Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2017

Course Code**: EC204**

Course Name**: ANALOG INTEGRATED CIRCUITS (AE, EC)**

Max. Marks:100 Duration: 3 Hours

PART A

Question No.1 is compulsory. Answer question 2 or 3

1. a. Define the following terms (6)
   - i) CMRR
   - ii) Slew rate
   - iii) PSRR

   b. Design a circuit to obtain an output voltage of $-(V_1 + 2V_2 + 5V_3)$ (5)

   c. Derive the following characteristics of voltage series feedback amplifier. (4)
   - i) Closed loop gain
   - ii) Input impedance
   - iii) Output impedance
   - iv) Bandwidth

2. a. Explain in detail a method of improving CMRR of differential amplifier. (10)

   b. Explain the various stages of op-amp. (5)

OR

3. Draw an instrumentation amplifier using four op-amps and explain the need for each op-amp. Derive the expression for its output voltage. (15)

PART B

Question No.4 is compulsory. Answer question 5 or 6.

4. a. Explain the working of precision full wave rectifier with a neat diagram. (7)

   b. Draw a second order active high pass filter and derive the expression for its cut off frequency. (8)

5. a. With the help of a neat diagram, derive the frequency of oscillation for RC phase shift oscillator. (10)

   b. Draw the circuit of antilog amplifier and derive the output voltage. (5)

OR

6. a. Explain in detail the working of Schmitt trigger and explain the transfer characteristics. (8)

   b. Design a first order low pass filter with a cut off frequency of 2kHz. (7)

PART C

Question No.7 is compulsory. Answer question 8 or 9.

7. a. Discuss in detail any two applications of PLL. (5)

   b. Write a short note on IC723 based voltage regulators (5)

   c. Explain the working of dual slope A/D converters. (10)

8. a. Explain in detail the working of monostable and astable multivibrator using 555. (10)

   b. Discuss different methods for implementing analog multipliers. (5)

   c. Explain the working of high speed sample and hold switch. (5)

OR

9. a. Derive the output voltage for a 4 bit R-2R ladder D/A converters (10)

   b. Explain the working of successive approximation type A/D converters. (7)

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Total Pages: 1

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: EC204

Course Name: ANALOG INTEGRATED CIRCUITS (AE, EC)

Max. Marks: 100 Duration: 3 Hours

PART A

Question No.1 is compulsory. Answer question 2 or 3

1	a)	Draw the block diagram of an op-amp and explain the necessity and implementation of each block.	(10)
	b)	Design an op-amp based circuit to implement the function, Vo = 2Va + 3Vb.	(5)
2	a)	With suitable diagram explain how the voltage series feedback is implemented in op-amp based circuits.	(5)
	b)	Derive the expressions for gain, input impedance, output impedance and frequency response of the above configuration.	(10)

OR

3	a)	Draw and explain the circuit diagram of an instrumentation amplifier and derive the output equation.	(10)
	b)	With suitable diagram and equation, explain how the average of signals can be achieved by using an op-amp circuit.	(5)

PART B

Question No.4 is compulsory. Answer question 5 or 6

4	a)	Design an op-amp based astable multi-vibrator for a duty cycle of 75% and draw the waveforms at different points.	(8)
	b)	Draw and explain the circuit diagram of a log amplifier and derive the output equation.	(7)
5	a)	Draw and explain the working of a practical differentiator circuit including frequency response analysis.	(15)

OR

6	a)	Design a Schmitt trigger circuit for different UTP and LTP magnitudes.	(7)
	b)	Draw and explain the circuit of a square/saw tooth wave generator using op-amps.	(8)

PART C

Question No.7 is compulsory. Answer question 8 or 9

7	a)	List the features of IC555 and design a monostable multi-vibrator for a pulse duration of 1ms using IC555.	(10)
	b)	With suitable diagram explain the working of a flash convertor.	(10)
8	a)	Draw and explain the working of a PLL and describe the importance of lock range and capture range.	(10)
	b)	Explain the method of current boosting in voltage regulator IC's.	(10)

OR

9	a)	Draw and explain the working of a binary ladder type D/A convertor.	(10)
	b)	List and explain at least five important specifications of D/A and A/D convertors.	(10)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EC204

Course Name: ANALOG INTEGRATED CIRCUITS (AE, EC)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

