Course No.	Course Name	L-T-P-Credits	Year of Introduction
BM204	INTEGRATED CIRCUITS AND SYSTEMS	4-0-0-4	2016

Prerequisite : Nil

Course Objectives

To familiarize students with the Integrated Circuit fabrication technology, make them learn to design and analyze circuits using op-amp and also using some specialized ICs.

Syllabus

Overview of microelectronic fabrication technology, Introduction to operational amplifiers, important parameters, different configurations, difference, instrumentation, summing, log and antilog amplifiers , Integrator and differentiator, Comparators, window detector, peak detector circuit, precision rectifiers. Sample and hold circuit, ADC, DAC, Multivibrators, wave generators- Triangular and saw tooth - RC phase shift and Wien bridge oscillators. Active filters, Gyrator, Negative Impendence Converter- Universal Active Filters, All Pass filters, Switched Capacitive Filters. IC regulators, Timers – 555, Astable and monostable multivibrators using 555, VCO – 566. PLL - 565.

Expected Outcome

The student will

- Understand the different steps in microelectronic fabrication technology
- Develop the capability to analyze and design circuits using operational amplifiers
- Be introduced to the principle, working and applications of many specialized ICs

Text Books:

Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Pearson Education Asia. 4th ed.

References:

1. Coughlin & Driscoll: Op amps and Linear Integrated circuits - Pearson Education Asia.2000
2. Sergio Franco, Design with operational Amplifiers &Analog ICs, Tata McGraw Hill.1998
3. Millman & Grabel: Microelectronics, McGraw Hill International, 2nd edition.1988.
4. K R Botkar: Integrated circuits, Khanna Publishers, Delhi. 1991
5. Gray: Analog Integrated Circuits, John Wiely.
6. Horstian: Micro Electronics, Prentice Hall of India.
7. Sedra &Smith: Microelectronic circuits, Oxford University Press. 5th ed.
8. D A Bel, Opamps and Linear integrated Circuits, Prentice Hall of India.
9. Clayton: Operational Amplifiers, Butterworth &Co. (Publishers) Ltd.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	*Brief overview of microelectronic fabrication technology - Epitaxial Growth, Diffusion, Ion Implantation Processes* - Description - Fabrication of BJT, MOSFETs	5	15%
	Introduction to operational amplifiers, Internal block schematic of op amp - Power supply requirements	5	

II	Op-amp parameters - ideal op amp open loop gain – input and output impedance – frequency response, frequency compensation. Slew rate, Input bias current – offset - drift - compensating networks CMRR, SVRR, finite gain bandwidth and its effect in op amp circuit performance	5	**15%**
	Open loop and closed loop op amp configurations: Feedback configurations- Voltage series feedback and voltage shunt feedback - concept of virtual ground - voltage follower - V/I &I/V converters and their applications.	5	
FIRST INTERNAL EXAM			
III	Difference amplifiers with one op amp and 3 op amps - Use of offset minimizing resistor (ROM) and its design. Instrumentation amplifier - *IC and its application*.	4	**15%**
	Op amp applications - Summing - Difference – *Log and Antilog amplifiers* - Integrator and differentiator. Comparators: zero crossing – with reference voltage - regenerative (Schmitt trigger) comparators, window detector. Peak detector circuit. Precision rectifiers.	5	
IV	Sample and hold circuit. ADC -successive approximation, flash, integrating types. DAC – weighted, R-2R types, ADC&DAC – performance specifications	5	**15%**
	Multivibrators- Astable and monostable – Design and working. Wave generators- Triangular and saw tooth - RC phase shift and Wien bridge oscillators.	4	
SECOND INTERNAL EXAM			
V	Active Filters : Transfer functions – LPF, HPF, BPF, BRF Approximation methods –Butter worth – Chebyshev - ActiveFilters - I order and II order filters, Quality factor –Design	5	**20%**
	Gyrator- Negative Impedance Converter- Universal Active filters –All Pass filters, Switched Capacitive Filters	4	
VI	Specialized ICs and applications: IC regulators - 723 (block diagram, typical low voltage regulator circuit), *78XX*, *79XX*, 317 - applications.	4	**20%**
	Timers - 555 – Functional block diagram- Astable and monostable multivibrators using 555 -applications. VCO – 566. PLL - Block diagram and derivation of capture range, lock range and pull in time- 565 – applications.	5	
END SEMESTER EXAM			

***Note*: Topics in italics are self-study topics.**

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There shall be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There shall be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There shall be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.