



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

Department of Electrical and Electronic Engineering

UNIVERSITY EXAMINATION FOR:

Diploma in Electrical Power Engineering

ECI 2205: Control systems 1

END OF SEMESTER EXAMINATION

SERIES: APRIL 2025

TIME: 2 HOURS

DATE: APRIL 2025

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **five** Questions; Attempt question one (**COMPULSORY**) and any other **TWO** Questions.

Do not write on the question paper.

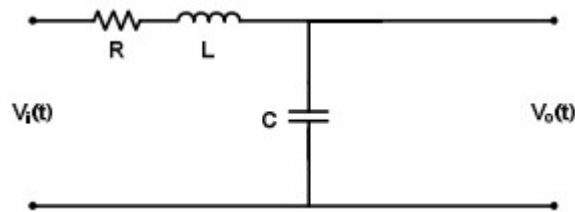
1. (a) (i) Explain the term Control System
(ii) State and explain any **THREE** reasons why control systems are used in industries. (8 marks)
- (b) (i) Distinguish between positive and negative feedback with respect to control systems.
(ii) With aid of a block diagram, show that the transfer function of a positive feedback is given by;

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 - G(s)H(s)} \quad (12$$

marks)

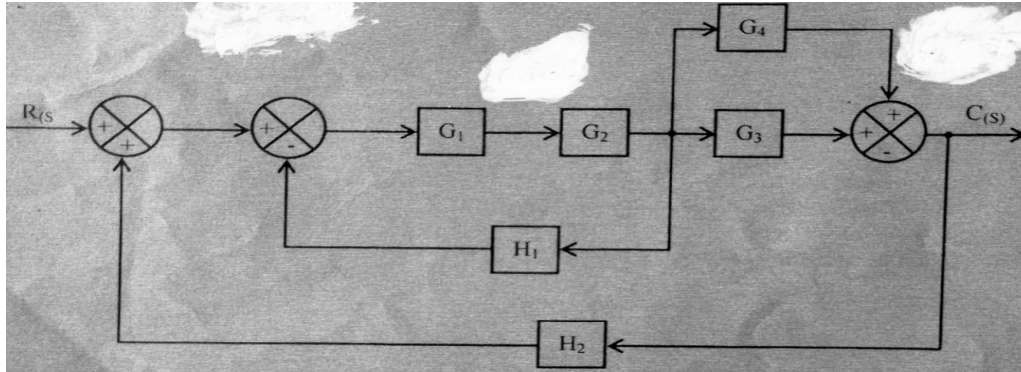
2. (a) (i) Explain the term system modelling.
(ii) Figure 1 shows an RC Network. Obtain its transfer Function. (10 marks)

Fig. 1



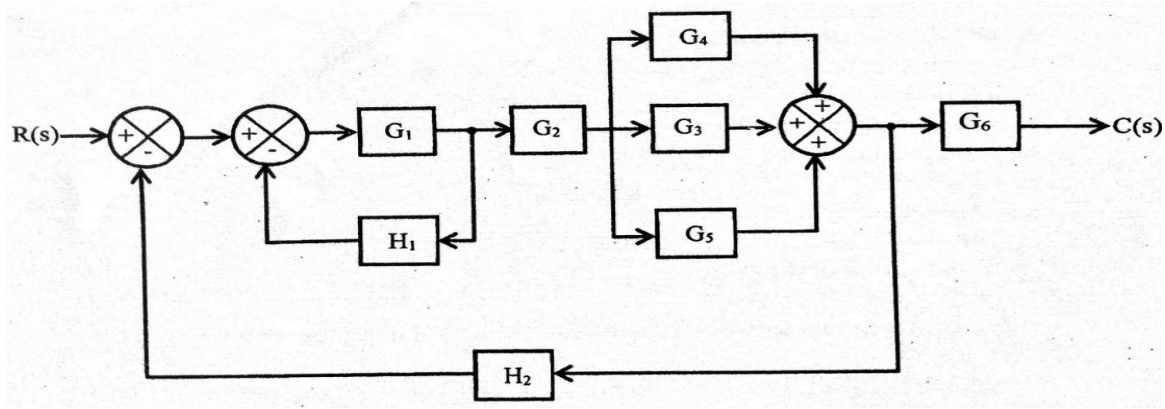
- (b) Figure 2 shows a block diagram of a control system. By using block diagram reduction techniques, determine the transfer function of the system. (10 marks)

Fig. 2



3. (a) Derive the expression and draw the response of the first order system for a unit step input. (6 marks)
 - (b) (i) Differentiate between time-variant and time-invariant control systems.
 - (ii) State any **FOUR** differences between open loop and closed loop control system. (8 marks)
 - (c) State and explain any three types of nodes with respect to signal flow graphs. (6 marks)
4. (a) Explain the following terms as used in control systems
 - i. Loop
 - ii. Forward path
 - iii. Gain.
 (6 marks)
 - (b) **Figure 3** shows a block diagram of a control system.

Fig. 3



- i. Draw its equivalent signal flow graph
 - ii. Using Mason gain formular, derive its transfer function. (14 marks)
5. (a) (i) Differentiate between viscous and velocity damping in control systems
- (ii) With aid of a circuit diagram, explain how a steady state error due to velocity feedback can be Reduced. (12 marks)
- (b) A second order control system is subjected to a unit-step input. Draw its response curve, hence define each of the following;
- i. Delay time
 - ii. Peak overshoot
 - iii. Settling time
 - iv. Rise time. (8 marks)