

KABARAK



UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF SCIENCE IN
COMPUTER SCIENCE**

COURSE CODE: PHYS 120

COURSE TITLE: BASIC ELECTRONICS

STREAM: Y1S2

DAY: MONDAY

TIME: 2.00 – 4.00 P.M.

DATE: 10/08/2009

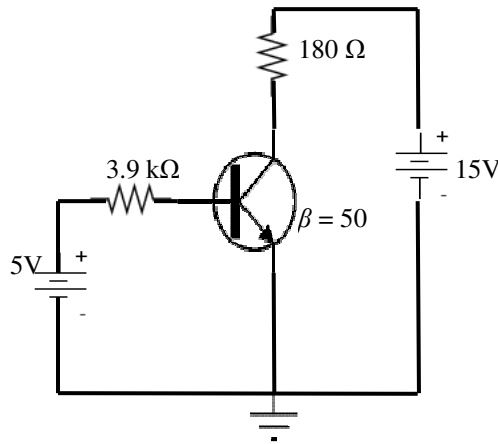
INSTRUCTIONS

1. Answer Question ONE and any other TWO questions.
2. Question ONE carries 40 marks. Questions TWO – FOUR carry 15 marks each.
3. Assume $\pi = 3.14$

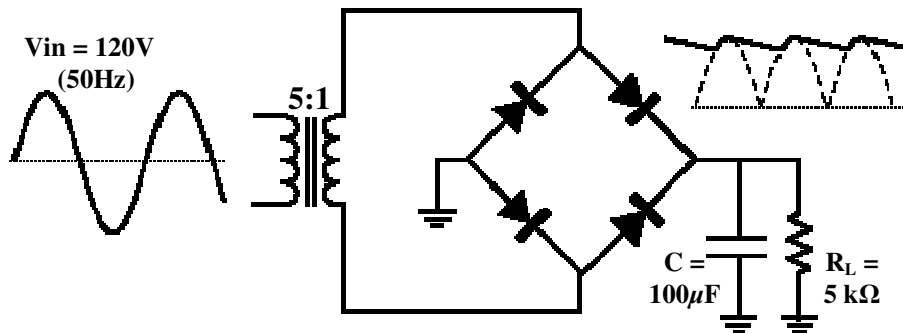
PLEASE TURN OVER

QUESTION ONE (40 MARKS)

- a) Sketch the atomic structure of a neutral copper atom (atomic number 29) indicating the location of all particles in the atom. (5 marks)
- b) What makes the atom in question (a) above conductive and how? (4 marks)
- c) In an atom, how many orbitals exist in each sub-shell? (2 marks)
- a) Calculate I_B , I_C , I_E , V_{BE} , V_{CB} and V_{CE} for the BJT bias circuit below. Assume the transistor has $\beta_{DC} = 50$.



- (12 marks)
- d) Draw the band diagram of a p-n junction when it has reached equilibrium. (6 marks)
- e) State at least three advantages of CMOS devices. (3 marks)
- f) Draw the output voltage signal from the capacitor-input filter below indicating the peak output voltage of the signal. Determine also the peak-to-peak ripple voltage and the V_{avg} of the signal produced. Assume the diodes are silicon diodes and the transformer has a turns ratio of 5:1.



(8 marks)

QUESTION TWO (15 MARKS)

- a) In your own opinion, is doping necessary in electronic devices? Explain why and if possible give examples to support your argument. (8 marks)
- b) Draw the structure of an n-channel junction field effect transistor (JFET). How does the circuit symbol of this transistor look like?. (5 marks)
- c) Define *pinch-off voltage* as applied in Junction field Effect transistors (2 marks)

QUESTION THREE (15 MARKS)

- a) Sketch the structure of a CMOS device showing how the various regions are doped. (7 marks)
- b) Briefly describe the operation of the CMOS device in question a) above. (8 marks)

QUESTION FOUR (15 MARKS)

- a) Explain how a light emitting diode (LED) works. Also, give one example of a material that is used to produce LED's and indicate the colour of light that devices made of this material emit. (10 marks)
- b) An OP-AMP has an open-loop gain of 125,000 and a common mode gain of 0.2. What is its CMRR in decibels? (3 marks)
- c) To switch on a p-channel enhancement mode MOSFET, do you require a positive or negative gate voltage? (2 marks)