Programme	**:**	**Diploma in ET**/CE/EE//ME/MT/CM/IT/DDGM
Programme Code	**:**	01/02/**03**/04/05/06/07/08/21/22/**23**/24/26/16/**17**
Name of Course	**:**	**Linear Integrated Circuits**
Course Code	**:**	**ET 386**

Teaching Scheme:

	Hours /Week	**Total Hours**
Theory	**03**	**48**
Practical	**02**	**32**
Tutorial	**01**	**16**

Evaluation Scheme:

	Progressive Assessment	**Semester End Examination**			
		Theory	**Practical**	**Oral**	**Term work**
Duration	**Two class tests, each of 60 minutes**	**3 Hrs.**	**3 Hrs.**	**--**	**--**
Marks	**20**	**80**	**25**	**--**	**--**

Course Rationale:

The physical world is inherently analog, indicating that there is always need for analog circuitry. Today the growth of any industry is depend upon electronics to a great extent. This subject acquaints students with general analog principles and design methodologies using practical devices & application. It focus on process of learning about signal conditioning, signal generation, instrumentation, timing & control using various IC circuitry.

Course Objectives:

Learning of this subject will help the student to gain the following information

•	Describe working principle of OPAMP and its application
•	In defining the Op-amp characteristics.
•	To learn the features and advantages of integrated circuits.
•	Design electronic circuit using OPAMP for various mathematical operation.
•	Design electronic circuit using OPAMP for industrial application.
•	Design electronic circuit using timer IC's
•	In analyzing the response of frequency selective circuit such as PLL with respect to the incoming signal.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Marks
1.	**Operational Amplifier (Op-Amp):**		
	1.1 Importance of Op-Amp: 1.2 Block diagram of Op-Amp and function of each block with the circuit such as balanced, Unbalanced, differential amplifiers with simple current source, level shifter and complementary push-pull amplifier. 1.3 Parameters of Op-Amp: Input offset voltage, Input offset current, Input bias current, differential input resistance, Input capacitance, Input voltage range, offset voltage adjustment range, Common Mode Rejection Ratio (CMRR), Supply Voltage Rejection Ratio(SVRR), large signal voltage gain and transfer characteristics, supply voltages, supply current, output voltage swing, output resistance, slew rate, gain bandwidth product, output short circuit current 1.4 Ideal op-amp: electrical characteristics 1.5 Ideal voltage transfer curve 1.6 OPAMP IC's: 741 pin diagram and pin function 1.7 Open loop and closed loop configuration of op-amp, its comparison 1.8 Basic concept of frequency compensation of op-amp	**09**	**14**
2.	**OP-AMP basic circuits:**		
	2.1 Virtual ground concept 2.2 Open loop configuration – Inverting , Non-inverting 2.3 Close loop configuration – Inverting, non- inverting, differential amplifier, unity gain amplifier (voltage follower) inverter (sign changer) 2.4 Inverting & non-inverting configuration of Adders (summing amplifier, scaling Amplifier, averaging amplifier),Substractor 2.5 Basic Integrator 2.6Basic Differentiator 2.7 Numerical based on designing of above circuits	**09**	**14**
3.	**Applications of Op-Amp:**		
	3.1 Instrumentation amplifier using two three OPAMP requirements		

	,Circuit diagram, circuit operation, derivation of output voltage equation advantages & applications. Pin diagram pin functions and specifications of IC LM 324 3.2Voltage to current converter (with floating load, with grounded load) Current to voltage converter. 3.3 Sample and hold circuit 3.4Logarithmic and antilogarithmic amplifiers (using Diodes)Analog divider and analog multiplier 3.5 Concept of comparator: zero crossing detector,Schmitt trigger, window detector, phase detector, active peak detector, peak to peak detector	**12**	**16**
4.	**Filters**		
	4.1Introduction to filters 4.2 Classification of filters 4.3 Merits & demerits of active filters over passive filters 4.4 Concept of passive & active filters 4.5Ideal and actual characteristics, terms: - cut off frequency, pass band, stop band, center frequency, roll off rate, BW, Q-factor, first order & second order Butterworth filters 4.6 Low pass filter, high pass filter, band pass filter(wideband pass , narrow band pass filter) Band reject filter(wide band reject, narrow band reject filter), all pass filter 4.7 Numerical based on design of different filters.	**08**	**14**
5.	**Timers:**		
	5.1 Introduction to timer IC 555 5.2 Block diagram of IC 555 and its pin diagram & function of each pin 5.3 Concepts of different timer circuits used in industries: water level controller, touch plate switch, frequency divider etc. 5.4 Monostable multivibrator, astable multivibrator, bistable multivibrator, Schmitt trigger, voltage controlled oscillator 5.5 IC 556 features , pin diagram and specifications 5.6 Numerical based on timers	**08**	**14**
6.	**PLL**		
	6.1IC 565 (phase lock loop), its block diagram and pin diagram, 6.2 IC566 (voltage controlled oscillator) , its block diagram and pin diagram, 6.3 Application of PLL as frequency multiplier, FM demodulator.	**04**	**08**
	TOTAL	**48**	**80**

List of Practical/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment
1.	To assemble inverting and non inverting amplifier and draw input output waveforms.
2.	To assemble adder using OPAMP
3.	To assemble substractor using OPAMP
4.	Observe output of active integrator for different types of input (sine and square)
5.	Observe output of active differentiator for different types of input (sine and square)
6.	Study of input and output for V to I converter and I to V converter
7.	To assemble zero crossing detector
8.	Study of astable multivibrator using IC555
9.	Study of Bistable multivibrator using IC555
10.	Study of Monostable multivibrator using IC555
11.	Study of Schmitt triggers using IC 555.
12.	Plot the frequency response of first order butterworth low pass filter.
13.	Plot the frequency response of first order butterworth band pass filter/ band reject filter.
14.	Plot the frequency response of second order butterworth high pass filter
15	Plot the frequency response of second order butterworth low pass filter
16	Plot the characteristics of PLL

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Operational Amplifier (Op-Amp):	Classroom Teaching
2.	OP-AMP basic circuits:	Classroom Teaching & Laboratory work
3.	Applications of Op-Amp:	Classroom Teaching & Laboratory work
4.	Filters	Classroom Teaching & Laboratory work
5.	Timers	Classroom Teaching & Laboratory work
6.	PLL	Classroom Teaching ,Projector & PPTs

Reference Books:

Author	Title	Publisher
SergioFranco	Design with OPAMP & analog integrated ckts	Tata McGraw-hill New Delhi
G B Clayton	Operational Amplifiers	British library cataloguing in publication data
William d. Stanley	Operational Amplifier with Linear Integrated Circuits	Pearson Education
Ramakant Gaikwad	Op-Amp & Linear Integrated Circuits	Prentice-hall of India New Delhi
Coughlin & Dirscoll	Operational amplifier & Linear Integrated circuits	Pearson Education
K.R. Botkar	Integrated circuits	Khanna Publisher, New Delhi
D Roy Choudhari & Salil Jain	Linear Integrated circuits	New Age International (P) Ltd. Publishers New Delhi

Learning Resources:
Reference Books, Manuals and journals of devices, Components brochures

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Operational Amplifier (Op-Amp):	4	6	4	14
2.	OP-AMP basic circuits:	4	8	2	14
3.	Applications of Op-Amp:	4	4	8	16
4.	Filters	4	6	4	14
5.	Timers	--	8	--	08
6.	PLL	--	10	4	14
Total		**16**	**42**	**22**	**80**

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