



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

EED 313:CONTROL SYSTEMS III

DATE: 2/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS:

Answer question one and any other two questions

QUESTION ONE (30 MARKS)

- a) State the three linear elements that are used in system simulation in analogue computation (6 marks)
- b) Give any two advantages of closed loop diagrams (4 marks)
- c) With an aid of a diagram, derive the expression of the output voltage of a three input summing amplifier. (7 marks)
- d) State three components used to solve differential equations as applied to analogue controllers. (3 marks)
- e) Give five effects of a phase lead network and five effects of a phase lag networks in a circuit. (10 marks)

QUESTION TWO (20 MARKS)

Obtain an analogue computer flow diagram to solve the following second order simultaneous differential equations.

$$Y' = X + 8$$

$$X' = Y' + 3$$

QUESTION THREE (20 MARKS)

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

$$X'' + 3y'' + 4x' + 14x = 2$$

$$Y'' + 5x'' + 3y' + 7x' + 12y = 0$$

QUESTION FOUR (20 MARKS)

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

$$G(s) = 20$$

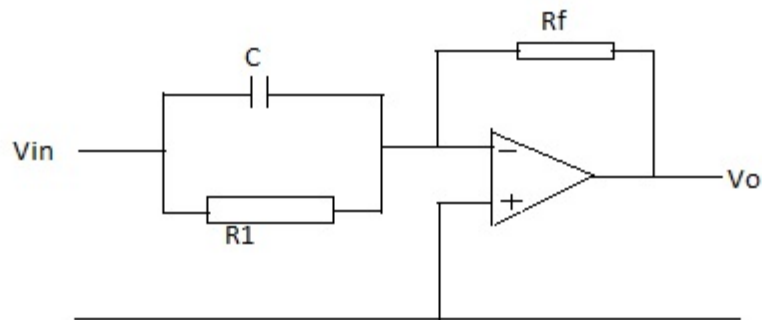
$S(1+0.2s)^2$ for phase margin of at least 45°

Compensating details are

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

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)