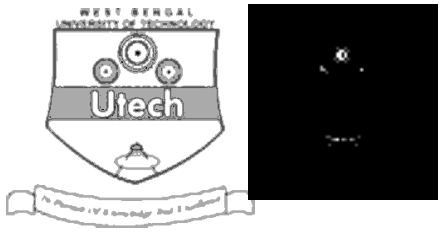
CONTROL SYSTEMS (SEMESTER - 4)

CS/B.TECH (IT)/SEM-4/EE-411/09



1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No.

Roll No. of the Candidate

CS/B.TECH (IT)/SEM-4/EE-411/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

CONTROL SYSTEMS (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **36 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question.**
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. 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

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

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

4642 (16/06)

DO NOT WRITE ON THIS PAGE

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

CONTROL SYSTEMS

SEMESTER – 4

Time : 3 Hours] [Full Marks : 70

Graph paper and semi-log paper are provided at the end of this booklet.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The transfer function of a system is its

a) square wave response b) step response

c) ramp response d) impulse response.

ii) The concept of analogous system is applicable to

a) linear systems only

b) non-linear systems only

c) both linear & non-linear systems

d) non-linear systems but can be extended to linear systems too.

iii) In a signal flow graph

a) nodes represent variables

b) branches represent variables

c) some specified nodes & some specified branches represent variables

d) only one node & all branches represent variables.

iv) PID controller improves the

a) steady state response only

b) transient response only

c) both steady state response & transient response

d) none of these.

v) Nyquist criterion for determination of stability of control systems is

a) algebraic method b) graphical method

c) semi-graphical method d) none of these.

vi) A control system is defined by the relationship $\frac{d^2x}{dt^2}+6\frac{dx}{dt}+5x = 12\left(1-e^{-2t}\right)$. The response of the system at $t \to \infty$ is

a) $x = 6$ b) $x = 2$

c) $x = 2{\cdot}4$ d) $x = -2$.

vii) The number of root loci for a unity feedback system having open loop transfer function with finite n number of poles & finite m number of roots is

a) $m - n$ b) $n - m$

c) m d) n.

viii) The transfer function of a basic PI controller is given by (all k's are real constants)

a) $k_0+\frac{k_1}{s}+k_2s$ b) k_0+k_2s

c) k_1s+k_2s d) $k_0+\frac{k_1}{s}$.

ix) The initial slope of the Bode plot for a transfer function having a simple zero at origin is

a) – 20 dB/decade b) 10 dB/decade

c) 20 dB/decade d) – 10 dB/decade.

x) If the maximum overshoot is 100%, the damping ratio is

a) 1 b) 0

c) 0·5 d) ∞.

xi) The input-output equation of a system is given by $Y = mx + c$, where m & c are constants. The system is

a) linear b) non-linear

c) active d) passive.

GROUP – B

(Short Answer Type Questions)

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

2. Derive the transfer function of the network shown below

3. Find the stability of the system whose characteristic equation is given by $s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 3 = 0$.

4. Find out the overall transfer function C/R of the following system using the rules of signal flow graph.

5. a) Define error efficients corresponding to step & ramp inputs.

b) A unity feedback closed loop second order system has a transfer function $\frac{81}{s^2+0\cdot6s+9}$ & it is excited by a step input of 10 units. Find out its steady state error. 2 + 3

6. A unity feedback system has an open loop transfer function $G(s)=\frac{25}{s(s+8)}$. Determine its damping ratio, peak overshoot & time required to reach peak.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions. 3 × 15 = 45

7. a) Explain the meaning and significance of phase margin & gain margin of a control system. How will you obtain the values of these margins from Bode plots ?

b) Sketch the Bode plot for the following function & find out the value of gain margin & the phase margin :

$G(s)=\frac{10(s+2)}{s(s+6)(s+10)}$. 6 + 7 + 1 + 1

8. a) A unity feedback control system has open loop transfer function $G(s)=\frac{k}{s^3+s^2+s-3}$.

Find out the range of values of k so that the closed loop system is stable.

b) Sketch the root locus for the system having $G(s)\,H(s)=\frac{k}{s(s+2)(s^2+4s+20)}$.

Show all the steps. 5 + 10

9. a) Construct the state model for the system characterized by differential equation $\dddot{Y}(t)+6\ddot{Y}(t)+11\dot{Y}(t)=u(t)$.

b) Find the pulse transfer function for the sampled system shown in the following figure.

7 + 8

10. a) State the Nyquist stability criterion.

b) Using Nyquist stability criterion, determine whether the unit feedback close loop system having open loop transfer function $G(s)\,H(s) = \frac{10}{s(1+s)(1+0\cdot 05s)}$ is stable or not.

c) What is meant by relative stability ? Can you find out relative stability by Routh stability criterion ? 3 + 7 + 5

11. Write short notes on any *three* of the following : 3 × 5

a) Servo motor

b) PID controller

c) Sample & Hold circuits

d) Absolute stability & Relative stability.

END