KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF EDUCATION SCIENCE, BACHELOR OF SCIENCE IN RENEWABLE ENERGY, GEOPHYSICS AND MINERALOGY AND WASTE MANAGEMENT

SECOND SEMESTER 2015/2016

(JANUARY-APRIL, 2016)

PHYS 222: SEMICONDUCTOR PHYSICS AND DEVICES

STREAM: Y2S2 **TIME: 2 HOURS**

DAY: WEDNESDAY, 3.00 – 5.00 PM **DATE: 30/03/2016**

INSTRUCTIONS

1. ***Do not write anything on this question paper.***
2. ***Answer question ONE and any other TWO questions.***

QUESTION ONE (30 MARKS)

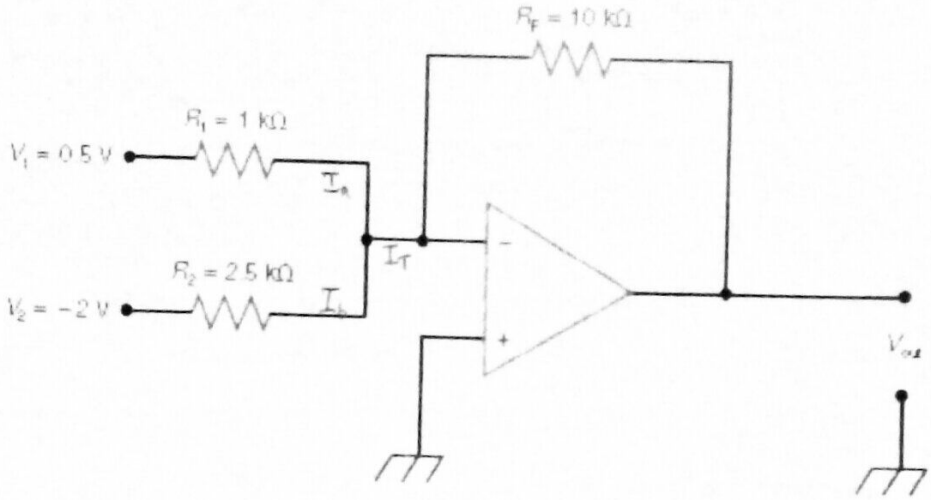
a) Outline two advantages of the bridge rectifier over the other types of rectifiers (4 mks)

b) Explain the forward and reverse diode connections using appropriate diagrams. (4 mks)

c) Explain three effects of increasing the filter capacitance (3 mks)

d) A half wave rectifier has a peak output voltage of 12.2V at 50Hz and feeds a resistive load of 100Ω. Determine;
   i. The value of the shunt capacitor to give 1 percent ripple factor.
   ii. The resulting dc voltage across the load resistor (6 mks)

e) For the summing amplifier below, calculate the output voltage, V_{out}



(3 mks)

f) Outline any three precautions to bear in mind when handling MOSFETs

(3 mks)

g) A transistor has the following currents.
I_E = 15mA, I_B = 60μA. Calculate α_{dc}

(4 mks)

h) Draw the schematic diagrams of the three basic configurations of transistor amplifier circuits.

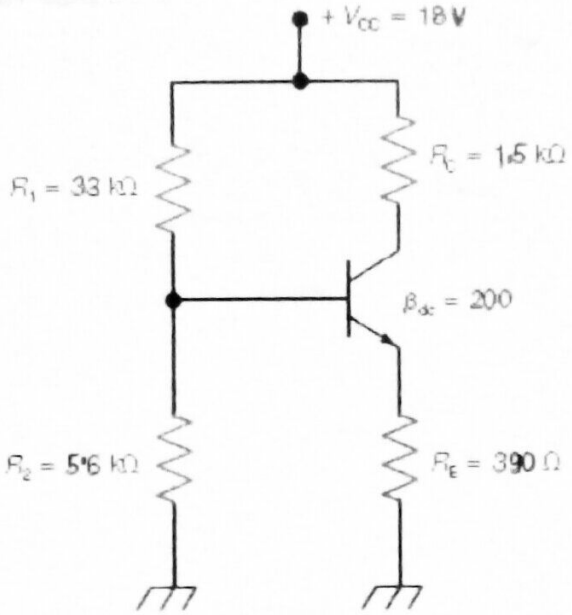
(3 mks)

QUESTION TWO (20 MARKS)

a) Explain the process of doping a semiconductor to produce and n-type and p-type material.

