Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Examination December 2021 (2019 scheme)

Course Code: ECT301

Course Name: LINEAR INTEGRATED CIRCUITS

Max. Marks: 100 Duration: 3 Hours

PART A

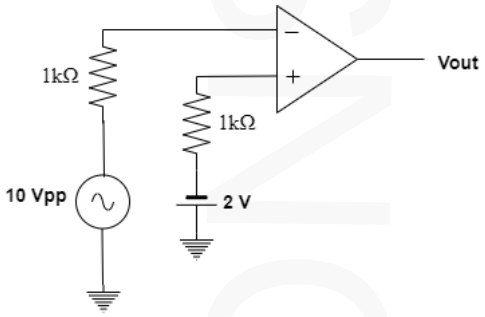
(Answer all questions; each question carries 3 marks) Marks

1 Define the parameter CMRR of an op-amp. (3)
Given that an operational amplifier produces an output voltage of 50 mV when the input voltages V_1 and V_2 are equal to10V and output voltage of 10V when V_1 = 10 mV and V_2 = 20mV. Determine the CMRR in dB.

2 Draw the ideal and practical voltage transfer characteristics of an op-amp. and explain the difference. (3)

3 Design an inverting amplifier for a closed loop voltage gain of 10. (3)

4 Draw the input-output waveforms for the circuit shown in figure below. (3)



5 Draw the circuit diagram of a triangular wave generator using op-amp. (3)

6 Design a first order high pass filter for a cut off frequency of 1kHz and maximum gain of 11. (3)

7 Draw and list the functions of 555 timer IC pins. (3)

8 Explain the terms (i) Pull in time (ii) Capture range and (iii) Lock range with respect to a PLL. (3)

9 Define the terms (i)Resolution (ii) Settling time and (iii) Monotonicity with respect to a DAC. (3)

10 Explain the terms (i) Line regulation and (ii) Load regulation for a regulated power supply. (3)

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

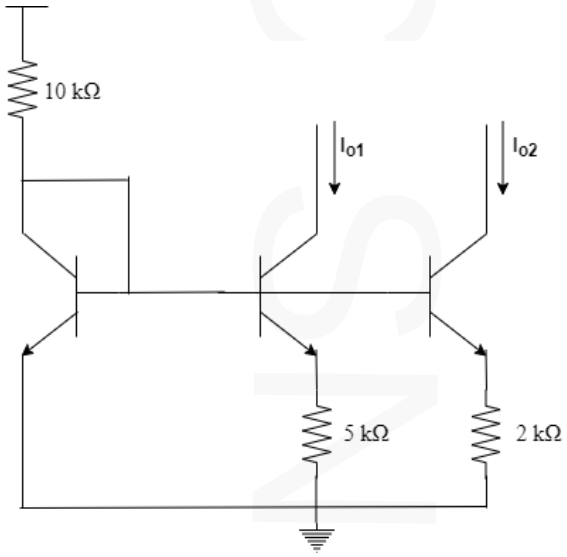
11 a) Analyse the differential amplifier circuit using BJT and derive an expression for differential mode gain and common mode gain. (7)

b) Draw the circuit diagram of a Wilson current source and derive an expression for output current in terms of the reference current. (7)

12 a)1. Define Slew rate and derive the expression for maximum input frequency at which an undistorted signal is obtained in terms of slew rate. (7)

2. Define Input offset voltage and Input offset current,

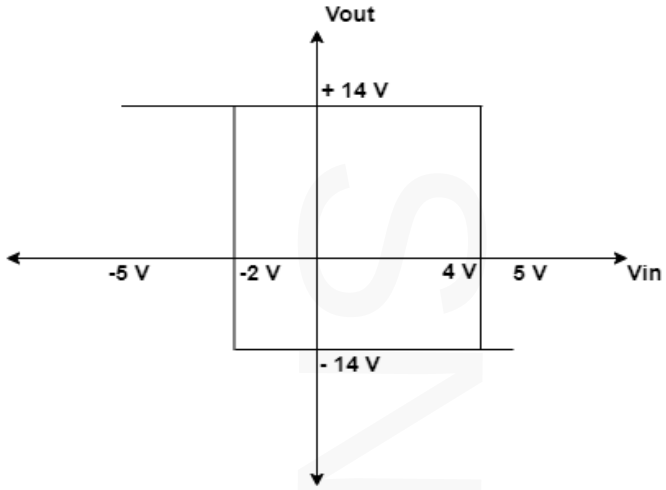
b) Determine the values of current I_{o1} and I_{o2} in the figure given below. Assume V_{BE} = 0.7 V, V_T = 25 mV and β=125. (7)



