



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN SOFTWARE ENGINEERING AND COMPUTER SCIENCE

SCT 103: ELECTRONIC DEVICES & CIRCUITS

DATE: Tuesday 10th April 2012

TIME: 2.00p.m – 4.00p.m

SECTION ONE: SOFTWARE ENGINEERING

INSTRUCTIONS:

Attempt ONE Question And Any Other TWO Questions From this Section

Question 1

30 marks

- a) (i) Describe the SI system of units. (2 marks)
- (ii) Distinguish between a base unit and a derived unit giving an example in each case. (4 marks)
- (iii) Derive the expression for the SI unit of force. (2 marks)
- b) (i) What is an intrinsic semiconductor? (2 marks)
- (ii) State three pentavalent atoms that can be used as dopants. (3 marks)
- (i) Find the conductivity of an intrinsic silicon and an n-type silicon with 10^{21} donors at 300°K. Take mobility $\mu_h = 0.045$ and $\mu_e = 0.15\text{m}^2/\text{v-sec}$. Take note, at room temperature $n_i = p_i = 1.4 \times 10^6\text{m}^{-3}$. (6 marks)

- c) i) Comment on conductivity in semiconductors. (2 marks)
- ii) Conductivity in semiconductors can be improved significantly by doping. What is doping? Explain how acceptor type semiconductors are formed. (4 marks)
- d) Look at the diagram below. What is the formula for the feedback voltage and the gain of the circuit? (4 marks)

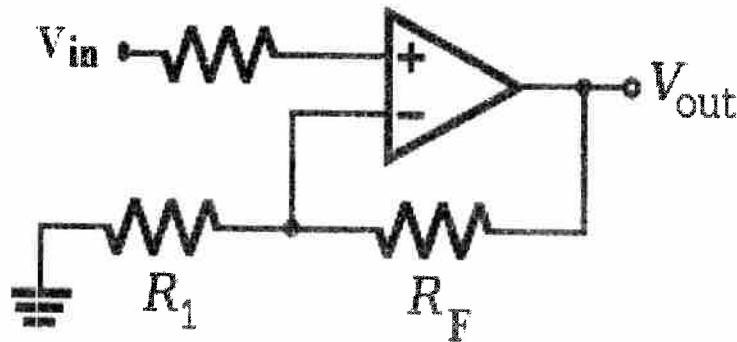


Fig. Q1(d)

Question 2

20 marks

With the aid of appropriate diagrams, describe the operation of the following methods of analog to digital conversion:

- a) Dual-slope integration method. (11 marks)
- b) Successive approximation method. (9 marks)

Question 3

20 marks

- a) (i) State four characteristics of an ideal OP Amp. (4 marks)
- (ii) With the aid of a diagram, derive an expression for the output voltage of an inverting Op Amp. (6 marks)
- a) Consider an Op Amp summing circuit shown in Fig. Q3(b) below.

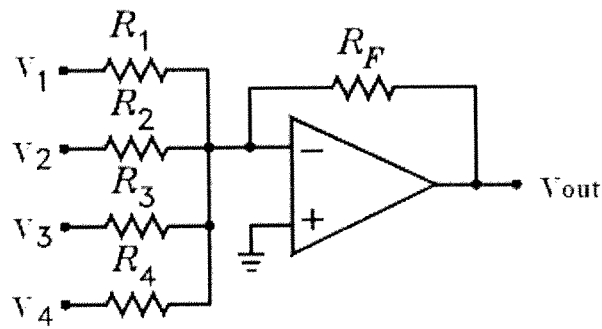


Fig. Q3(b)

If $R_1 = R_2 = R_3 = R_4 = R_F$, find the output voltage, v_{out} in terms of V_1, V_2, V_3 and V_4 .

(6 marks)

b) What is a comparator? Explain three applications of a comparator. (4 marks)

Question 4

20 marks

- a) (i) Give three applications of tunnel diodes. (3 marks)
- (ii) A Ge p-n junction diode at 300°K gives a current of 1.0mA when forward biased by 0.20V. What is the saturation current for the diode? (4 marks)
- b) (i) What is a *depletion layer*? (2 marks)
- (ii) Explain how a P-N junction can be used as a rectification diode. (3 marks)
- c) (i) Give a brief description of zener diodes. (3 marks)
- (ii) Determine if the zener diode in Fig. Q4(c) is properly biased, and explain why?