(4 mks)

b) For the circuit shown in the figure below, solve for V_B, V_E, I_C, V_C and V_{CE}. Also, calculate $I_{C(sat)}$ and $V_{CE(off)}$. Finally, construct a dc load line showing the values of $I_{C(sat)}$, $V_{CE(off)}$, I_{CQ} and V_{CEQ}.



(12ks)

c) i. A transistor has $\alpha_{dc} = 0.995$. Calculate β_{dc}.

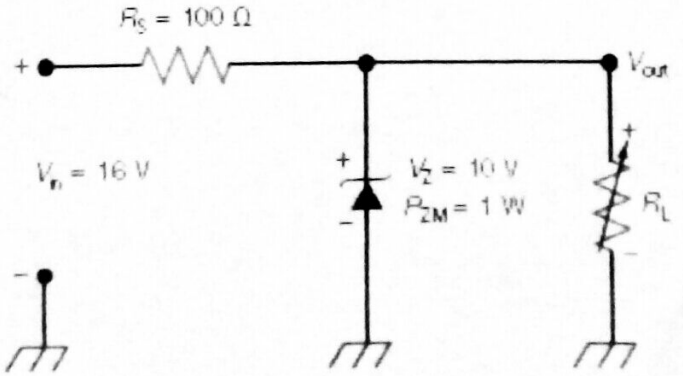
(4 mks)

QUESTION THREE (20 MARKS)

a) Distinguish between regulated and unregulated power supplies

(3 mks)

b) For the figure below, calculate I_S, I_L, and I_Z for
   (a) $R_L = 200\Omega$
   (b) $R_L = 500\Omega$



(12 mks)

c) Show the construction of a solar cell and explain how it works.

(5 mks)

QUESTION FOUR (20 MARKS)

a) Explain two application areas of bipolar junction transistors.

(4 mks)

b) Using an appropriate diagram, explain the working of an L-C filter.

(5 mks)

c) Explain how a transistor can be used as a switch using a diagram

(4 mks)

d) Explain the working of a half wave rectifier.

(7 mks)

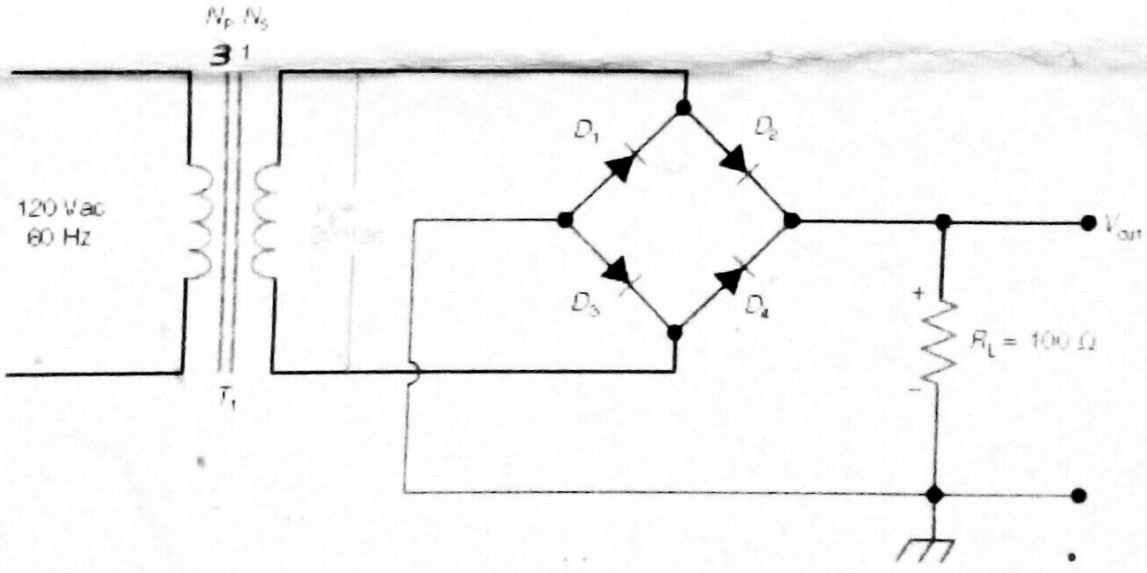
QUESTION FIVE (20 MARKS)

a) Explain the voltage ampere characteristic curve of a diode using an appropriate diagram.

(8 mks)

b) If the turns ratio $N_P : N_S$ is 3:1 in the figure below, calculate the following;

i. V_{dc}
ii. I_L
iii. I_{diode}
iv. PIV for each diode, and
v. f_{out}.



(12 mks)