1 a) Derive CMRR, input resistance and output resistance of a dual input balanced output differential amplifier configuration. (8)

b) Define the following: (3)
i)Input bias current ii)Input offset current iii) Input offset voltage

c) Implement the equation using two op-amps (4)
$V_0 = -5V_1 + 2V^2 - 10V3$

2 a) Derive the following characteristics of voltage shunt amplifier: (8)
i) Closed loop voltage gain ii)Input resistance
iii) Output resistance iv)Bandwidth

b) What is slew rate? Derive an equation for it. (4)

c) A differential amplifier has a common mode gain of 0.05 and difference mode gain of 1000.Calculate the output voltage for two signals V1 = 1mV and V2 = 0.9mV (3)

3 a) Explain the variation of differential gain of a differential amplifier with frequency of operation with relevant expressions. (5)

b) Draw the circuit diagram of a differential instrumentation amplifier with a transducer bridge and show that the output voltage is proportional to the change in resistance. (7)

c) How a constant current bias circuit can be used to improve the CMRR of a differential amplifier? (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Draw the circuit of a temperature compensated logarithmic amplifier and show that it provides temperature independent logarithmic output. (8)

b) Explain the working of a triangular waveform generator with a neat circuit diagram. Also derive an expression for frequency of oscillation. (7)

5 a) Draw the circuit of a Wien Bridge oscillator using op-amp and derive an equation for frequency of oscillation. (7)

b) With a neat circuit diagram explain the working of astable multivibrator using op-amp. Also derive an expression for time period. (8)

6 a) Draw the circuit of second order low pass filter and derive its transfer function. (8)

b) Draw the circuit of a precision full-wave rectifier and explain its working. (7)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Explain how a monostable multivibrator can be implemented with 555 IC with relevant waveforms and functional diagram. Derive an expression for pulse width. (10)

b) With a neat circuit diagram, explain the operation of a 3-bit flash converter. (10)

8 a) With a neat block diagram explain the working of PLL. Explain any two applications of PLL. (10)

b) Explain the working of dual-slope ADC with a neat circuit diagram. (10)

9 a) Explain how short circuit, fold back protection and current boosting are done using IC723 voltage regulator. (10)

b) With a neat circuit diagram explain the working of a weighted resistor D/A converter (10)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EC204

Course Name: ANALOG INTEGRATED CIRCUITS (AE, EC)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Analyse the BJT differential amplifier pair under large signal operation and illustrate its transfer characteristics. (8)

b) How to implement the instrumentation amplifier using three Op.Amp. Deduce the condition for ensuring high CMRR in the circuit? (7)

2 a) Using the small signal analysis, deduce the expression for CMRR and differential input resistance of the BJT differential amplifier from fundamentals. (9)

b) What is the principle of operation of Wilson current mirror and its advantages? Deduce the expression for its current gain. (6)

3 a) Deduce the expression for the closed loop voltage gain, input resistance and output resistance for an op. amp. with voltage series feed back. (10)

b) For an op-amp having a slew rate of 2V/µsec. What is the maximum closed loop voltage gain that can be used when the input signal varies by 0.5V in 10µsec? (5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) How to realize Wein-Bridge oscillator using op. amp.? Derive the condition of oscillation and frequency of oscillation for the circuit. (8)

b) Design a circuit to generate 1KHz triangular wave with 5V peak. (7)

5 a) Illustrate the working principle of the grounded load voltage to current converter and deduce the condition for its ideal current converter. (8)

b) Design a fullwave rectifier to rectify an ac signal of 0.2V peak-to-peak. Explain its principle of operation. (7)

6 a) Derive the design equations for a second order Butterworth active low pass filter. (10)

b) Design a Notch filter to eliminate power supply hum (50 Hz). (5)

P.T.O.

PART C

Answer any two full questions, each carries 20 marks.

