



DHANALAKSHMI SRINIVASAN
INSTITUTE OF TECHNOLOGY
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COURSE PLAN

Subject code: EC8453	Branch/Year/Sem/Section: B.E BME/II/IV
Subject Name: LINEAR INTEGRATED CIRCUITS	Batch:2018-2022
Staff Name: A.ANUSUYA	Academic year:2019-2020

COURSE OBJECTIVE

1. To introduce the basic building blocks of linear integrated circuits
2. To learn the linear and non-linear applications of operational amplifiers
3. To introduce the theory and applications of analog multipliers and PLL
4. To learn the theory of ADC and DAC
5. To introduce the concepts of waveform generation and introduce some special function ICs

TEXT BOOK:

1. D.Roy Choudhry, Shail Jain, —Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.
2. Sergio Franco, -Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition, Tata Mc Graw-Hill, 2007.

REFERENCES:

1. Ramakant A. Gayakwad, —OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 2001.
2. Robert F.Coughlin, Frederick F.Driscoll, -Operational Amplifiers and Linear Integrated Circuits, Sixth Edition, PHI, 2001.
3. B.S.Sonde, -System design using Integrated Circuits, 2nd Edition, New Age Pub, 2001
4. Gray and Meyer, -Analysis and Design of Analog Integrated Circuits, Wiley International, 2005.
5. Michael Jacob, -Applications and Design with Analog Integrated Circuits, Prentice Hall of India, 1996.
6. William D.Stanley, -Operational Amplifiers with Linear Integrated Circuits, Pearson Education, 2004.
7. S.Salivahanan & V.S. Kanchana Bhaskaran, —Linear Integrated Circuits, TMH, 2008

WEB RESOURCES

TEACHING METHODOLOGIES:

- BB - BLACK BOARD
- VIDEO - VIDEO TUTORIAL
- PPT - POWER POINT PRESENTATION



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DEPARTMENT OF BIOMEDICAL ENGINEERING

EC8453

LINEAR INTEGRATED CIRCUITS

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UNIT I BASICS OF OPERATIONAL AMPLIFIERS

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters.

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC

TOTAL: 45 PERIODS

S.NO	UNIT	TOPICS	Hours Planned	Cumulative Hours	Text	Page No	TEACHING METHODOLOGIES
UNIT 1 - BASICS OF OPERATIONAL AMPLIFIERS							
1	I	Current mirror ,Current sources	2	2	T1, R7	55-76	BB
2		Current sources as active loads	1	3	T1, R7	77-79	BB
3		Voltage References, BJT Differential amplifier with active loads	1	4	R7,T1	50-65	BB
4		Basic information about op-amps	1	5	T1, R2	37-50	BB
5		Internal circuit diagrams of IC 741	2	7	T1	82-89	BB
6		DC performance	1	8	T1, R1	104-111	BB
7		AC performance characteristics, slew rate	1	9	T1, R1	111-127	BB
8		Open and closed loop configurations	2	11	T1,R1	42-50	BB
UNIT 2 - APPLICATIONS OF OPERATIONAL AMPLIFIERS							
9	II	Sign Changer, Scale Changer, Phase Shift Circuits	1	12	T1,R1	42-49	BB
10		Voltage follower , V-to-I and I-to-V converters	1	13	T1, R1	49-50, 146-147	BB
11		Adder, subtractor, Instrumentation amplifier	1	14	T1, R1	135-144	BB
12		Integrator, Differentiator	1	15	T1,R1	164-175	BB
13		Logarithmic amplifier, Antilogarithmic amplifier	1	16	T1	155-159	BB
14		Comparators, Schmitt trigger	2	18	T1,R1	207-216	BB
15		Precision rectifier	1	19	T1,R2	148-150	BB
16		peak detector, clipper and clamper	1	20	T1, R2	151-153	BB
17		Low-pass Butterworth filters	1	21	T1,R1	262-271	BB
18		high-pass and band-pass Butterworth filters	1	22	T1,R1	271-277	BB
UNIT 3 - ANALOG MULTIPLIER AND PLL							
19	III	Analog Multiplier using Emitter Coupled Transistor Pair	1	23	T2, R7	615-616	BB
20		Gilbert Multiplier cell	2	25	T2, R7	617-621	BB
21		Variable trans conductance technique	1	26	T2, R7	616-617	BB
22		Analog multiplier ICs and their applications	1	27	T2	622-624	BB

