KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COURSE CODE: PHYS 120

COURSE TITLE: BASIC ELECTRONICS

STREAM: Y1S2

DAY: THURSDAY

TIME: 9.00 – 11.00 A.M.

DATE: 03/12/2009

INSTRUCTIONS:
Answer **QUESTION 1** and **ANY OTHER TWO**

PLEASE TURN OVER

Question 1 (30 marks)

(a) Explain the difference in conductivity between metals, conductors and insulators. (3 marks)

(b) Explain the term band gap as applied in semiconductors. (1 mark)

(c) Starting with pure silicon material, describe how a n-type semiconductor can be achieved. (4 marks)

(d) Define the following amplifier terms

I. Closed loop gain
II. Open loop gain
III. Loop gain

(e) Give any THREE differences between a JFET and a BJT. (3 marks)

(f) I. Sketch the typical drain curves for an n-type JFET for varying Vgs. On the curves, mark and explain the Pinch – off voltage (Vp) and the IDSS (7 marks)

II. Given that Vp = 5V and I_{DSS} = 10mA, find the drain – source resistance of the JFET. (2 marks)

(g) Compare the I/V characteristic curves of a Si and Germanium diodes (4 marks)

(h) Explain the three main operating regions of a transistor (6 marks)

Question 2 (20 marks)

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

(b) Draw and explain the principle operation of a zener diode voltage regulator. (5 marks)

(c) (i) Explain the formation of the depletion layer in a simple pn junction (2 marks)

(ii) Give the normal bias conditions of a transistor (2 marks)

(d) Explain the following methods of making pn junctions
I. Grown junction
II. Alloying

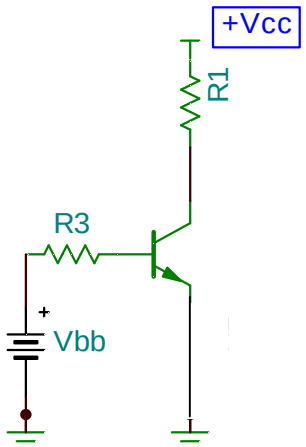
Question 3 (20 marks)

(a) (i) Draw a circuit indicating the normal biasing of an n-type JFET.. (2 marks)

(ii) Explain how the V_{gs} bias regulates the drain current. (3 marks)

(b) (i) State THREE factors that the DC transistor gain β_{dc} depends on. (3 marks)

((ii) For the circuit shown below, R_1= 3k, R_3= 200k, β =100, V_{BE} = 0.7 V, V_{bb}= 5V and V_{CC} = 10 V.



(i) Find the transistor currents I_B, I_C and I_E. (7 marks)

(ii) Determine V_{CB} (2 marks)

(iii) Draw the load-line and estimate the Q point (3 marks)

Question 4 (20 marks)

(a) (i) List 5 advantages of negative feedback in amplifiers. (5 marks)

(ii) Draw a black box representation of an amplifier with feedback, and use the diagram to show that the closed loop gain of an amplifier employing negative feedback is of the form

$A_0 = \dfrac{A}{1 + A\beta}$ where A is the open loop gain and β , the feedback factor.

(7 marks)

(b) (i) Draw a labeled block diagram of a shunt - series feedback amplifier. (4 marks)

(ii) The input to the shunt – series feedback amplifier is 5 mA and the output is 4.5 mA when the feedback network is 10. Find the open loop gain of the amplifier. (4 marks)