(5 marks)

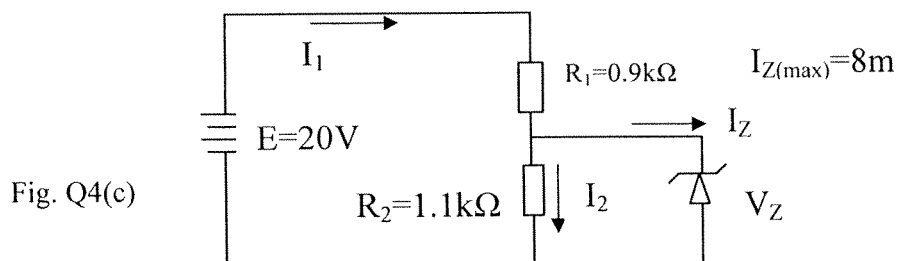


Fig. Q4(c)

- a) (i) Give a clear distinction between BJT and JFET. (4 marks)
- (ii) With the aid of a circuit diagram, demonstrate how a transistor can work as a switch. (3 marks)
- (iii) Consider the Common Base transistor configuration given in Fig. Q3(a) below. For this configuration, find I_E , I_C and V_{CB} . (6 marks)

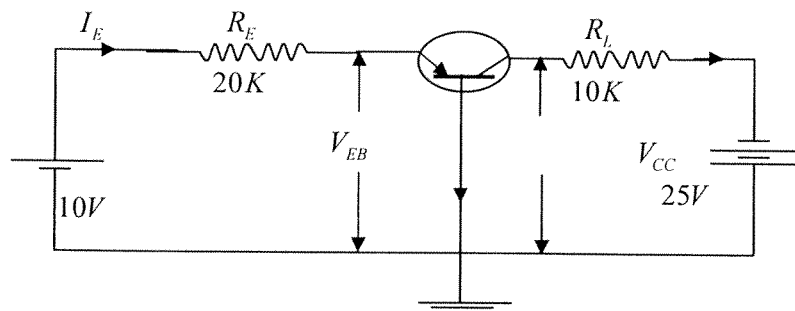


Fig. Q5(a)

- b) (i) State four advantages of a JFET. (4 marks)
- (ii) A JFET has the following parameters: $I_{DSS}=32\text{mA}$, $V_{GS(off)}=-8\text{V}$ and $V_{GS}=-4.5\text{V}$. Find the value of the drain current? (3 marks)

SECTION TWO: COMPUTER SCIENCE

INSTRUCTIONS:

Attempt Question ONE And Any Other TWO Questions From This Section

Question 1

- (a) State any TWO purpose of resistance continuity testing in electronics (2 Marks)
- (b) Outline any SIX advantages of digital oscilloscopes over analogue oscilloscopes (3 Marks)
- (c) Name any FOUR SI standards units (2Marks)
- (d) Distinguish between electronics and electricity (2 Marks)
- (e) Distinguish between analog and digital circuits (4 Marks)
- (f) Explain the formation of the P type and N type semiconductor (2 Marks)
- (g) (i) Define complementary transistor
- (ii) State ONE application of complementary transistor (2 Marks)
- (h) Outline THREE classes of transistor amplifies (3 Marks)
- (i) Calculate the base current I_b of an NPN transistor given that the NPN Transistor has a DC base bias voltage, V_b of 20v and an input base resistor, R_b of $100k\Omega$. (2 Marks)
- (j) Outline any THREE distinction between BJT and FET transistors (3 Marks)
- (k) Name any THREE classifications of operational amplifier gain (3 Marks)
- (l) State any FOUR types of Operational amplifiers (Op Amp) (2 Marks)

Question 2

- (a) (i) Draw the PN junction symbol
- (ii) Draw a well labeled V/I characteristics of the PN junction (5 Marks)
- (b) Distinguish between half wave rectification and full wave rectification involving diodes with the aid of a diagram (7 Marks)
- (c) State any other FOUR application of diode (4 Marks)
- (d) Outline any Eight types of diodes (4 Marks)

Question 3

- (a) Draw the symbol, analogy and construction of PNP and NPN transistors (3 Marks)
- (b)
 - (i) Outline ONE differences between JFET and MOSFET
 - (ii) Outline TWO similarities between JFET and MOSFET (3Marks)
- (c) Describe with the aid of a diagram the key attributes of the THREE basic connections of BJT in an electronic circuit (12 Marks)

Question 4

- (a)
 - (i) Draw a well labeled BJT transistor V/I output characteristics
 - i. Draw the DC load-line with the key points (6 Marks)
- (b)
 - (i) Describe the depletion –mode MOSFET
 - (ii) Draw the symbol for the depletion –mode MOSFET
 - (iii) Draw the V/I characteristics of the depletion –mode MOSFET (7 Marks)
- (c)
 - (i) Describe the depletion –mode MOSFET
 - (ii) Draw the symbol for the depletion –mode MOSFET
 - (iii) Draw the V/I characteristics of the depletion –mode MOSFET (7 Marks)

Question 5

- (a)
 - (i) Draw a well labeled equivalent circuit of an ideal operational amplifier
 - (ii) Explain any FOUR parameters with their idealized characteristics (10 Marks)
- (b) Describe with the aid of a diagram TWO applications of a summing amplifier (10 marks)