23		Operation of the basic PLL, Closed loop Analysis	1	28	T1, R1	327-333	BB
24		Voltage controlled oscillator	1	29	T1, R1	334-337	BB
25		Monolithic PLL IC 565	1	30	T1, R1	337-342	BB
26		Application of PLL for AM detection, FM detection, FSK modulation and demodulation, Frequency synthesizing.	1	31	T1, R1	342-345	BB
UNIT 4 - ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS							
27	IV	Analog and Digital Data Conversions, D/A converter – specifications	1	32	T1,R2	348-349, 366-368	BB
28		Weighted resistor type, R-2R Ladder type	1	33	T1,R2	349-354	BB
29		Voltage Mode and Current-Mode R - 2R Ladder types	2	35	T2,R2	570-572	BB
30		Switches for D/A converters	1	36	T2	572-574	BB
31		High speed sample-and-hold circuits	1	37	T2	574-576	BB
32		A/D Converters – specifications - Flash type - Successive Approximation type	1	38	T1,R2	357-363	BB
33		Single Slope type – Dual Slope type	1	39	T1	363-366	BB
34		A/D Converter using Voltage –to - Time Conversion - Over-sampling A/D Converters	1	40	T2	595-599	BB
UNIT 5 - WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs							
35	V	Sine-wave generators, Multivibrators	1	41	T1,R2	222-228, 216-220	BB
36		Triangular wave generator, Saw-tooth wave generator	1	42	T1,T2	220-222	BB
37		ICL8038 function generator	1	43	T1	229-232	BB
38		Timer IC 555	1	44	T1,R2	311-324	BB
39		IC Voltage regulators – Three terminal fixed and adjustable voltage regulators	1	45	T1,R2	241-248	BB
40		IC 723 general purpose regulator, Monolithic switching regulator	1	46	T1	248-255	BB
41		Switched capacitor filter IC MF10	1	47	T1,R1	288-293, 298-300	BB
42		Frequency to Voltage and Voltage to Frequency converters	1	48	T1,R1	180-184	BB
43		Audio Power amplifier, Isolation Amplifier	1	49	T1,R1	188-194	BB
44		Video Amplifier	1	50	T1	194-196	BB
45	Opto-couplers and fiber optic IC	1	51	T1	198-204	BB	

COURSE OUTCOME**At the end of the course, the student should be able to:**

- Design Linear and Non-linear applications of op-amp.
- Design applications using analog multiplier and PLL.
- Design DAC and ADC using op-amps.
- Generate waveform using op-amp circuits.
- Analyze special function ICs

CONTENT BEYOND THE SYLLABUS**CONTINUES INTERNAL ASSESSMENT DETAILS**

ASSEMENT NUMBER	I	II	MODEL
TOPIC NO.(UNIT)	(1 st & 2 nd units)	(3 rd & 4 th units)	(units 1-5)

ASSIGNMENT DETAILS

ASSIGNMENT NUMBER	I	II	III
TOPIC NUMBER FOR REFERENCE	(1 st & 2 nd units)	(3 rd & 4 th units)	(units 1-5)
DEAD LINE			

ASSIGNMENT NUMBER	BATCH	DESCRIPTIVE QUESTIONS/TOPIC (Minimum of 8 Pages)
I		1. JFET operational Amplifiers
II		1. Principle of PLL and applications of PLL
III		1. IC723 general purpose regulator