

CS/M.TECH (ECE)/SEM-2/EC-1001/09
ADVANCED PROCESS CONTROL AND INSTRUMENTATION (SEMESTER - 2)



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Roll No. of the Candidate

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

CS/M.TECH (ECE)/SEM-2/EC-1001/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
ADVANCED PROCESS CONTROL AND INSTRUMENTATION (SEMESTER - 2)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. You have to answer the questions in the space provided marked 'Answer Sheet'. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification.**
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

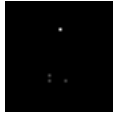
Question Number												Total Marks	Examiner's Signature
Marks Obtained													

.....
Head-Examiner / Co-Ordinator / Scrutineer

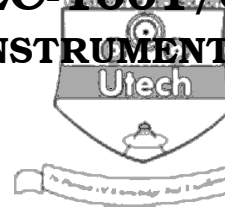
44001 (30/06)



DO NOT WRITE ON THIS PAGE



CS/M.TECH (ECE)/SEM-2/EC-1001/09
ADVANCED PROCESS CONTROL AND INSTRUMENTATION
SEMESTER – 2



Time : 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.

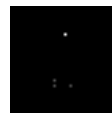
GROUP - A

Answer any *four* questions.

1. a) What do you mean by transportation lag ? Determine its transfer function for a system whose output is the same as its input but delayed by T sec.
- b) How does the root sensitivity depend on the small change of the parameter ?
- c) A unit feedback system has an open loop transfer function $G(s) = \frac{k}{s^2(s+2)}$.
By sketching a root locus plot, show that the system is unstable for all values of k .
2 + 4 + 3 + 5

2. a) What do you mean by bandwidth of a feedback control system ?
- b) Find out its relation with normalized bandwidth.
- c) The open loop transfer function of a system is $G(s)H(s) = \frac{k}{s(s+2)(s+3)}$.
Find out the gain and phase margin and then find out the value of k for the system to be stable ?
Now if a zero is added at -2 in the s -plane, what will be the effect on phase & gain margin ?
2 + 3 + 5 + 2 + 2

3. a) What are the stability criteria of a discrete system given by $C(Z) = T(Z)R(Z)$ (where the symbols have their usual meaning.)
- b) Discuss on Jury's stability test.



- c) Investigate the stability of the system shown in the following figure for sampling period $T = 0.6$ second :



14

4. a) For the system shown in the figure

represent the system in state variable form.

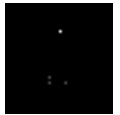
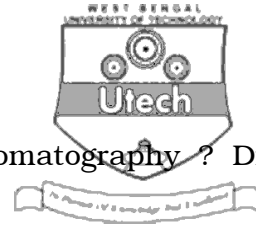
- b) Find whether the system is stable or not.
- c) How can controllability of a system be determined ? What do you mean by full state feedback ? Explain. 4 + 4 + 3 + 3

5. a) What do you mean by a non-linear system ? Write down the state equation of a non-linear system.
- b) How can the controllability of a non-linear system be determined ? What is the basic stability theorem ?
- c) A simple mass, spring and viscous friction system is shown in the following figure :

Show that the system is stable.

1 + 1 + 3 + 3 + 6

6. a) What do you mean by model-reference adaptive control ?
- b) What is MIT rule ? Apply it to a 1st order control system.
- c) Draw the block diagram of MRAC for the above 1st order system. 2 + 2 + 6 + 4

**GROUP - B**Answer any *one* question.

7. a) What is the principle of operation of Gas-chromatography ? Draw the basic building blocks of a chromatography.
- b) Write short notes on any *two* of the following :
- i) Photo-ionization detector
 - ii) Chromatographic column
 - iii) Catalytic detector. 3 + 3 + (4 + 4)
8. a) Discuss how level can be measured using capacitive type level sensor.
- b) What is the operating principle of electromagnetic flowmeter ? For what type of flow, is this meter used ? Draw and explain its operation. 6 + (2 + 1 + 2 + 3)

END