Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CSE/IT)/SEM-5/EE-503/2009-10

2009

CONTROL SYSTEM

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.

Graph paper(s) and Semi log paper(s) will be provided by the institution.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Feedback control system is basically

a) high pass filter b) band pass filter

c) low pass filter d) band stop filter.

ii)

Dia.

The value of x_3 / x_1 is

a) 8 b) 2

c) 12 d) 5.

iii) If the gain K of the system increses, the steady state error of the system

a) decreases

b) increases

c) may increase or decrease

d) remains unaltered.

iv) If some pole of a system lies on the imaginary axis, the system is

a) absolutely stable b) conditionally stable

c) marginally stable d) unstable.

v) The root locus of a system has four separate loci. The system can have

a) four poles or four zeros

b) four poles & four zeros

c) six poles & two zeros

d) two poles & two zeros.

vi) A system has 14 poles & 2 zeros. The slope of its highest frequency asymptote in its magnitude plot is

a) – 40 dB/decade b) – 240 dB/decade

c) – 280 dB/decadde d) – 320 dB/decade.

vii) The disadvantage (s) of polar plot is (are)

a) plot is cramped of high frequencies

b) the calculations are time consuming for exact plot

c) it is very difficult to calculate gain & phase margin

d) all of these.

viii) Teh number of points encircled by X & Y is

Fig.

a) 2, 1 b) 1, 2

c) 1, 1 d) 2, 2.

ix) The proportional error device has output as function of

a) derivative of error b) integral of error

c) error d) none of these.

x) The system response can be tested better with

a) sinusoidal input signal

b) ramp input signal

c) unit impulse damping signal

d) exponentially decaying signal.

xi) The input-output relationship of a linear system is given by

a) $y = a_0 x^2 + a_1 x + a_0$

b) $y = a_1 x + a_0$

c) $y = a_1 x$

d) $y = a_0$.

xii) Regenerative feedback means the output is feedback with

a) positive sign b) negative sign

c) step input d) oscillation.

GROUP – B

(Short Answer Type Questions)

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

2. Determine the transfer function of the system having the following graph.

Graph

3. Calculate the transfer function of the electrical network shown in the figure.

Fig.

4. A system has $G(s) = \frac{20}{s^2 + 5s + 5}$ & unity feedback. Find

i) W_n ii) ξ

iii) W_d iv) M_p

v) T_s .

5. A unity feedback system has

$$G(s) = \frac{180}{s(s+6)} \quad \& \; r(t) = 4t.$$

Determine,

i) the steady state error

ii) the value of k to reduce the error by 6%.

6. Find the stability of a system having characteristic equation $s^6 + 2s^5 + 7s^4 + 10s^3 + 14s^2 + 8s + 8 = 0$.

GROUP – C

(Long Answer Type Questions)

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

7. The open loop transfer function of an unity feedback system is given by $G(s) = \frac{k}{s(1 + 0{\cdot}02s)(1 + 0{\cdot}04s)}$.

Draw the Bode plot. Find gain margin & phase margin. Hence find the value of open loop gain so that the system has a phase margin of 45°.

8. The transfer function of an open loop control system is $G(s) = \frac{k}{s(s^2 + 4s + 8)}$.

a) Sketch the root loci of the system on a graph paper, touching the following points :

i) Number of the root loci

ii) Number of asymptotes

ii) Angle of asymptotes & their real axis intercept.

iv) Angle of departure

v) Imaginary axis intercepts

vi) Real axis part of root locus.

b) Find from your sketch, the value of gain k at which dominant pole will have a damping ratio, $\xi = 0{\cdot}5$. Also find the corresponding transient frequency of oscillation.

9. By applying Nyquist criterion, state whether the closed loop system having the following open loop transfer function is stable or not.

$$G(s)H(s) = \frac{s+3}{(s+1)(s-1)} \ .$$

10. a) What is a polar plot ?

b) Draw the polar plot of a first order system.

c) What is the effect on the polar plot if a non-zero pole is added to the transfer function.

d) What is Nichols chart ?

e) What is the application of Nichols chart ?

3 + 5 + 2 + 3 + 2

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

a) PID controller

b) Lead-lag compensator

c) AC tachometers

d) Effect of adding poles & zeros to a second order linear system.