54

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF TECHNOLOGY EDUCATION IN ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE CODE: TEE 322

COURSE TITLE: ANALOQUE ELECTRONICS II

DATE: WEDNESDAY, APRIL 27TH, 2022. **TIME:** 12:00 - 2:00 PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 5 Printed Pages. Please Turn Over.

Question One (30 marks)

(a) (i) Explain the main differences between voltage rectifier and regulator in dc power supplies. (2 marks)

(ii) A power supply having output resistance 1.5 Ω supplies a full-load current of 500 mA to a 50-Ω load. Determine the percentage regulation of the supply. (3 marks)

(b) The closed-loop gain of a positive feedback operation amplifier is given as $A_C = 1 + R_f / R_1$, where the variables carry the usual meaning.

(i) Sketch the circuit indicating the input and output variables.

(ii) Determine the gain when $R_f \to 0$ and state the main application of the circuit in electronic circuit construction.

(c) (i)) Sketch a diagram for

(i) Half wave single phase voltage rectifier and its output waveforms. (4 marks)

(ii) Full wave single phase bridge voltage rectifier driven from 2:1 transformer complete with output waveforms. (4 marks)

(iii) Compare and deduce the relative efficiency performance in (i) and (ii) above.

(2 marks)

(d) (i) Sketch a typical frequency response curve of an ideal amplifier and indicate the half-power points. (3 marks)

(ii) Show that at half-power point the gain of the amplifier is 3 dB down the midband gain. (2 marks)

(e) (i) Differentiate between monostable and free running multivibrators.

(2 marks

(ii Sketch the schematic diagram of an SR flip flop and truth table.

(2 marks)

Question Two (20 marks)

(a) Consider the circuit in Fig. 1.

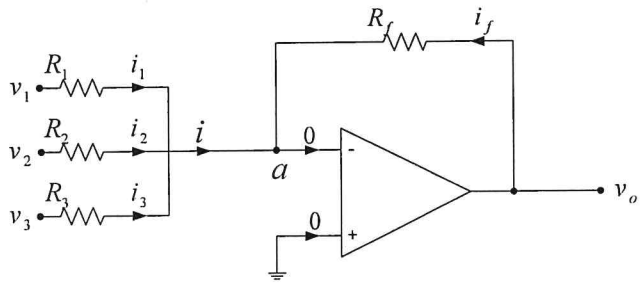


Fig. 1

(i) Express the current i in terms of the input branch currents. (2 marks)

(ii) State Kirchhoff's current law at node a. (2 marks)

(b) (i) Obtain the expression of v_o in terms of input voltages in Fig. 1 above. (11 marks)

(ii Evaluate the expression for v_o when $R_1 = R_2 = R_3 = R$. (2 marks)

(iii)Hence, state 3 computational operations presented in the circuit in Fig. 1. (3 marks)

Question Three (20 marks)

(a) (i) Differentiate between an amplifier and an oscillator as feedback systems.

(3 marks)

(ii) For an oscillator consisting of an amplifier with open-loop gain A and feedback loop gain β designed to generate a signal for driving a digital clock, sketch a block diagram and state the Barkhausen criterion for the circuit (6 marks).

(b) (i) Sketch the circuit for an inverting operation amplifier featuring the input resistance R_1, feedback resistance R_f, input voltage v_i and output voltage v_o. (4 mark)

(ii) By calculating the closed gain, show that the amplifier in (a) causes a phase shift of 180^o between the output and the input signals. (4 marks)

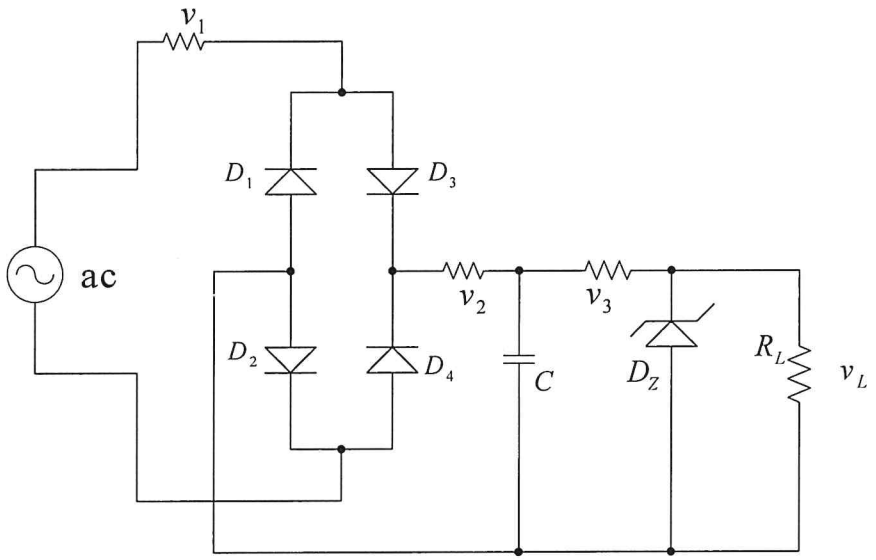
(iii Hence, deduce the gain and phase of the feedback network required for the circuit to oscillate. (3 marks)

Question Four (20 marks)

(a (i) Sketch a centre-tapped full wave voltage rectifier driving a load R_L. (4 marks)

(ii) Draw the input/output voltage waveforms on the same time axis. (4 marks)

(b Sketch the waveforms for the voltages v_1, v_2, v_3, and v_L across the respective resistors in Fig. 2.



(12 marks)

Fig. 2

Question Five (20 marks)

(a) The circuit shown in Fig. 3 is a switching circuit for an industrial application based on bipolar transistors Q_1 and Q_2.

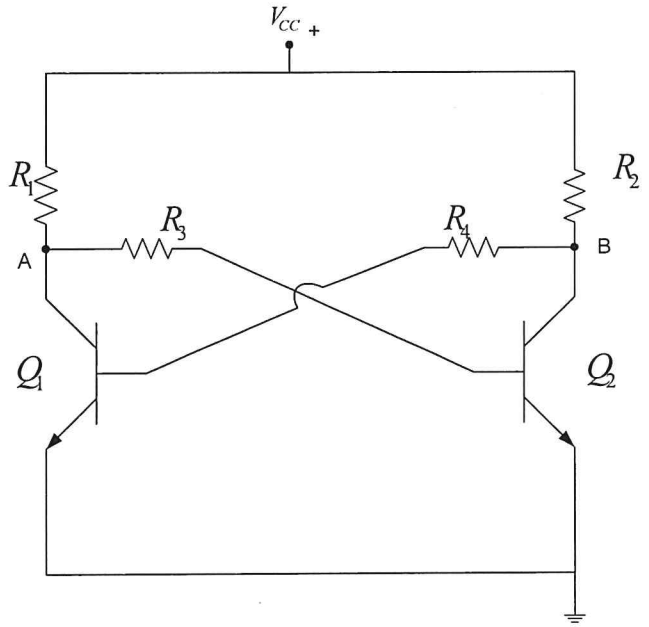


Fig. 3

Explain the condition of a transistor said to be in

(i) Cut-off mode

(ii) Conducting mode

(iii)Saturation mode (9 marks)

(b) Assume that in Fig. 3 Q_2 starts to conduct ahead of Q_1 when the voltage source V_{cc} is connected.

(i) Describe how the voltage at points A and B changes.

(ii) The state achieved in (i) above will change if the circuit is toggled. Explain what is meant by toggle and how the new state is achieved. (8 marks)

(c) Explain the differences between bistable and monostable multivibrators. (3 marks)