



COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical & Control Engineering

Lecturer : Prof. Dr. Ahmed Amer

Course : Discrete Control

Course Code: EE 511

Date : 26 / 05 / 2015

Marks: 40

Time : 11:30-13:30

Final Exam

Answer the following questions:

Question One: (10 marks) (A.27)

a) Find the z-transform of the following functions:

i) ka^k (N.B. $a^k \leftrightarrow \frac{z}{z-a}$)

ii) $5\delta(k) + 0.5ku(k)$ (N.B. $\delta(k)$ is the unit impulse, $u(k)$ is the unit step)

b) Given the z-transform of a function $F(z)$ as,

$$F(z) = \frac{0.792z^2}{(z-1)(z^2 - 0.416z + 0.208)}$$

Find the corresponding time function $f(k)$.

c) Given the function,

$$f(k) = (0.1)^k u(k) + 0.5k(0.1)^{k-1} u(k-1)$$

Find the z-transform of $f(k)$.

Question Two: (10 marks) (A.4)

(i) Find the difference equation associated with the transfer function:

$$\frac{Y(z)}{U(z)} = \frac{z(z-1)}{z^2 - 0.5z + 0.06}$$

(ii) Solve for $f(k)$ as a function of k for the following z-domain function:

$$F(z) = \frac{z}{z^2 - 1.2z + 0.2}$$

(iii) What is the final value $f(\infty)$ of the function given in part (ii)?

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Question Three: (10 marks) (A.31)

a) Given the following discrete-data system transfer function,

$$F(z) = \frac{0.5z}{(z-0.5)(z-0.7)}$$

a) Find the system impulse response.

b) Determine the first four samples of the discrete-time function $f^*(t)$

b) Consider the system difference equation:

$$x(k) - 0.8x(k-1) + 0.12x(k-2) = u(k), \quad u(k) = 1, k \geq 0,$$

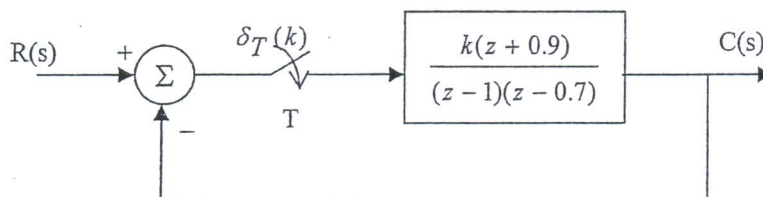
(i) Find the system sampled-data transfer function.

(ii) If the system has a unity feedback, check its stability using bilinear transformation.

Question Four: (10 marks) (A.5)

For the system shown in figure below, determine the range of k for stability:

- i) Using the root locus technique.
- ii) by finding the roots of the characteristic equation.



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