



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR FIRST SEMESTER DIPLOMA IN ELECTRICAL AND ELECTRONICS
ENGINEERING

EED 302: CONTROL SYSTEMS II

DATE: 2/8/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Attempt Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) In relation to nyquist stability criterion, what do you understand by phase and gain margin of a system. (4 marks)
- (b) for the systems characteristic equation below, find the values of k for stability.
$$S^4 + S^3 + KS^2 + S + 1 = 0$$
 (10 marks)
- (c) state any 3 advantages of using bode diagram over nyquist diagrams in analysing stability of a system. (6 marks)
- (d) with an aid of a diagram, explain the operation of process control system and state the function of a system (10 marks)

QUESTION TWO (20 MARKS)

(a) the open loop response of servo mechanism is given below

ω radians/sec	1	2	3	4	5
Gain margin	13	4	-2	-7	-10
Phase angle	-127	-152	-168	-180	-188

Draw a nichols chart and determine

- (i) gain margin
- (ii) phase margin
- (iii) band width
- (iv) phase cross over frequency
- (v) gain cross over frequency

(20 marks)

QUESTION THREE (20 MARKS)

A feed back control system has an open loop transfer function

$$G(s) = \frac{50}{s(1 + 0.1s)(1 + 0.5s)}$$

Draw a nyquist diagram and hence determine the phase and gain margin. Deduce from this values whether the system is stable or not. (20 marks)

QUESTION FOUR (20 MARKS)

The forwad path transfer function of a unity feed back control system is given below. Plot a bode plot and hence determine the gain and phase margins of the system.

$$G(s) = \frac{1.43}{s(1 + 0.5s)(1 + 0.01s)}$$

(20 marks)

QUESTION FIVE (20 MARKS)

- a) With an aid of a a diagram of a control system,define the following terms
- (i) Overshoot
 - (ii) Delay time
 - (iii) Settling time
 - (iv) Rise time
 - (v) Time constant (10 marks)
- (b) With the aid of a diagram, explain how a digital computer functions as a process controller for multiple digital and analogue control. (10 marks)