4140 - ANALOG ELECTRONICS

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
4	2	6	25	25	3 Hrs.	100	50/or	200

Pre-requisite	Source	Semester	Theory	Test	Total	TW	PR	Gr Total
4132,4135	EXN		75	25	100	25	50	175

Rationale: Analog electronic circuits are widely employed in Electronic Instrumentation and Control Circuits. The study of op-amps is thus indispensable in any course of Electronics.

COURSE CONTENTS	Hrs	Mks
	16	25

1. OPERATIONAL AMPLIFIER

DC amplifiers, concept of differential amplifiers, expression for CMRR. Emitter coupled differential amplifier.

Introduction :- Block diagram, Schematic diagram, Op-amp Equivalent circuits, Op-amp Parameters – I/P offset voltage, O/P offset voltage, I/P Bias current, I/P offset current, Total O/P offset voltage, Thermal drift, Temperature and supply voltage Sensitive parameters, Common mode configuration, common mode Rejection Ratio, Slew rate, PSRR.

Op-amp with negative feedback: Concepts of Negative feedback, effect of negative feedback, different types of feedback, voltage series circuits and voltage shunt feedback circuits.

Operational amplifier circuits: - Inverting, non-inverting, differential amplifiers, DC and AC amplifiers, summing Scaling and Averaging Amplifiers, Instrumentation Amplifier, Voltage to current converters, current to voltage converters. 16 25

2. WAVEFORM GENERATOR AND WAVE SHAPING

Sinewave Oscillator – Phase shift Oscillator, Quadrature Oscillator, Wein bridge Oscillator.

Square wave Generator – Astable and Monostable circuits, Triangular wave generator, Ramp and Pulse generator circuits staircase generator, study of W/F Generator.

Integrator, frequency compensation for Integrator and practical circuits.

Differentiator, frequency compensation for differentiator and practical circuits.

Clipper, Clamps, Precision rectifiers. 6 10

3. ACTIVE FILTERS

Introduction to Active filters, Butterworth low pass and high pass filters. Band pass filters – Wide band and narrow band, Band Reject Filters (Wide band and Narrow band). 6 10

4. COMPARATORS

Basic comparator, Zero crossing detector, Schmitt trigger, peak detector, sample and hold circuit, clippers, clampers, precision rectifiers. 8 12

5. PHASE LOCKED LOOPS

Phase locked loops :-VCO, operating principles, Block diagram of PLL, Transfer characteristics of PLL, Lock range, capture range. Applications of PLL, Study of IC 565

	6	10
6. VOLTAGE REGULATORS Operational amplifiers as a voltage regulator, IC voltage regulator circuits, short circuit protection and over voltage protection, switching regulators. Study of IC 723, IC 3085, IC 78 Series, IC 79 Series, LM 309.	6	8
7. ANALOG COMPUTER Basic block diagram of analogue computers, solution of differential equations, Amplitude scaling and time scaling (Quarter square Multipliers, Diode function Generator techniques and applications.)		
Total	64	100

LIST OF PRACTICALS : [ANY 8]

1. Determination of Op-amps parameters such as Input offset voltage, I/P offset current, slew rate, CMRR (3)
2. Op-amp as Adder, Subtractor, Scaler, Averager (2)
3. Op-amp as V-I Converter and I-V Converter (2)
4. Op-amp as W/F Generator for Sine, Square, Pulse, ramp, Triangular (3)
5. Op-amp as Integrator and Differentiator (2)
6. Op-amp as a Comparator (2)
7. Op-amp as Active filter (1)
8. AC Amplifier by using Op-amp (1)
9. Voltage Regulator – 78, 79 Series, 723 (3)
10. Study of PLCIC 565

REFERENCE BOOKS :

1. Operational Amplifiers by Ramakant Gayaekwad.
2. Integrated Circuits by K. R. Botkar
3. Operational Amplifiers by Clayton.
4. Analog Computer & Simulations by Rajaraman, Schamm series.