Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/Practical	Tutorial	Total
ETC505	Integrated Circuits	04	--	--	04	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
ETC505	Integrated Circuits	20	20	20	80	--	--	--	100

Course Pre-requisite:

- FEC105: Basic Electrical & Electronics Engineering
- ETC302: Analog Electronics-I
- ETC303: Digital Electronics
- ETC402: Analog Electronics-II

Course Objectives: To teach students

- Fundamentals of analog and digital integrated circuits.
- Design methodologies using practical integrated circuits.
- The application areas of integrated circuits.

Course Outcomes: After successful completion of the course student will be able to

- Understand the fundamentals and areas of applications for the Integrated Circuits.
- Analyze important types of integrated circuits of day-to-day requirements.
- Demonstrate the ability to design practical circuits that perform the desired operations.
- Understand the differences among theoretical, practical & simulated results in integrated circuits.
- Choose the appropriate integrated circuit modules to build a given application.

Module No.		Topics	Hrs.
1.		**Review of Operational Amplifier**	04
	1.1	Operational amplifier overview: parameters, open loop and closed loop configurations	
2		**Applications of Operational Amplifier**	12
	2.1	**Amplifiers:** Current amplifier, difference amplifier, instrumentation amplifier, and programmable gain amplifier	
	2.2	**Converters:** Current to voltage converters, voltage to current converters, generalized impedance converter, voltage to frequency converter, frequency to voltage converter, logarithmic converters and antilog converters	
	2.3	**Active Filters:** Second order active finite and infinite gain low pass, high pass, band pass and band reject filters	
	2.4	**Sine Wave Oscillators:** RC phase shift oscillator, Wien bridge oscillator, Quadrature oscillator	
3		**Non-Linear Applications of Operational Amplifier**	10
	3.1	**Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector, window detector and level detector	
	3.2	**Schmitt Triggers:** Inverting Schmitt trigger, non-inverting Schmitt trigger, and adjustable threshold levels	
	3.3	**Waveform Generators:** Square wave generator, triangular wave generator, and duty cycle modulation	
	3.4	**Precision Rectifiers:** Half wave, full wave, and applications	
	3.5	Peak detectors, sample and hold circuits	
4		**Special Purpose Integrated Circuits**	08
	4.1	**Functional block diagram, working, design and applications:** Timer 555	
	4.2	**Functional block diagram, working and applications:** VCO 566, PLL 565, multiplier 534, waveform generator XR 2206, power amplifier LM380	
5		**Voltage Regulators**	08
	5.1	Functional block diagram, working and design of three terminal fixed (78XX, 79XX series) and three terminal adjustable (LM 317, LM 337) voltage regulators.	
	5.2	Functional block diagram, working and design of general purpose 723 (LVLC, LVHC, HVLC and HVHC) with current limit and current fold-back protection, Switching regulator topologies, Functional block diagram and working of LT1070 monolithic switching regulator	
6		**Counters, Shift Registers and ALU (Logic Diagram and applications)**	10
	6.1	**MSI Counters:** Ripple counters (7490 decade, 7492 modulus-12, 7493 4-bitbinary), synchronous counters (74162 decade, 74163 4-bit binary, 74169 4-bit up/down binary)	
	6.2	**MSI Shift Registers:** 74164 serial input parallel output, 74166 parallel input serial output, 74191 serial input serial output, 74194 universal shift register	
	6.3	**Arithmetic Logic Unit:** 74181 ALU	
Total			52

Recommended Books:

1. Sergio Franco, "*Design with Operational Amplifiers and Analog Integrated Circuits*", Tata McGraw Hill, 3rd Edition
2. John F. Wakerly, "*Digital Design – Principles & Practices*", Pearson Education, 3rd Edition
3. J. Millman and A. Grabel, "*Microelectronics*", Tata McGraw Hill, 2nd Edition.
4. D. Roy Choudhury and S. B. Jain, "*Linear Integrated Circuits*", New Age International Publishers, 4th Edition
5. David A. Bell, "*Operation Amplifiers and Linear Integrated Circuits*", Oxford University Press, Indian Edition
6. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall, 4th Edition
7. R. F. Coughlin and F. F. Driscoll, "*Operation Amplifiers and Linear Integrated Circuits*", Prentice Hall, 6th Edition
8. J. G. Graeme, G. E. Tobey and L. P. Huelsman, "*Operational Amplifiers- Design & Applications*", New York: McGraw-Hill, Burr-Brown Research Corporation

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of two tests should be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each of 20 marks.
2. Total 4 questions need to be solved.
3. Question No.1 will be compulsory and based on entire syllabus wherein sub questions for 2 to 5 marks will be asked.
4. Remaining questions will be selected from all the modules