KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: PHYS 120

COURSE TITLE: BASIC ELECTRONICS

STREAM: Y1S2

DAY: FRIDAY

TIME: 2.00 – 4.00 P.M.

DATE: 18/03/2011

INSTRUCTIONS:

Answer question ONE and any other TWO

PLEASE TURN OVER

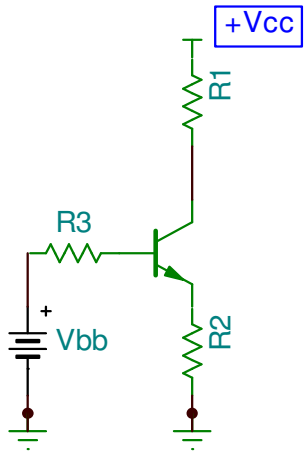
Question 1 (30 marks)

a) Name the main charge carriers in
(i) Metals (1 mark)
(ii) Semiconductors (1 mark)

b) Describe the operation of a full-wave rectifier (5 marks)

c) List 2 disadvantages of negative feedback in amplifiers. (2 marks

d) For the circuit shown below, R_1= 3k, R_3= 200k, R2 = 500 ohms, β =100, V_{BE} = 0.7 V, V_{bb}= 5V and V_{CC} = 14 V. Find the transistor currents I_B and I_C. (5 marks)



e) Explain how a BJT can act as a switch (2 marks)

f) Give arbitrary base and collector I/V characteristics for an npn transistor in the active region starting with V_{BE} = 0 V. (2 marks)

g) Briefly explain the following methods of pn junction formation

(i) Grown junction (2 marks)
(ii) Alloying (2 marks)

h) With aid of diagram, explain how an p-type material can be achieved (4 marks)

i) State why a FET is called a unipolar device. (1 marks)

j) State the four possible operating regimes of a BJT and give the required biasing conditions (6 marks)

k) Explain the term thermal runaway and how it brings about transistor failure. (2 marks)

Question 2 (20 marks)

a) With regard to feedback amplifiers, define the following terms:

i) Open loop gain (1 mark)

ii) Closed loop gain (1 mark)

iii) Round trip gain (1 mark)

b) Draw a black box representation of an amplifier with feedback and show how quantitatively that feedback reduces gain sensitivity. (8 marks)

c) i) state the criteria for oscillation to occur in a circuit (2 marks)

ii) Draw a circuit diagram of a Colpitts oscillator and derive its resonance frequency (7 marks)

Question 3 (20 marks)

a) i) Define transistor biasing. (1 mark)

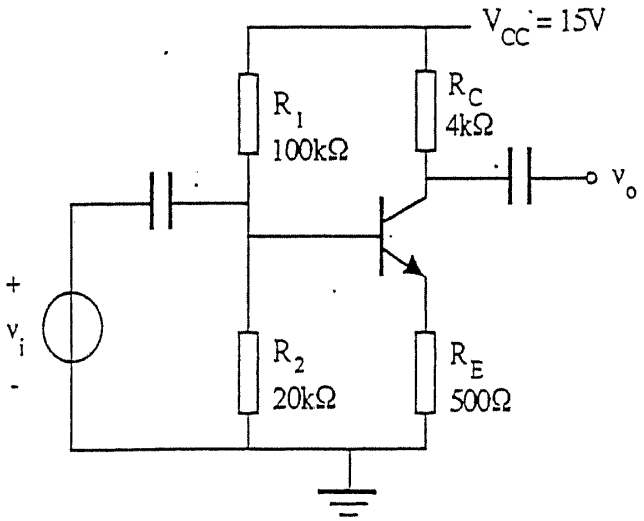
ii) State the advantage of potential divider bias method over base bias (2 marks)

iii) Draw a single stage BJT circuit employing base biasing and show that the I_C current for a base bias circuit is likely to be unstable. Provide the reason for instability. (7 marks)

b) The circuit below shows a single stage transistor amplifier.

i) Determine the quiescent voltage V_{CQ} and quiescent collector current I_{CQ}. (use β =100, V_{BE} = 0.6 V) (5 marks)

ii) Sketch the output characteristics (I_C versus V_{CE}) and the load line. (5marks)



Question 4 (20 marks)

a) State the functional differences between the following family of FET devices: Depletion Mode MOSFET and Enhancement Mode MOSFET. (3 marks)

b) With the aid of a diagram, explain how the Gate voltage controls current flow in a JFET. (5 marks)

c) For $V_{gs} = 0$, sketch the Drain current versus V_{DS} curve. Mark and explain the following:

i) I_{DSS}
ii) V_p
iii) Breakdown region
iv) Ohmic region

(8 marks)

d) The circuit below shows a gate-biased JFET amplifier. Determine the Q - point values for the gate biasing circuit if $V_{GG} = -5$ V, $V_{GS}(off) = -7$ V, $I_{DSS} = 9$ mA, $V_{DD} = 5$ V, and $R_D = 500\ \Omega$. (4 marks)