Integrated Circuits

Unit I : OP-AMP Basics

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations using 'r' parameters, Need and types of level shifter, current mirror circuits. Voltage series and voltage shunt feedback amplifier and its effect on Ri, Ro, bandwidth and voltage gain, Study of Various types of Operational and their applications; Power supply configurations for OP-AMP applications , ; DC and AC parameters of opamp ; interpretation of TL082 datasheet.

Unit II : Linear Applications of OP-AMP

Inverting and Non-inverting amplifier, voltage follower. Summing, averaging scaling amplifier, difference amplifier, Ideal integrator, practical integrator with frequency response, Ideal differentiator, practical differentiator with frequency response, isolation amplifier and ISO12X IC, Instrumentation amplifiers.

Unit III : Non-linear Applications of OP-AMP

Comparator, Comparator contrary to op amp e.g. LMX93,TLV350X, characteristics of comparator, applications of comparator, Schmitt trigger (symmetrical/asymmetrical), Monostable and AstableMultivibrator ,Multivibrator IC CD4047B, clippers and clampers, voltage limiters, Square wave generator, triangular wave generator, Need of precision rectifier, Half wave , Full wave precision rectifiers, peak detectors, sample and hold circuits and LF-398N S/H IC .

Unit IV : Converters using OP-AMP

V-F, I-V and V-I converter, DAC: types of DAC, characteristics, specifications, advantages and disadvantages of each type of DAC,Study of DAC 7821 IC, ADC: types of ADC, characteristics, specifications, advantages and disadvantages of each type of ADC, Study of ADC32XX IC

Unit V : Phase Locked Loop &Oscillators

Introduction to analog multiplier e.g.MPY634,Basic application of Analog multiplier: AM,FM,FSK; Typical application using op-AMP and analog multipliers: Voltage Controlled Oscillator, Block diagram of PLL and its function, PLL types, characteristics/parameters of PLL, and different applications of PLL, AGC/AVC ,Self-tuned filters and VCA820; Oscillators principle, types and frequency stability, design of phase shift, wein bridge, Quadrature, voltage controlled oscillators.

Unit VI : Active filters

Design and frequency scaling of First order and second order Active LP, HP, BP and wide and narrow band BR Butterworthfilters and notch filter. All pass filters, Universal Active filter design and UAF42 IC

Text Books:

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.

2. Salivahanan and KanchanaBhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill,India 2008

Reference:

1. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.

2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.

3. Bali,”Linear Integrated Circuits”, Mc Graw Hill 2008.

4. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications.

Other References:

1.TL082: http://www.ti.com/lit/ds/symlink/tl082.pdf

2.Various Type of Op amp: http://www.ti.com/lsds/ti/amplifiers-linear/operational-amplifier-op-amp-products.page

3. LMX93: http://www.ti.com/lit/ds/symlink/lm2903-n.pdf

4. TLV350X: http://www.ti.com.cn/cn/lit/ds/symlink/tlv3501.pdf

5. LF-398N :http://www.ti.com/lit/ds/symlink/lf398-n.pdf

6. INAXXX: http://www.ti.com/lsds/ti/amplifiers-linear/instrumentation-amplifier-products.page

7. IS012X: http://www.ti.com/lit/ds/symlink/iso121.pdf

8. UAF42:http://www.ti.com/lit/ds/symlink/uaf42.pdf

9.MPY634: http://www.ti.com/lit/ds/symlink/mpy634.pdf

10. VCA820: http://www.ti.com.cn/cn/lit/ds/symlink/vca820.pdf

11. CD4046: http://www.ti.com/lit/ds/symlink/cd4046b.pdf

12. TPS40200: http://www.ti.com.cn/cn/lit/ds/symlink/tps40200.pdf

13. TPS40210: http://www.ti.com/lit/ds/symlink/tps40210.pdf

14.TPS7A4901: http://www.ti.com/lit/ds/symlink/tps7a49.pdf

15. TPS7250: http://www.ti.com.cn/cn/lit/ds/symlink/tps72.pdf

16.DAC 7821:http://www.ti.com/lit/ds/symlink/dac7821.pdf

17.ADC32X: http://www.ti.com/lsds/ti/data-converters/analog-to-digital-converter-products.page.

List of Practical’s

Lab Setup Requirement:

Dual Channel Cathode Ray Oscilloscope (0-20 MHz), Function Generator (10MHz and above), Dual Power Supply , TL082, MPY634, ASLKPRO, Clip Probes, digital multimeter,System with installed circuit simulation software(Tina/Pspice/MultiSim)

1. Measure Op-Amp parameters and compare with the specifications. Input bias current, input offset current and input offset voltage. slew rate , CMRR of TL082 Compare the result with datasheet of corresponding Op-Amp.

2.To design and study the characteristics of negative feedback amplifier

a) Inverting and non inverting using operational amplifier TL082

b) Voltage follower using operational amplifier using TL082.

3. Design, build and test integrator and Differentiator for given frequency fa using TL082.
4. Design, build and test three Op-Amp instrumentation amplifiers for typical application using TL082
5.To design and study the characteristics of regenerative amplifier
a) Schmitt Trigger using operational amplifier TL082
b) Astable and Monostable using operational amplifier using TL082.
6.Design of a function generator and VCO using op-Amp and MPY634
7.Examine the operation of a PLL designed using TL082 and MPY634 and to determine the free running frequency, the capture range and the lock in range of PLL
8. 2 bit DAC and 2 bit ADC. A) Design and implement 2bit R-2R ladder DAC. B) Design and implement 2bit flash type ADC.
9. Design, build and test square & triangular wave generator.
10.Design Low pass, High pass and Band pass, stop band 2nd order Butterworth active filters using universal active filter topology

Optional Experiments:

1. Verify and understand practically virtual ground and virtual short concept in inverting and non-inverting configuration.
2. Plot DC transfer characteristics of emitter coupled differential amplifier.
3. Study effect of emitter resistance and constant current source on figure of merit (CMRR) of emitter coupled differential amplifier.
4. Design and implement V-I converter.
5. Any experiment based on application of Op-Amp.
6. Design, build and test precision half & full wave rectifier.

Reference Material:

1. Data Sheet: http://www.ti.com/lit/ds/symlink/tl082.pdf
2. Application Note: http://www.ti.com/lit/an/sloa020a/sloa020a.pdf
3. MPY634 Data Sheet: http://www.ti.com/lit/ds/symlink/mpy634.pdf
4. Application Note: http://www.ti.com/lit/an/sbfa006/sbfa006.pdf
5. ASLK Pro Manual: http://download.mikroe.com/documents/specials/educational/aslk-pro/aslk-pro-manual-v103.pdf