

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  $2\text{V}/\mu\text{sec}$ . What is the maximum closed loop voltage gain that can be used when the input signal varies by  $0.5\text{V}$  in  $10\mu\text{sec}$ ? (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  $1\text{KHz}$  triangular wave with  $5\text{V}$  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  $0.2\text{V}$  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 ( $50\text{Hz}$ ). (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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**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  $V_0 = -(0.2V_1 + 2V_2 + 20V_3)$ , where  $V_1$ ,  $V_2$  and  $V_3$  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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**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)  $V_{b1}=1V$ ,  $V_{b2}=1V$  (iii)  $V_{b1}=-1V$ ,  $V_{b2}=1V$  (4)
- b) List out the ideal characteristics of an op.amp. (3)
- c) Design the circuits to obtain the following output,  $V_o$ . (i)  $V_o = (5V_1)$  (8)  
(ii)  $V_o = V_1 + 2V_2$  (iii)  $V_o = -\frac{V_1 + V_2 + V_3}{3}$  (iv)  $V_o = -2V_1 - 5V_2$
- 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 (8)  
(iii) Input offset voltage (iv) Input offset current

**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  $\pm V_{sat} = \pm 14V$ . (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. (6)  
Design a Wein Bridge oscillator for  $f_0 = 1\text{KHz}$ .
- c) Derive the equation for the transfer function of a first order wide Band Pass filter. (6)  
Design a first order wide bandpass filter with  $f_H = 2\text{KHz}$  and  $f_L = 500\text{ Hz}$
- 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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**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. (8)  
Also explain its working with suitable diagram.
- 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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