when step input has been given so it ?   4

9. Discuss the steps as how a raw hide is converted into finished leather. Discuss the controllers to be used in each step to impose automation in leather industry.

10. a) What do you mean by 'controllability' and 'observability' is MIMO system. How it is examined ? 3

   b) A MIMO system has been described by the following state equations :

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

   $$\dot{x}_2 = -x_2$$

   Check for controllability and observability. 12

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