



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR CERTIFICATE IN

ELECTRICAL AND ELECTRONICS ENGINEERING

EED 313: CONTROL SYSTEMS IIII

DATE:30/5/2017

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- i) State two advantages of and one disadvantage of open loop diagrams. (6 marks)
- ii) Give any two advantages of closed loop digrams. (4 marks)
- iii) Witha an aid of a diagram,derive the expression of the out put voltage of a three input summing amplifier. (7 marks)
- iv) State three components used to solve differential equitions as applied to analogue controllers. (3marks)
- v) Obtain an analogue computer diagram to solve the defferential equation below
$$Y''+5y'+4y=3$$
 (10 marks)

QUESTION TWO (20 MARKS)

Obtain a scaled analogue computing flow diagram for the equation below $2x'' + 9x' + 20x = 35$
given that $x(\max) = 5$, $x''(\max) = 20$ and $x' = x_0 = 0$ (20 marks)

QUESTION THREE (20 MARKS)

Given the following differential equations, obtain a computer flow diagram that will solve them.

$$X'' + 3Y'' + 4X' + 14X = 2$$

$$Y'' + 5X'' + 3Y' + 7X' + 12Y = 0 \quad (20 \text{ marks})$$

QUESTION FOUR (20 MARKS)

Design a phase lead network system whose transfer function is given by

$$G(s) = \frac{20}{s(1+0.2s)^2} \quad \text{for phase margin of at least } 45^\circ$$

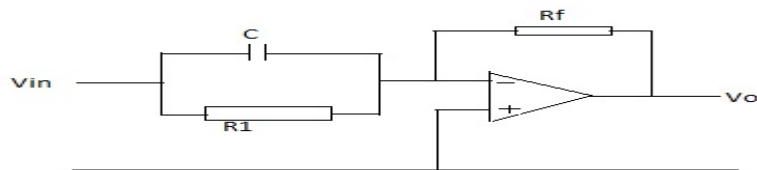
Compensating details are

$\dot{\omega}(\text{rad/sec})$	1	2	3	4	5	10	20
angle	-112	-136	-152	-167	-180	-217	-242

(20 marks)

QUESTION FIVE (20 MARKS)

Figure below shows an analogue electronic process controller.



State what type of the controller it is and derive the equation of its output voltage. (20 marks)