UNIVERSITY OF ESWATINI

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF ELECTRICAL AND

ELECTRONIC ENGINEERING

MAIN EXAMINATION, DECEMBER 2018

Title of Paper:

Analogue Design III

Course Code: **EE421**

Time allowed: Three (3) Hours

INSTRUCTIONS:

1. To answer, pick any 5 from the 6 questions in the following pages.
2. The answer must be written in the space provided in the question book, those in elsewhere considered invalid. Use the answer book as a scratch pad. Both question and answer book must be handed-in and marked with name and ID.
3. This paper has 7 pages, including this page.

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

Q1: (10 pts) (i) Draw the equivalent circuit of the schematic on the right. **(10 pts)** (ii) Write the matrix of the equivalent circuit. **(extra 5 pts)** What is the configuration of this 2-stage amplifier and its name . Assume the two Tr's are of the same spec.

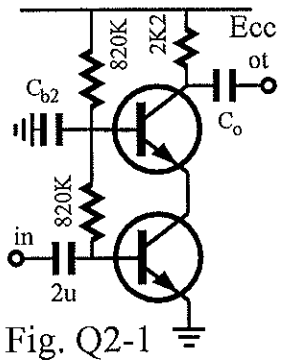

Fig. Q2-1

Q2: (10 pts) Draw the system block diagram of any switching mode power supply . **(10 pts)** Give a brief but key function of each block

Q3: (10 pts) Draw the system block diagram of a PLL system. **(10 pts)**
Give a brief but key function of each block.

Q4: (10 pts) Draw the schematic circuit of any phase detector used in PLL system. **(10 pts)** With this circuit, draw its average output voltage vs phase difference curve.

Q5: (10 pts) Some of the following terms are equal. Group them into one if they equal, only 4 different groups. **(10 pts)** Briefly define each group.

Free running frequency, Lock range, Capture range,
Pull-in range, Pull-in time, Tracking range,
Hold-in range, Acquisition range. Lock-up time,
....Center Frequency,

Q6: (4 pts) (i)Draw a differential amplifier schematic circuit, which is properly biased. **(4 pts)** (ii)What is the configuration of this differential amplifier? **(4 pts)** (iii) Define the differential mode input and its amplification factor with the reference to the circuit. Be careful with the polarity of the input signal. **(4 pts)** (iv)Do the same as (iii) to the common mode. **(4 pts)** (v)What are the CMRR and its definition? Assume the 2 BJT are matched, and R_e is a variable. Find the CMRR=? Hint: Let $A_0 = \frac{-h_{fe}R_C}{h_{ie}} ... K = 2 + \frac{h_{ie}}{(1+h_{fe})R_e}$

From the circuit in (i) $V_{o1} = \frac{A_0}{K}[(1-K)V_{i1} + V_{i2}]$ $V_{o2} = \frac{A_0}{K}[(1-K)V_{i2} + V_{i1}]$