UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

Department of Electronic and Electrical Engineering

Supplementary EXAMINATION 2011

Title of the Paper: **ELECTRONICS II**
Course Number: **E442**
Time Allowed: **Three Hours.**

Instructions:

1 To answer, pick any five out of seven questions in the following pages.
2. The answer is better written in the space provided in the question book. Use the answer book as a scratch pad.
3. Each question carriers 20 points.
4. This paper has 9 pages, including this page.

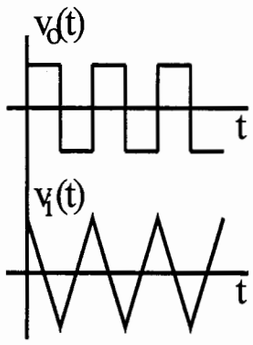
DO NOT OPEN THE PAPER
UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

Q1a: List R_{in}, R_{ot}, A_i, and A_v of the single BJT amplifier of all three configurations, CE, CB, and CC. **10 pts** (1 pts for a blank, only 10 blanks counted)

	R_{in}	R_{ot}	A_i	A_v
CE				
CB				
CC				

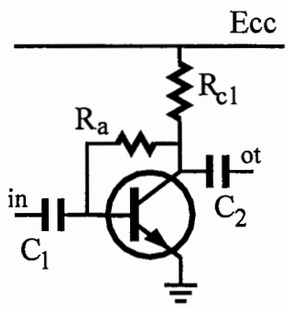
Q1b: An alarm signal from uA555 timer is to drive a speaker of 16 Ohm. Is the 555 timer able to drive the speaker? If not, which configuration can help to do the job? Draw the schematic circuit diagram with components values. All resistors, capacitors must have reasonable values. Assume the transistor β 100, and the timer circuit is not included. **10 pts** (5 pts for yes/no, 5 pts for Tr ckt)

Q2a: An op amp circuit has the input and output time traces below in the figure; draw the op amp circuit schematic diagram. **10 pts**



Q2b: Draw the circuit diagram of any op voltage amplifier with single power supply. **10 pts**

Q3a: A linear amplifier with feedback is shown below. Identify whether the feedback is positive or negative and its feedback topology. **10 pts** (4 pts for p/n, 3 for in topo, 3 for out topo)



Q3b: Calculate the voltage amplification factors to Es, ie, Av=Vo/Es, both with and without feedback. Given signal source: R_s=1 KOhm; R_{C1}= 2K, R_a=20K and C1, C2 large. The transistor parameters are: r_π=2K Ohm, β=120. Needs symbolic network equations first before numerical solving calculation. **10 pts** (5 pts for with, 5 pts for without)

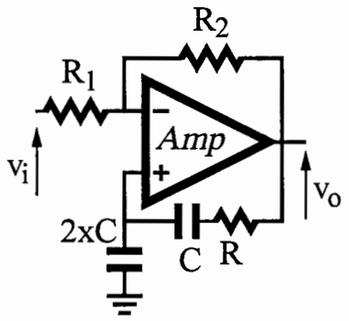
Without Feedback:

With Feedback:

Q4a: Draw either a Hartley or a Colpitts schematic circuit. It must have components values, which must be reasonably enough to suppose the circuit working fine. Of course, a bias circuit is included. 10 pts (5 for circuit, 5 for component values)

Q4b: Pick any one ADC and any one DAC, and describe them with symbolic diagrams/circuits and equations. **10 pts** (5 pts for ADC, 5 pts for DAC)

Q5a: An LPF amplifier is shown below; derive the voltage amplification factor in terms of the component symbols given. R_s=0. **10 pts**

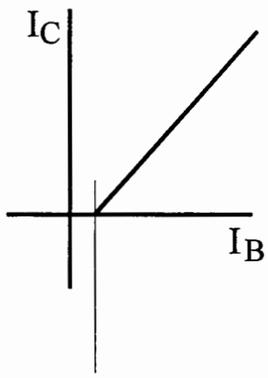


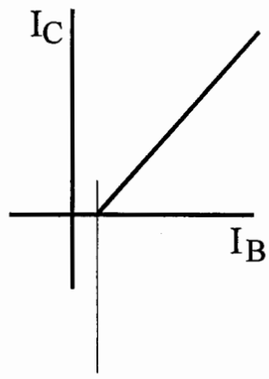
Q5b: Discuss the stability of the amplifier in terms of the resistor ratio, $R_2/R_1 \equiv \eta$; that is, to discuss circuit states in every possible domain (η_i, η_{i+1}). **10 pts**

Q6a: 2N3055 has a power dissipation rating 125 Watts at case temperature 25°C and a maximum junction temperature 200°C. To maintain a case temperature 25°C needs an infinitively large heat sink, which is not possible. Design a practical heat sink to dissipate the heat to the air at a temperature 25°C. Assume the transistor case and heat sink has a perfect thermal contact. Study the relationship between the power dissipation rating, P_D, and case temperature, T_C. Draw the curve P_D~T_C. Case temp may be around 45°C; calculate sink θ_{ca} , where ca is between the case and the air. **10 pts** (5 pts for curve, 5 pts for sink θ_{ca})

Q6b: Draw a switching topology to step-down a DC voltage 120 V to a lower DC voltage 24 V. Implement this circuit. **10pts** (5 for topo, 5 pts for implement)

Q7a: Use I_B~I_C curve to define amplifier class: A, AB, B, and C. Important: Mark the ac zero-crossing points clearly on the signal. Which one is a linear amplifier? Do you know what a class D amplifier is? If you know, describe it and win at most a 10 pts bonus. **10 pts** (2 pts for each answer)(10 pts for bonus)





Q7b: Drive the efficiency of a class A amplifier. The transistors are idealized. **10 pts**