



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR
OF SCIENCE IN COMPUTER ENGINEERING
SCE 314: ANALOGUE ELECTRONICS II

DATE: THURSDAY 12TH APRIL 2012

TIME: 8.00 A.M. – 10.00 A.M.

INSTRUCTIONS

1: Answer Question ONE (compulsory) and any other TWO Questions.

Question 1 (30 marks)

- a) A typical operational amplifier is normally connected to supply voltages of $\pm 15\text{Volts}$. Based on this statement explain the meaning of **SATURATION VOLTAGES**. (3 marks)
- b) i) State the 3 characteristics associated with an ideal operational amplifier. (3 marks)
- ii) By using appropriate diagram of an inverting op-amp, show what you understand by the term Virtual Ground. (4 marks)
- c) List some uses of an operational amplifier. (4 marks)
- d) Use appropriate sketches to explain a voltage follower type of op-amp. (4 marks)
- e) Write down the 4 major considerations taken when designing a Small-Signal op-amp. (4 marks)
- f) What do you understand by the term NOISE GAIN when considering op-amps? (4marks)
- g) There are two different types of gain functions associated with a differential amplifier, name them. (2 marks)
- h) What does the value of slew rate of an operational amplifier indicate? (2 marks)

Question 2 (20 Marks)

- a) Draw a sketch of (i) Inverting op-amplifier. (ii) Non-inverting op-amplifier (2 marks)

b) From the first principles derive the equation for the closed loop gain of an inverting amplifier ? **(6 marks)**

c) A certain op-amp has $A = 5 \times 10^4$, $r_d = 0.3 \text{ M}\Omega$, and $r_o = 120 \Omega$. It is connected in a noninverting amplifier circuit with $R_i = 1 \text{ K}\Omega$ and $R_f = 99 \text{ K}\Omega$. At dc and very low frequencies , calculate the values of;

(i) Feedback factor β (ii) Loop gain (iii) exact closed loop gain (iv) closed-loop impedance (v) closed loop output impedance **(12 marks)**

Question 3 (20 Marks)

a) Sketch a model used to study output impedance of a non-inverting amplifier. **(4 marks)**

b) For the sketch in (a) derive the equation used to determine the output impedance. **(8 marks)**

c) Explain what you understand by the term UNITY-GAIN frequency in relation to ac signal consideration of an op-amp. **(2 marks)**

d) Determine the noise gain for the non-inverting amplifier circuit of Fig-1.

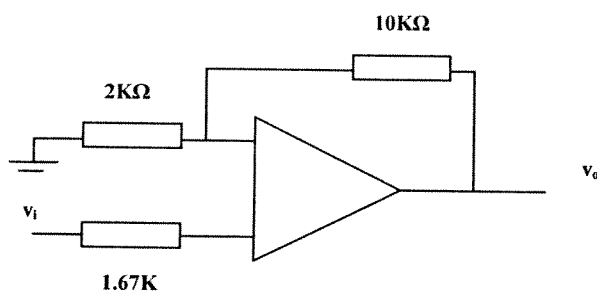


Fig.1

(6 marks)

Question 4 (20 Marks)

a) Sketch a closed-loop frequency response trace based on op-amp gain against frequencies and indicate what is 3-dB drop? **(6marks)**

b) From the first principles derive the closed voltage gain equation for a non-inverting op-amp. **(6 marks)**

c) Sketch the following op-amp circuits (i) True differentiator (ii) True integrator. **(4 marks)**