Master of Science in Physics

M. Sc. (Physics) Semester I

Course Code	**PS01CPHY53**	Title of the Course	**Analog and Digital Electronics**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. The content of this paper is useful for students to develop the basic understanding of analog circuits which are directly applicable in day today electronic systems. 2. Similarly, the digital circuits which constitute the base for advanced systems are also covered in this paper. Thus, this course exposes students to understanding of i) various fundamental electronic devices, components and basic circuits. ii) varied digital circuitry and their operation.

Course Content		
Unit	Description	Weightage* (%)
1.	*PN Junction Based Devices:* Carrier Statistics in P N Junction-Barrier Potential and I-V Characteristics, Applications of P-N junctions- Diode as clipper, Diode as a clamper circuit, Diode as a switch, Reverse Recovery time of diode, optoelectronic devices, light emitting diode, photodiode and phototransistor, solar cells, Uni-junction Transistor, Silicon control rectifier, DIAC and TRIAC.	25%
2.	*Non-linear Integrated Circuits:* Block diagram of Operational Amplifier IC 741, Characteristics and parameters of Op-Amp, Non-Linear Applications of Op-Amp- comparator, Schmitt Trigger, UTP and LTP adjustments, Voltage Controlled Oscillator using IC-741, Timer IC 555 block diagram, Timing waveform generators using IC 555 Astable multivibrator and monostable multivibrator	25%
3.	*BCD Codes and Digital Circuits:* Review of Binary Coded Decimal codes, Boolean functions, Min-terms and Max-terms. Karnaugh Mapping, Tri-state logic, positive and negative logic, signed binary numbers. Arithmetic logic circuits: Adders- Half adder and Full adder, Subtractors, comparators, Combinational and Sequential Circuits- Decoders, De-multiplexers, Encoders, Multiplexers, Registers and Counters.	25%
4.	*Applications of Digital Circuits***:** Semiconductor Memories: Read Only Memory, Programmable Read Only Memory, Erasable	25%

	Programmable Read Only Memory & Random Access memory, expanding memory size. Digital to Analog and Analog to Digital Convertors: Resistive divider, Binary ladder, Digital to Analog Convertor using OPAMP, specifications, parallel comparators, counter method & approximation methods.	

Teaching-Learning Methodology	Direct black board teaching supported by PPT presentation, providing web links etc., giving real time examples, models etc. The theory topics related experiments are also included in the laboratory session in order to establish good understanding of key concepts of important applications oriented topics.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	After undergoing the course, the students will get insight of the operation of different advanced electronic devices, circuit concepts and digital circuit discernment. They will then be able to understand and design the analog circuits using Clippers and Clampers, Op-Amp, Timer etc. At the same time, they can design the basic building blocks of digital electronic circuits which will be further used in the microprocessors.

Suggested References:	
Sr. No.	References
1.	Solid State Pulse Circuits by David A. Bell; Prentice Hall of India, New Delhi (1991)
2.	Digital Principles and Applications by Donald P Leach, Albert Paul Malvino and Gautam Saha, Tata McGraw Hill Education Pvt. Ltd., 8th Edition, New Delhi.(2015)

3.	Microelectronics: Digital and Analog by K. R. Botkar, Khanna Publishers (1991)
4.	Integrated Circuits by K. R. Botkar, Khanna Publishers (1987)
5.	Electronic Devices & Components by J. Seymour, Longman (1989)
6.	Operational Amplifier by Ramakant Gaekwad (2019)
7.	Fundamentals of Digital Circuits by A. Anandkumar, Prentice-Hall India (2014).

On-line Resources
neurophysics.ucsd.edu *learn.sparkfun.com* www.freebookcentre.net www.ntnu.edu www.glos.ac.uk