



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**FOURTH YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE
IN ELECTRICAL AND ELECTRONICS ENGINEERING**

SUPPLEMENTARY EXAMINATION

ANALOGUE ELECTRONICS III

DATE: 30/8/2017

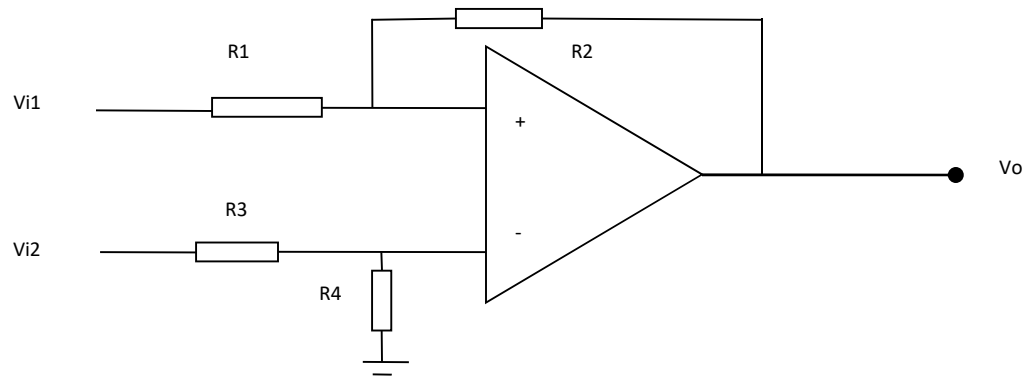
TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

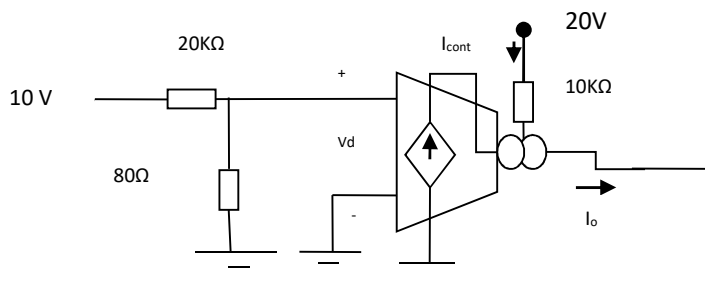
- a. Discuss THREE characteristics of ideal Opamp. (6 marks)
- b. With aid of a well labeled diagram derive the expression of output voltage of a current to voltage converter using OPAMP. (6 marks)
- c. Describe an operational transconductance amplifier (OTA). (4 marks)
- d. For the difference amplifier given below, $R_1=10K$, $R_2=100K$, $R_3=5K$ and $R_4=75K$. Calculate the common mode rejection ratio (CMRR). (8 marks)



- e. With aid of diagram derive the expression of Wien-bridge based opamp sine wave generator. (6 marks)

QUESTION TWO (20 MARKS)

- a) With aid of a well labeled diagram, derive the expression of load current of a voltage to current converter using OPAMP. (6 marks)
- b) The circuit given below is an operational trans-conductance amplifier, OTA. Determine the value of V_d and I_{cont} . (6 marks)



- c) Briefly discuss the importance of common mode rejection ratio (CMRR). (4 marks)
- d) With aid of a labeled diagram, derive the expression of a log amplifier using OPAMP and a diode. (4 marks)

QUESTION THREE (20 MARKS)

- a) With aid of a diagram show how logarithmic divider performs arithmetic division. (8 marks)
- b) Sketch a well labeled diagram of instrumentation amplifier and derive the expression of the output. (6 marks)
- c) Briefly discuss the advantages of instrument amplifiers in comparison with difference amplifiers. (6 marks)

QUESTION FOUR (20 MARKS)

- a) With aid of a diagram, explain the working of a positive clipping circuit. (6 marks)
- b) With aid of a diagram, explain the working of an opamp based sample and hold circuit. (6 marks)
- c) Sketch a typical opamp magnitude Bode plot. (2 marks)
- d) Determine the values of I_{C1} and I_{C2} for the circuit in fig.6. (6 marks)

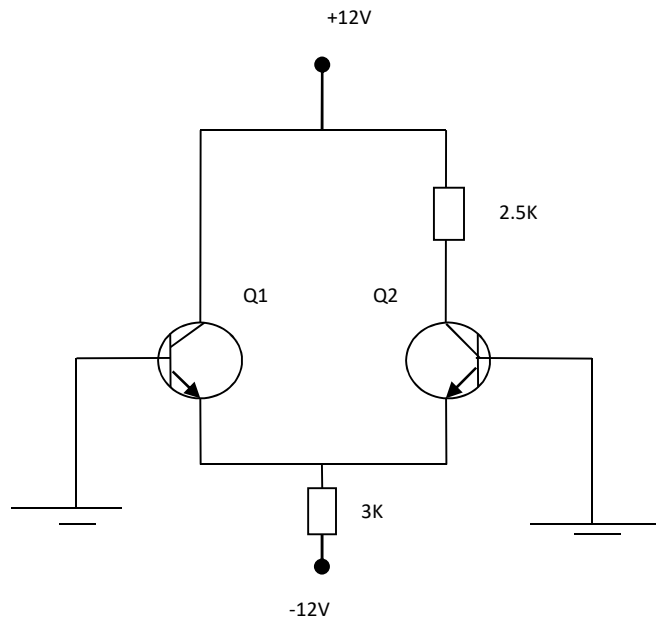


Fig.6

Question four (20 marks)

- a) With aid of a diagram derive the output expression of diode based op amp antilog circuit. (7 marks)
- b) Determine the maximum rate of change in volts per microsecond of the following signals:
 - (i) $v = 20\sin 3000t$ volts
 - (ii) $v = 10\sin 2\pi 2000t$ volts(6 marks)
- c) With aid of labeled diagrams, describe the working of voltage clampers and voltage clippers. (7 marks)