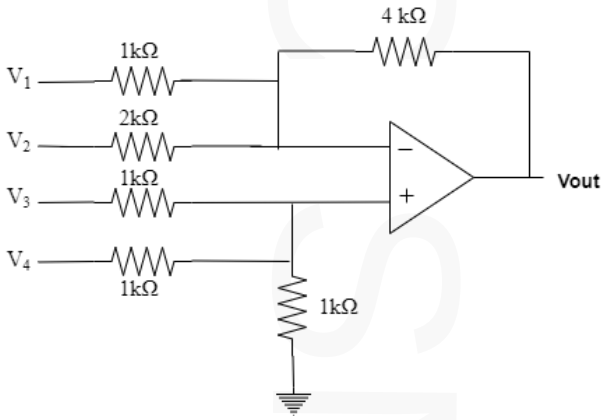
Module -2

13 a) Derive an expression for voltage gain, input resistance and output resistance of a voltage series feedback amplifier. (7)

b) Design a circuit to obtain the following transfer characteristics. Draw the input output waveforms also. (7)



14 a) Analyze the circuit given below and derive an expression for the output voltage. (7)



b) Draw the circuit of a Half wave Precision rectifier and explain its working (7)

Module -3

15 a) Draw the circuit diagram of a Wein bridge oscillator using op-amp and derive an expression for frequency of oscillations. (7)

b) Draw the circuit diagram of a Band Pass filter and derive an expression for the transfer function. (7)

16 a) Design a circuit to generate a square wave of frequency 2 kHz and amplitude 10 V_{pp} using op-amp. Assume that the duty cycle is equal to 50%. (7)

b) Derive the transfer function of a second order Butterworth low pass filter. (7)

Module -4

17 a) With a neat functional diagram and waveforms, explain the working of a monostable multivibrator using 555 timer IC. (7)

b) With block diagram, explain the working a phase locked loop. (7)

18	a)	Explain the block diagram of a voltage-controlled oscillator.	(7)
	b)	Discuss in detail any 3 applications of PLL.	(7)

Module -5

19	a)	Explain the working of a flash type analog to digital converter.	(7)
	b)	Explain how current fold back and current boosting are done using IC723 voltage regulator.	(7)
20	a)	Explain the working of a successive approximation type ADC.	(7)
	b)	Explain the working of a weighted resistor type DAC. Mention its drawbacks.	(7)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2022 (2019 Scheme)

Course Code: ECT 301

Course Name: LINEAR INTEGRATED CIRCUITS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		What are the ideal characteristics of an op-amp.?	3
2		Define Slew rate? Explain its significance.	3
3		Discuss the concept of virtual ground.	3
4		State how practical integrator is different from simple integrator circuit, with relevant sketches.	3
5		Draw the circuit of an op-amp monostable multivibrator and write down the expression of time period.	3
6		What are the advantages of active filters over passive filters?	3
7		Design a free-running multivibrator using 555 for a frequency of 1 KHz and a duty cycle of 60%. Choose C= 0.1µF.	3
8		Mention three applications of PLL.	3
9		Explain the features and functional block diagram of IC 723.	3
10		List out DAC specifications.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	Derive CMRR, input resistance and output resistance of a dual input balanced output differential amplifier configuration.	7
	b)	How a constant current bias circuit can be used to improve the CMRR of a differential amplifier?	7
12	a)	Draw the block diagram of an op-amp and explain the functions of each block.	7
	b)	Draw the equivalent circuit of an op-amp and explain the voltage transfer characteristics of an op-amp.	7

Module -2

13 a) Design the circuits to obtain the following output, V_o. (i) $V_o = (5V_1)$ 8

(ii) $V_o = V_1 + 2V_2$ (iii) $V_o = -\left(\frac{V_1+V_2+V_3}{3}\right)$ (iv) $V_o = -2V_1 - 5V_2$

b) Derive the following characteristics of voltage shunt amplifier: (i) Closed loop voltage gain (ii)Input resistance (iii) Output resistance (iv)Bandwidth 6

14 a) What is a logarithmic amplifier? Draw the circuit and derive the transfer function of a logarithmic amplifier. 7

b) Draw and explain the circuit of a voltage to current converter with grounded load and derive its transfer function. 7

Module -3

15 a) With the help of circuit diagram explain the operation of RC phase shift oscillator using op-amp. Derive the expression for frequency of oscillation and the minimum gain requirement for sustained oscillation. 10

b) Design a first order low pass filter with the following specifications 4
(i)-3dB frequency 1 KH_z , (ii) DC gain 20dB. Choose C= 0.01µF.

16 a) Design a circuit to generate a triangular waveform of $7V_{P-P}$ at 1 KH_z using an op-amp having saturation voltage of ±14 V and draw the waveforms also. 7

b) Derive the equation for the frequency of oscillation of an opamp astable multivibrator with the help of circuit diagram and waveforms. 7

Module -4

17 a) Draw the functional block diagram of 566 VCO and explain its operation. 7

b) Explain the operation of PLL. What is its lock range and capture range. 7

18 a) List the features of Timer IC 555 4

b) Draw the internal diagram of a 555 timer and explain its working as a monostable multivibrator and derive the expression for its pulse-width. 10

Module -5

19 a) Discuss how the IC 723 can be used as high voltage regulator with current limit and with current fold back. 7

b) Draw and explain the working of successive approximation type ADC. 7

20 a) With neat circuit diagram explain the working of a 3-bit flash ADC. 7

b) Explain the circuit of a 4-bit R-2R ladder DAC. 7

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