UNIVERSITI KUALA LUMPUR
KAMPUS CAWANGAN MALAYSIAN SPANISH INSTITUTE

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE	: SAB36703
COURSE NAME	: DIGITAL CONTROL SYSTEM
PROGRAMME LEVEL	: BACHELOR
DATE	: 27 JANUARY 2025
TIME	: 2.00 PM – 4.30 PM
DURATION	: 2 HOURS AND 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of FIVE (5) questions.
4. Answer ONLY FOUR (4) questions.
5. Please write your answers on answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer FOUR (4) questions only.
Please use the answer booklet provided.

Question 1

(a) Referring to Figure 1, draws and explain the analytical block diagram of digital control system represented by transfer functions G(s) to digital controller can be present by "Post Transfer functions Gc (z)" for ,

i. Equivalent Analog Digital converter (ADC)

(10 marks)

ii. Equivalent Digital Analog Converter (DAC)

(10 marks)

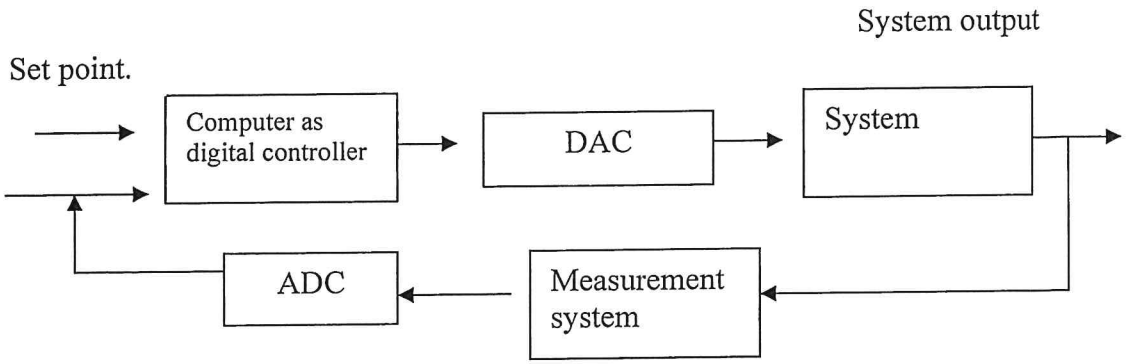

Figure 1

(b) Describe the relationship between the Region of Convergence (ROC) and stability.

(5 marks)

Question 2

(a) Explain what the Z-transform is, and why it is used in discrete-time signal processing

(5 marks)

(b) Explain three (3) solutions for the Z-transform, and how does it help in analyzing and solving discrete-time linear time-invariant system equations efficiently

(10 arks)

(c) Define the Region of Convergence (ROC) in the Z-transform and explain its significance.

(5 marks)

(d) Explain the relationship between the Z-transform and the Discrete-Time Fourier Transform (DTFT).

(5 marks)

Question 3

(a) Explain three (3) means for a discrete-time system to be causal in terms of its input-output relationship, and why causality is important in practical systems.

(6 marks)

(b) Calculate the sequence of the x(n) as x(n) = {5,3,-3,0,4,-2}, when the {-3} is the middle number of Z- transform.

(10 marks)

(c) Calculate the sequence of x(n) when the x(n) = {5,3,0,1,2,4} find the Z- transform equation

(9 marks)

Question 4

(a) Describe four (4) advantages of performing the inverse Z-transform to recover the time-domain signal $w(n)$ from its Z-domain representation $W(z)$ in digital signal processing

(10 marks)

(b) Draw and define the block diagram representation and the corresponding equation for the inverse Z-transform of the signal $x(n)$ shown in Figure 2

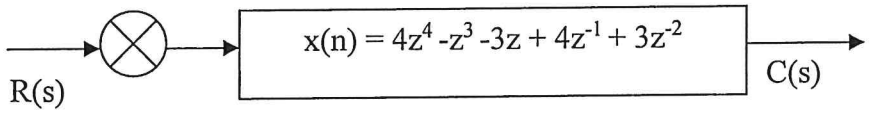

Figure 2: Inverse z-Transform

(15 marks)

Question 5

(a) Explain five (5) how a PID controller is implemented using the Z-transform in a digital control system and describe its practical advantages for real-time applications like robotics, temperature control, or motor speed regulation.

(10 marks)

(b) A Proportional–Integral–Derivative (PID) controller is implemented in a digital control system using Z-transform. Derive the discrete-time PID equation in terms of $e[n]$, the current error signal is continue -time PID controller is defined in Figure 3

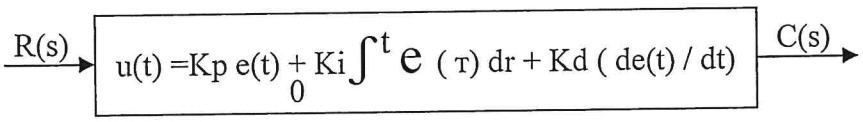

Figure 3: A Proportional–Integral–Derivative (PID)

(15 marks)

END OF EXAMINATION PAPER