7	a)	Design a circuit to convert 1 KHz, 50% duty cyclesquare wave to 1 KHz, 30% duty cycle rectangular wave.	(7)
	b)	How to configure fold back current limiting protection in 723 voltage regulator IC. Explain the circuit with internal block diagram of the IC.	(7)
	c)	What is the principle of operation of successive approximation ADC?	(6)
8	a)	Illustrate the principle of operation of PLL with its capture range and lock range	(7)
	b)	How phase detector is implemented in digital PLL?	(5)
	c)	Design a circuit to multiply the incoming frequency by a factor of 5 using 565 PLL.	(8)
9	a)	Find out the Dynamic range, Full-scale value and Resolution of a 12 bit DAC having full-scale range 10V.	(5)
	b)	Explain the working principle of R-2R ladder type DAC with circuit.	(6)
	c)	What is the principle of operation of Dual slope ADC. Deduce the relationship between analogue input and digital output of the ADC.	(9)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: EC204

Course Name: ANALOG INTEGRATED CIRCUITS (AE, EC)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

1 a) Derive the equation for closed loop voltage gain, input resistance with feedback, output resistance with feedback and total output offset voltage with feedback of a voltage series feedback amplifier. (10)

b) Define slew rate. What are its causes? Derive the equation for maximum input frequency at which an undistorted signal is obtained in terms of slew rate? (5)

2 a) Design an inverting adder circuit using opamp to get the output expression as V_0=--(0.2V1+2V2+20 V3) , where V1, V2 and V3 are the inputs. (7)

b) Derive the equation for the output voltage for an averaging circuit using opamp. (8)

3 a) Draw the equivalent circuit of an operational amplifier. Explain voltage transfer characteristics of an operational amplifier. (8)

b) Define a)Power Supply Rejection Ratio b) Input Offset Current (7)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Explain the working of full wave precision rectifier. (9)

b) Derive the equation for output voltage of an integrator. Why is it called a lossy integrator? (6)

5 a) Explain how switching takes place at UTP and LTP in a Schmitt trigger. Plot the hysteresis curve. (10)

b) What is a zero crossing detector? (5)

6 a) Design a first order low pass filter at a cut-off frequency of 2kHz with a pass band gain of 3 (8)

b) Prove that the input voltage is converted into corresponding output current in a voltage to current converter with floating load. (7)

PART C

Answer any two full questions, each carries 20 marks.

7	a)	Explain the operation of Phase Locked Loop. What is lock range and capture range?	(10)
	b)	With the help of internal diagram explain the monostable operation of timer IC 555. Draw the input and different output waveforms. Derive the equation for pulse width.	(10)
8	a)	Explain the working of successive approximation ADC	(10)
	b)	Discuss the operation of dual slope ADC	(10)
9	a)	What is a sample and hold circuit	(5)
	b)	Discuss how digital signal is converted into analog signal in a weighted resistor DAC.	(6)
	c)	Explain the internal diagram of I.C. 723	(6)
	d)	Explain how current boosting is achieved using I.C 723	(3)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: EC204

Course Name: ANALOG INTEGRATED CIRCUITS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

1 a) With the help of a circuit diagram explain the working of a differential amplifier if the following inputs are applied (i) V_{b1}=0V, V_{b2}=1V (ii) Vb_1=1V, Vb_2=1V (iii) Vb_1= -1V, Vb_2=1V (4)

b) List out the ideal characteristics of an op.amp. (3)

c) Design the circuits to obtain the following output, V_o. (i) V_o= ($5V_1$) (ii) V_o= V_1+ $2V_2$ (iii) $Vo = -\frac{V1+V2+V3}{3}$ (iv) Vo= - $2V_1$- $5V_2$ (8)

2 a) For a differential amplifier, find the value of v_{id} to cause i_{E2}= 0.98I where v_{id} = v_{B1}- v_{B2} and I is the tail current. (4)

b) Draw the block diagram and equivalent circuit of an operational amplifier. (3)

c) With the help of a neat circuit diagram, derive the equation for the output voltage of an Instrumentation amplifier. (8)

3 a) With the help of a circuit diagram, derive the equation for Input differential resistance of a differential amplifier. (4)

b) Explain the openloop configurations and voltage transfer curve of an ideal opamp. (3)

c) Explain the following properties of a practical opamp (i) Bandwidth (ii) Slew rate (iii) Input offset voltage (iv) Input offset current (8)

PART B

Answer any two full questions, each carries 15 marks.

