TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MEDICAL ENGINEERING

THIRD YEAR SEMESTER ONE

EEE 4331: ANALOGUE ELECTRONICS III

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEP 2018

TIME:2HOURS

DATE: SEP 2018

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FOUR** questions. **Question ONE is COMPULSORY**. Attempt any other two questions.

Do not write on the question paper.

Question ONE (COMPULSORY)

a) (i). State the four characteristics of an ideal operational amplifier.

ii) With a aid of Fig Q1(a) show that if the loop gain ($A\beta$) of a non ideal non inverting amplifier is very large then it's finite open loop gain is given by

$$A_V = 1 + \frac{R_2}{R_1}$$ (14mks)

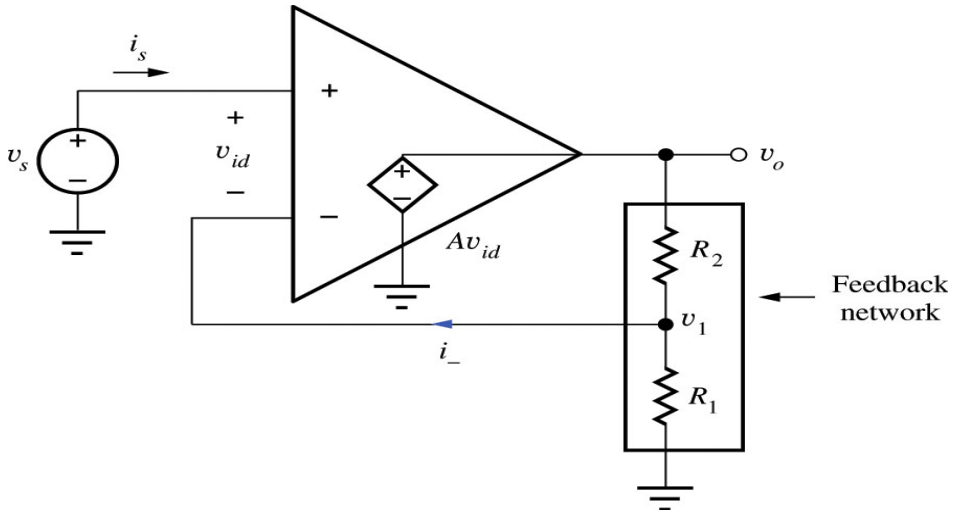

Fig Q1(a)

b) (i) State any three sources of power loss in silicon controlled rectifiers

(ii) The SCR of Fig Q1(b) has a gate trigger voltage V_T = 0.7V, gate trigger current I_T = 7mA and holding current I_H = 6mA. Determine the:

I. output voltage when SCR is off
II. input voltage that triggers the SCR
III. minimum anode voltage that can sustain conduction of SCR (11mks)

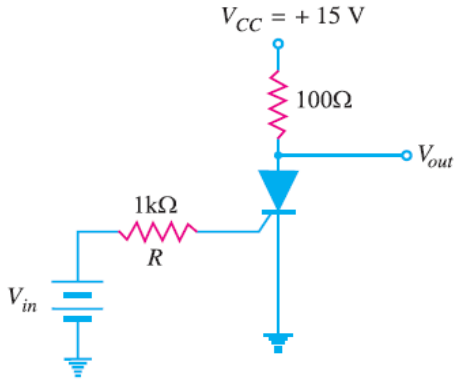

Fig Q1(b)

c) A non inverting amplifier is constructed with R_1 = 1kΩ, R_f = 39kΩ. If the op-amp has an open loop gain of 80dB and internal output resistance R_0= 50Ω. Determine the output resistance of the non inverting amplifier. (5mks)

Question TWO

a) Design an op-amp circuit that will produce an output voltage equal to $-(3V_1 + 2V_2 + 0.1V_3)$ if its feedback resistance is 100kΩ. Draw the amplifier circuit.

(7mks)

b) (i) A differential amplifier with common mode input of 500mV and a difference mode input 30mV has an output of 5mV due to common mode input and 3V due to difference input. Determine the:

I. difference mode gain
II. common mode gain
III. common mode rejection ratio

(ii) With an aid of a diagram derive the expression of the output voltage of an instrumentation amplifier. (13mks)

Question THREE

a) With an aid of a circuit diagram of a phase shift Oscillator and considering Barkhausen Criterion, show that oscillations are realized if the transfer function of the oscillator $T_{(j\omega 0)} = \frac{R_1}{12\,R}$ at the point when $R_1 = 12R$ (14mks)

b) Draw an equivalent circuit diagram of silicon bilateral switch hence describe its operation.

(6mks)

Question FOUR

(a) With an aid of a diagram and waveforms show that the mean voltage of a half wave controlled rectifier with resistive load is given by:

$$V_{dc} = \frac{V_{max}}{2\pi}(1 + \cos\theta)$$ (8mks)

(b) With an aid of Fig 4Q(b) show that the input resistance of a non ideal inverting amplifier is given by $R_{in} = R_1 + \frac{R_2}{1+A}$ (12mks)

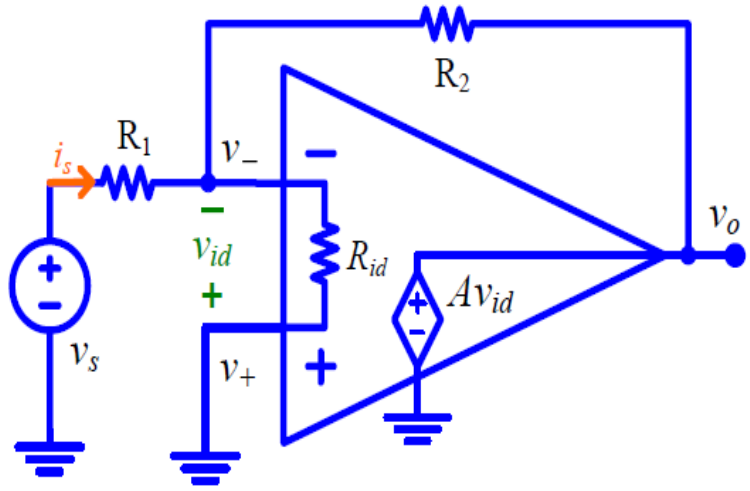

Fig Q4(b)