KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: PHYS 120

COURSE TITLE: BASIC ELECTRONICS

STREAM: SESSION II

DAY: TUESDAY

TIME: 9.00 – 11.00 A.M.

DATE: 10/08/2010

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 p-type semiconductor can be achieved. 3 marks

(d) Define the following amplifier terms

i) Closed loop gain
ii) Open loop gain
iii) Loop gain 3 marks

(e) 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. 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 5 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

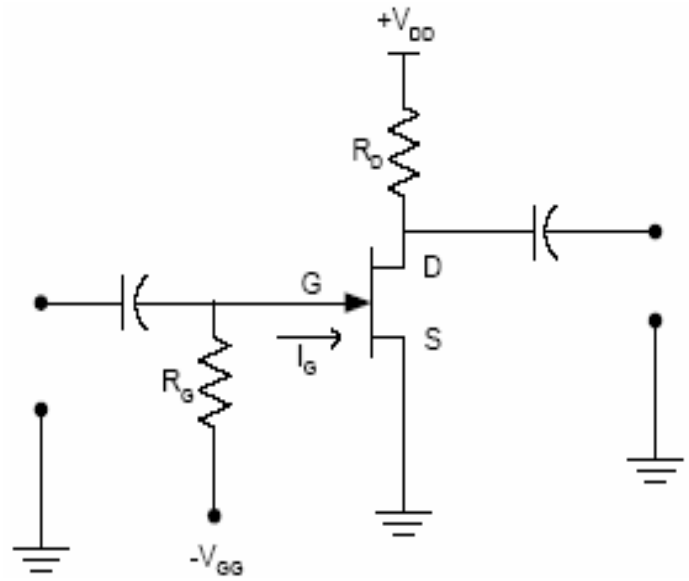
b) Draw and explain the principle operation of a zener diode voltage regulator. 5 marks

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

d) The circuit below shows a gate-biased JFET amplifier.

(i) Write the load-line equation. 2 marks

(ii) 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 Ω. 6 marks



Question 3 (20 marks)

a) 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

$A_0 = \frac{A}{1 + A\beta}$ where A is the open loop gain and β, the feedback factor. 6 marks

b) Derive the expression for the input and output impedance of a series-shunt feedback amplifier. 6 marks

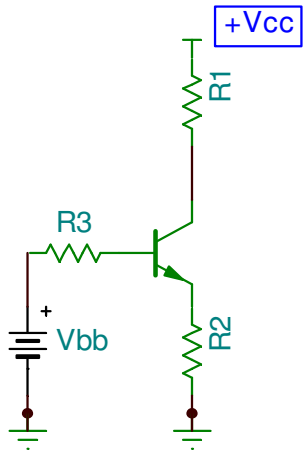
c) Describe the following advantages of negative feedback amplifier

i) Minimization of gain distortion 4 marks
ii) Bandwidth extension 4 marks

Question 4 (10 marks)

a) With the aid of a well labeled charge carrier flow diagram, derive the fundamental BJT relations. 8 marks

b) For the circuit shown below, R_1= 4kΩ, R_3= 200kΩ, R2 = 500 Ω, β =100, V_{BE} = 0.7 V, V_{bb}= 5V and V_{CC} = 12 V.



i)	Find the transistor currents I_B, I_C and I_E.	6 marks
ii)	Determine V_{CB}	3 marks
iii)	Draw the load-line and estimate the Q point	3 marks