4 a) With the help of circuit diagram and relevant equations, explain the disadvantages of a differentiator. How are the disadvantages removed in a practical differentiator? (4)

b) With the help of circuit diagrams and graphs, explain the working of a Full wave Precision rectifier. (3)

c) Design a Schmitt Trigger with hysteresis width, V_H= 2V. Assume ± V_{sat}= ± 14V. (4)

d) Design a second order Butterworth Low Pass Filter with f_H= 2KHz (4)

5 a) With the help of a circuit diagram, derive the equation for load current $I_{L,}$ for a V to I converter with grounded load. (3)

b) Derive the equation for frequency of oscillation (f_0) of a Wein Bridge oscillator. Design a Wein Bridge oscillator for f_0 = 1KHz. (6)

c) Derive the equation for the transfer function of a first order wide Band Pass filter. Design a first order wide bandpass filter with f_H= 2KHz and f_L= 500 Hz (6)

6 a) Draw the circuit of a log amplifier with temperature compensation and derive the equation for its output voltage. (7)

b) Derive the equation for frequency of oscillation for a square-triangular waveform generator. (8)

PART C

Answer any two full questions, each carries 20 marks.

7 a) With the help of circuit diagram, internal functional diagram and relevant graphs, explain the working of a Monostable Multivibrator using IC555. (10)

b) With the help of a circuit diagram and truth table, explain the working of a Flash type ADC. (10)

8 a) With the help of circuit diagram and internal diagram, explain the working of a Low Voltage Regulator using IC723. (10)

b) With the help of a circuit diagram explain the working of a Dual slope ADC. (10)

9 a) With the help of block diagram explain the working of PLL. Explain any two applications of PLL. (10)

b) The basic step of a 9bit DAC is 10mV. If 000000000 represents 0V, what output is produced if the input is 110011001? (5)

c) Define the following terms with respect to DAC (i)Resolution (ii)Linearity (iii) Full scale output voltage (iv) LSB (v)MSB (5)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: EC204

Course Name: ANALOG INTEGRATED CIRCUITS (AE, EC)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

			Marks
1	a)	How a constant current bias circuit can be used to improve the CMRR of a differential amplifier?	(7)
	b)	Define slew rate. What causes slew rate? Derive the equation for maximum input frequency at which an undistorted signal is obtained in terms of slew rate?	(8)
2	a)	Explain with suitable diagram how voltage shunt feedback is implemented in op-amp based circuits and derive the following characteristics (i) Closed loop voltage gain (ii)Input resistance, (iii) Output resistance (iv)Bandwidth	(12)
	b)	A 741C op-amp is used as an inverting amplifier with a gain of 50. The voltage gain vs frequency curve of 741C is flat upto 20kHz.What maximum peak to peak input signal can be applied without distorting the output.	(3)
3	a)	List and explain the function of all the basic building blocks of an op-amp.	(8)
	b)	What is the principle of operation of Wilson current mirror and its advantages? Deduce the expression for its output current.	(7)

PART B

Answer any two full questions, each carries 15 marks.

4	a)	Design a second order Butterworth low-pass filter with an upper cutoff frequency of 1kHz.	(7)
	b)	Explain the working of an inverting Schmitt trigger and draw its transfer characteristics.	(8)
5	a)	Draw the circuit of a temperature compensated logarithmic amplifier and show that it provides temperature independent logarithmic output.	(7)
	b)	Draw and explain the working of a practical differentiator and analyze its frequency response.	(8)

6	a)	Derive the frequency of oscillation of an RC phase shift oscillator using op-amp. Also explain its working with suitable diagram.	(8)
	b)	Explain how a free running square wave form can be obtained using op-amps.	(7)

PART C

Answer any two full questions, each carries 20 marks.

7	a)	Explain how a monostable multivibrator can be implemented with 555 IC with relevant waveforms and functional diagram. Derive an expression for pulse width.	(8)
	b)	Give the block diagram of IC566 VCO and explain its operation.	(6)
	c)	Discuss in detail any two applications of PLL.	(6)
8	a)	Why is a current foldback protection circuit used in regulators? Explain with suitable diagrams.	(8)
	b)	Illustrate the principle of operation of PLL with its capture range and lock range.	(7)
	c)	Explain the working of successive approximation ADC.	(5)
9	a)	With a neat circuit diagram explain the working of a weighted resistor D/A converter. Discuss how digital signal is converted into analog signal in a weighted resistor DAC.	(7)
	b)	With a functional diagram, explain the principle of operation of Dual slope ADC.	(8)
	c)	Draw the circuit of a Schmitt trigger using 555 timer and explain its operation.	(5)

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