MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

SECOND YEAR **FIRST** SEMESTER EXAMINATION FOR THE DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

SEE 1202 – ANALOGUE ELECTRONICS II

DURATION: 2 HOURS

DATE:

TIME:

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A – ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE

a) Explain the following classes of amplifiers:
   i. Class-A amplifier
   ii. Class-B amplifier
   iii. Class-C amplifier
   iv. Class-AB amplifier (4 marks)

b) In a class B amplifier, V_{CE}(min)=2V and Vcc=15V. Calculate its overall efficiency. (3 marks)

c) State two advantages of RC coupling. (2 marks)

d) State two advantages of negative feedback. (2 marks)

e) Define the term distortion as used in amplifiers. (2 marks)

f) An amplifier has an open-loop gain of 400 and a feedback of 0.1. If open-loop gain changes by 20% due to temperature, find the percentage change in closed-loop gain. (3 marks)

g) A differential amplifier has an open-loop gain of 150 and a common input signal of 4.0V to both terminals. If an output signal of 15mV results, determine:
   i. Common-mode gain and
   ii. Common-Mode Rejection Ratio (CMRR) (4 marks)

h) A filter section is required to pass all frequencies above 50kHz and to have a nominal impedance of 300Ω. Design a high-pass π-section filter to meet these requirement. (6 marks)

i) Define the following terms as used in oscillators:
   i. Damped oscillations
   ii. Undamped oscillations (4 marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO

a) State four applications of Silicon-Controlled Rectifiers (SCRs) (4 marks)

b) Using appropriate diagrams, show each of the following types of waveforms:
   i. Sine waveform
   ii. Saw-tooth waveform
   iii. Pulse waveform (6 marks)

c) Design an OP-amp that will produce an output equal to $-(4V_1+V_2+0.1V_3)$. Write an expression for the output and sketch its output when $V_1=2\text{Sin }\omega t$, $V_2=+5$Vd.c. and $V_3=100$Vd.c. (10 marks)

QUESTION THREE

a) Distinguish between linear and non-linear distortion. (4 marks)

b) Define the following terms as used in filter networks:

i. Attenuation

ii. Cut-off frequency, fc

iii. Nominal impedance, Ro (3 marks)

c) The parameters of a crystal oscillator equivalent circuit are $L_1=0.8$H; $C_1=0.08$pF; f=5kHz and $C_2=1.0$pF. Determine the resonant frequency f_1. (3 marks)

d) For the single stage Common-Emitter (CE) amplifier shown in figure 1, $R_B=1M\Omega$, $Rc=10k\Omega$, $V_{cc}=20$V, $R_L=10k\Omega$, and $\beta = 50$.

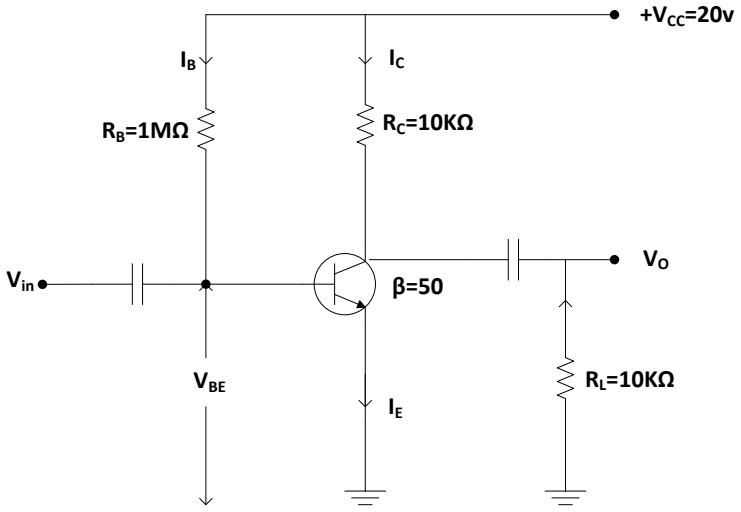

fig 1

Calculate:

i. V_{in}

ii. r_o

iii. A_i

iv. A_v

v. Gp in dB

QUESTION FOUR

a) In a negative feedback feedback amplifier, A=50, β = 0.05 and V_i = 100mV. Find:

i. Gain with feedback, A

ii. Output voltage, Vo

iii. Feedback factor

iv. Feedback voltage (8 marks)

b) Define the following OP-amp parameters:

i. Input bias current

ii. Slew rate (4 marks)

c) For the differential amplifier shown in figure 2, determine the output voltage, V_o if:

i. V_1=4mV and V_2=0

ii. V_1=40mV and V_2=30mV (8 marks)

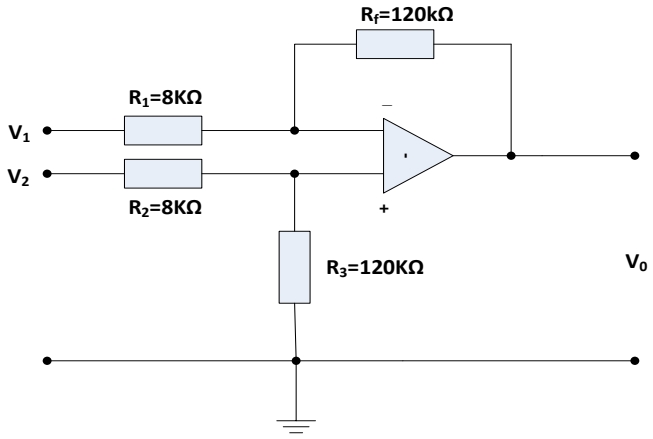

Fig 2