MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

..... SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

EED 302: CONTROL SYSTEMS II

DATE: **TIME:**

INSTRUCTIONS

Answer Quistion One And Any Other Two Quistions

QUESTION ONE

(a) A negative unit feed back system has an open loop transfer function of

$$\frac{K}{S^4+6s^3+11s^2+6s}$$

i) Determine the characteristic equition of the system

ii) Use the routh array to determine the range of values of k for which the system is stable

iii) Determine the value of k which will produce self oscillation (15 marks)

b) In relation to nyquist stability criterion what do you understand by phase and gain margin of a system (5 marks)

c) With an aid of a diagram, explain the operation of a process control system and state the functions of each element. (10 marks)

QUESTION TWO

The open loop response of servo mechanism is given below

ώ (rad/sec)	1	2	3	4	5
Gain (db)	13	4	-2	-7	-10
Phase angle	-127	-152	-168	-180	-188

Draw the nichols chart and determine

i) Gain margin

ii) Phase margin

iii) Phase cross over frequency

iv) Gain cross over frequency (20 marks)

QUESTION THREE

(a) The open loop frequency responce of a control system is given in the table below

ώ(rad/sec)	1.0	1.5	2.0	3.0	5.0	10
|G|	4.8	2.6	1.7	0.95	0.65	0.5
Phase angle	-110	-122	-126	-135	-142	-145

Plot the nyquist diagram and determin

Phase margine

Gain margine

Phase cross over frequency

Gain cross over frequency (20 marks)

QUESTION FOUR

A feed back control system has an open loop transfer function of

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

draw a nyquist diagram and hence detrmine the phase and gain margins (20 marks)

QUESTION FIVE

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

$$\frac{1.43}{S(1+0.5s)(1+0.01s)}$$ (20 marks)