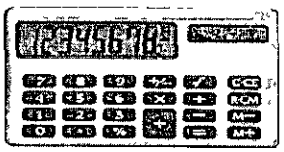
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

CSY3601

October/November 2016

CONTROL SYSTEMS III (THEORY)

Duration 3 Hours

100 Marks

EXAMINERS

FIRST	PROF Z WANG
SECOND	DR X YE
EXTERNAL	DR AA YUSUFF

Programmable pocket calculator is permissible

Partial/limited open book examination Specified material as indicated on examination paper, permissible

This examination question paper consists of 3 pages including this "cover" page
Partial Open book exam Ogata, K Modern Control Engineering

Answer all the questions

PLEASE NOTE IF YOU HAVE THE OPINION THAT INSUFFICIENT INFORMATION IS SUPPLIED FOR YOU TO ANSWER A PARTICULAR QUESTION, MAKE A REALISTIC ASSUMPTION, MOTIVATE IT AND THEN ANSWER THE QUESTION.

QUESTION 1

The system shown in Figure 1 has $\%os = 20\%$ and $T_p = 1s$, find the values of K and K_4

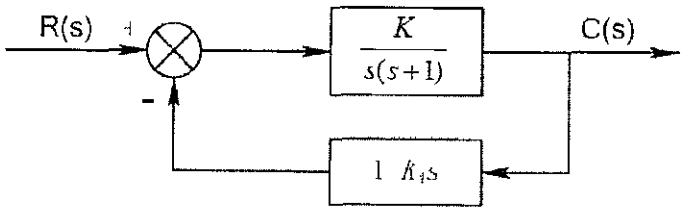


Figure 1 Control System for Question 1

[20]

QUESTION 2

Consider the circuit shown in Figure 2

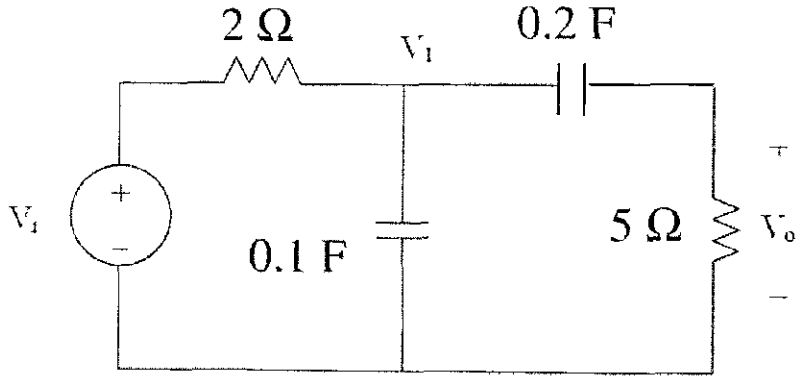


Figure 2 Circuit for Question 2

Determine the transfer function $H(s) = \frac{V_o(s)}{V_i(s)}$ of this system

[20]

[TURN OVER]

QUESTION 3

A unity negative feedback system has the following forward transfer function

$$G(s) = \frac{12}{s(s+2)(s+3)}$$

3 1 Evaluate the system type, K_p, K_v and K_a (8)

3 2 Use your answers to 3 1 to find the steady-state errors for the unit step, 10t and $3t^2$ inputs (12)

[20]

QUESTION 4

The closed-loop transfer function of a system is

$$T(s) = \frac{10}{s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4}$$

4 1 Construct a Routh-Hurwitz table for the transfer function (11)

4 2 Determine how many closed-loop poles lie in the right half-plane, how many closed-loop poles lie in the left half-plane and how many closed-loop poles lie on the jω-axis (9)

[20]

QUESTION 5

The Log Magnitude Bode diagram of a minimum phase system is shown in Figure 3 Determine the open loop system transfer function

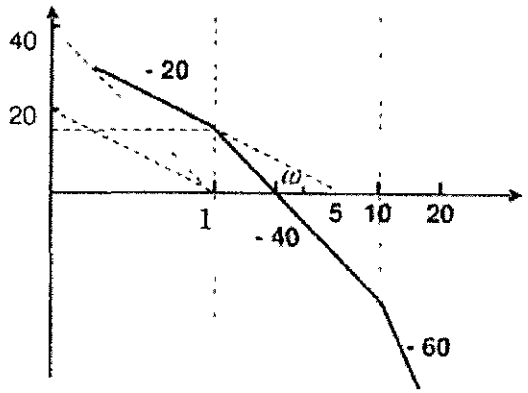


Figure 3 Log-magnitude Bode Plot for Question 5

[20]

TOTAL 100