THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

DIPLOMA IN TECHNOLOGY
MECHATRONICS & ROBOTICS ENGINEERING (MRE 5)

EME 2505: DYNAMICS OF AUTOMATIC & ROBOTICS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Scientific Calculator*
- *Laplace Transform tables*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are clearly shown.

This paper consists of **FIVE** printed pages

SECTION A (COMPULSORY)

Question 1

a) Explain the difference between an open and closed loop system and give an example for each (4 marks)

b) State the **SIX** basic mathematical modeling control signals (6 marks)

c) Define the following
   i. Disturbance
   ii. Control system
   iii. Feedback path
   iv. Actuating signal
   v. Feedfoward path
   vi. Disturbance (6 marks)

d) State and explain the **THREE** types of Mathematical models (8 marks)

e) State and explain the **THREE** types of control systems in Engineering modeling giving an example for each (8 marks)

SECTION B (Answer *any TWO questions from this section - 20 marks each*)

Question 2

a) In the mechanical system below, the initial conditions are y(o) = O, and $y^{(1)}(o)=2$. The constants are M = 1, B = 3, K= 2 and f(t) = u(t). Determine the transfer function H(s) = $\frac{Y(s)}{F(s)}$ (10 marks)

b) Calculate the capacitor voltage (Vc) for the circuit shown below if the initial conditions at t =0 are V(o) and $(l)^{(-1)} = 0$ (10 marks)

Question 3

a) Define the transfer function $\left(\frac{V_O(s)}{V_t(s)}\right)$ for the operational amplifier circuit below. (10 marks)

b) Determine the Y(s) at t = 0 for the system below (10 marks)

Question 4

a) Find the state equations for the system below (10 marks)

b) Derive the transfer function $\left(\frac{V_c(t)}{V_o(t)}\right)$ of the circuit below (10 marks)

Question 5

a) Determine the state equations of the circuit below. (10 marks)

b) Determine the differential equations for the system below at initial conditions M=1, K =2, B =3 at t = 3 seconds (10 marks)