

Analog and Digital Electronics

Unit 01 : Number system & Boolean's Algebra:

Numbering systems-binary, octal, decimal and hexadecimal and their conversion, codesBCD, Grey and excess3, Binary arithmetic: - addition and subtraction by 1's and 2's compliment. Booleans algebra, De-Morgan's theory etc. K-map: - structure for two, three and four Variables, SOP and POS form reduction of Boolean expressions by K-map.

Unit 02 : Combinational & Sequential circuits:

Concept of Combinational & Sequential circuits, Flip flops – R-S, Clocked S-R, D latches, Edge Triggered D flip-flops, Edge triggered JK flip flops, JK Master - slave flip flop, Register- Buffer registers, shift registers, controlled shift registers, ring counter, Counters – asynchronous Counters, synchronous counter, up - down counter , twisted ring counters, N –module Counters.

Unit 03 : Operational Amplifier & Applications:

Op-Amp: Block diagrams of 741 and TL082, ideal and practical parameters, open loop and close loop configuration of Op-Amp. Study of Various types of Operational Amplifiers and their applications; Power supply configurations for OP-AMP applications Applications of Op- Amp- Comparator, Comparator contrary to op amp e.g. LMX93,TLV350X, , zero crossing detectors, Schmitt trigger,Voltage limiters, Integrator and Differentiator ,V-I and I-V converters, Instrumentation amplifier, peak detector,Monostable and AstableMultivibrator ,Multivibrator IC CD4047B , Sample and hold Circuit and LF-398N S/H IC, isolation amplifiers and ISO12X IC

Unit 04 : Waveform generators, Filters & Regulators:

Waveform generation using Op-amp - sine, square, saw tooth and triangular generator, Active filters-Its configuration with frequency response, Analysis of first order Butterworth low pass and high pass filters,bandpass and bandstop filters, notch filter, All pass filters, Universal Active filter design and UAF42, IC 555 –construction, working and modes of operation- astable and monostable multi vibrators, Sequence generator, 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, Phase Locked Loop and features of CD4046 IC, voltage regulators using ICs 78xx, 79xx, LM 317 ; OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Basic Switching Regulator and characteristics of standard regulator ICs –TPS40200, TPS40210, Low Drop out (LDO) Regulators ICs-TPS7A4901, TPS7250;

Unit 05 : BJT & Applications:

BJT amplifier: Introduction, Class A amplifier, AC-DC load line analysis, Single stage and Multistage BJT amplifier, direct coupled, RC coupled and transformer coupled, Darlington pair, Push-Pull amplifier and differential amplifier FET-construction, Parameters, Characteristics.

Unit 06 : Diode & Precision Rectifiers:

Diode rectifier: Introduction, Single phase half wave rectifier with R, RL loads. Single phase full wave rectifier-Center tap and bridge rectifier supplying R and RL load and performance parameters. Three phase full wave bridge rectifier with R load. Comparison of single phase half wave and full wave rectifiers, Precision rectifiers: Half wave and Full wave. Comparison of diode and precision rectifier.

Other References:

1. TL082: <http://www.ti.com/lit/ds/symlink/tl082.pdf>
2. Various Type of Op amp: <http://www.ti.com/lit/ds/symlink/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/lit/ds/symlink/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>

Lab

Lab Setup Requirement: Dual Channel Cathode Ray Oscilloscope (0-20 MHz), Function Generator (10MHz and above), Dual Power Supply , TL082, MPY634, ASLKPRO, standard regulator ICs – TPS40200, TPS 7250, Clip Probes, digital multimeter, System with installed circuit simulation software(Tina/Pspice/MultiSim)

1. Study of ring counter and twisted ring counter.
2. Study of up - down counters (IC 74192/74193) and N- modulo counter. (IC 7490/7493).

3. Measurement and Comparison of Op-Amp parameters for TL082– CMRR,SVRR, slew rate, Open loop gain, input bias current and input offset current and Unity gain bandwidth
- 4.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.
- 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. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC
8. Design of a switched mode power supply that can provide a regulated output voltage for a given input range and compare the characteristics using the TPS40200 IC
- 9*. Study of IC-555 applications- astable, monostable multivibrator.
- 10*. Study of Single Phase Full-wave bridge rectifier with RL load.

Any three experiments are to be conducted of following experiments:

1. Study of Three Phase Full-wave Rectifier with R load.
- 2.Design Low pass, High pass and Band pass, stop band 2nd order Butterworth active filters using universal active filter topology.
3. Study of Instrumentation amplifier using three Op-amp, CMR measurement using TL082.
- 4.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
5. Transistor amplifiers: frequency response of BJT, multistage BJT amplifier.
- 6*. Study of Single Phase Half-Wave Rectifier.
7. Study of op-amp as a ZCD & Comparator
8. Study of various flip-flops and verification of truth table.
9. Study and verify shift register operation (IC 7495).

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>