TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

DIPLOMA IN MARINE ENGINEERING (DMAE)

EMR 2313
INSTRUMENTATION & CONTROL

END OF SEMESTER EXAMINATIONS

YEAR 3 SEMESTER 2

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. You should have the following for this examination:
   - Answer Booklet
   - Drawing Instruments

2. This paper consists of **FIVE** Questions.
3. Answer **ANY THREE** Questions.
4. All Questions carry Equal Marks.

This paper consists of FOUR printed pages.

Question ONE (Compulsory)

(a) Define the following terms:

(i) Open loop system
(ii) Closed loop system
(iii) Variable
(iv) Actuator

(4 marks)

(b) List **TWO** advantages and **TWO** disadvantages of closed loop system. **(4 marks)**

(c) Give the characteristics of the following controllers:

(i) Proportional
(ii) Integral
(iii) Differential

(12 marks)

Question TWO

(a) Explain the following terms:

(i) Stability
(ii) MIMO
(iii) SISO
(iv) Transfer function

(8 marks)

(b) Sketch the following block reduction technique:

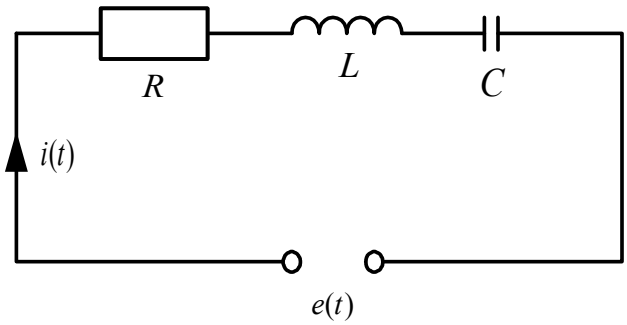
(i) Moving a summing point after a block
(ii) Eliminating a feedback loop
(iii) Combining blocks in parallel
(iv) Moving a pick off point after a block

(12 marks)

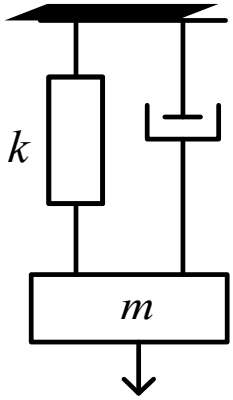
Question THREE

Derive the transfer functions for the following:

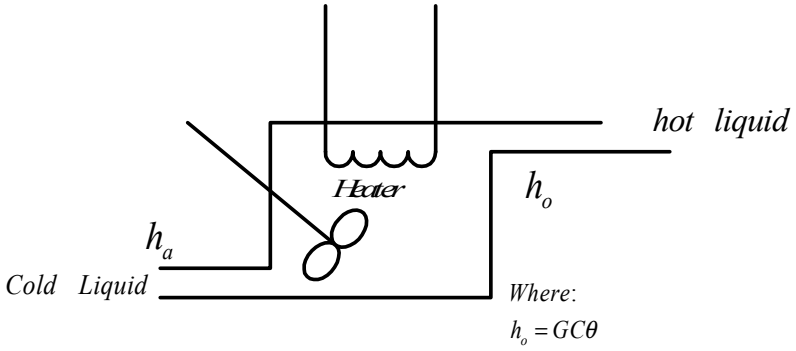
(i)



(ii)



(iii)



(20 marks)

Question FOUR

(a) What is the characteristics equation of a feedback loop at what is its significance? **(4 marks)**

(b) Explain the significance of a transfer function for the closed loop response. **(5 marks)**

(c) Discuss the difference between servo control and regulatory control. **(5 marks)**

(d) Give the function of the following in a control loop:

(i) Controller
(ii) Sensor
(iii) Actuator

(6 marks)

Question FIVE

(a) Draw a control diagram for a level controller on a tank with the flow rate of the feed to the tank is the MV for the level controller. **(10 marks)**

(b) List **TWO** advantages and **TWO** disadvantage of an open loop system. **(4 marks)**

(c) In a pneumatic system, the relationship between input pressure $P_i(t)$ and output pressure $P_o(t)$ is given by:

$$T\frac{d^2po}{dt^2} + P_o(t) = \frac{dp_i}{dt}$$

(d) Find the transfer function when the initial conditions are zero. **(6 marks)**