Course: M.Sc (Physics)

Semester	1
Paper Number	4 (MPHC4151)
Paper Title	Core Lab I and Computational Techniques
No. of Credits	6
Course description/objective	**Group A:** Designing analog circuits required in communication, signal transmission and processing and interfacing with digital devices using silicon electronic devices such as transistors and Op Amps **Group B:** Getting equipped with different plotting, numerical and typographical tools for scientific computing and scientific documentation through Octave, gnuplot and LaTeX.
Course Outcome	**Group A:** CO1: Acquiring the skill of using IC741 to design Active filters. CO2: Acquiring the skill of using BJT to design a multivibrator and a VCO. CO3: Acquiring the skill of using the UJT to design a saw-tooth generator. CO4: Studying MOS transistors and its applications. CO5: Designing certain types of ADC and DAC using discrete components and ICs. CO6: learning to program 8085 and 8051 using Assembly language. CO7: Learning to design and implement passive T and Pi filters. **Group B:** CO1: Learning about electronic lab notebook and typesetting CO2: Learning LaTeX for scientific type-setting and article writing CO3: Learning scientific computing and different tools of computing through Octave
Syllabus	**Group A: Core Lab-I (Electronics)** 1. Design of Passive Filters: Symmetric T- and Π- filters (LPF and HPF) designed using inductances and capacitances 2. Design of Active Filters: LPF, BPF, HPF and Notch filters designed using OPAMP IC – 741C. 3. Design of oscillators: Astable multivibrator designed using BJT as a square wave generator as well as VCO. Relaxation oscillator designed using UJT (2N 2646) 4. Design of A/D and D/A converters using discrete components 5. Experiment with MOS device: Drain and Transfer characteristic of MOSFET (Depletion and Enhancement mode) 6. Programming a micro-processor (8085) and interfacing using a 7 – segment display (Counting of pulses). 7. Programming a micro-controller (80851) [36 Lectures] **Group B: (Lab) (Computational Techniques)** Brief Introduction to ELN Matlab/Scilab/Octave: Matrix computing, Matrix vs. Array operations, Storage, Constants (e, pi, Inf,NaN etc) and Test matrices (Hadamard, Pascal, Magic etc). Simple applications using signals and images. Data Visualization: 2D/3D/Interactive plotting, Curve fitting, Interpolation and root finding (tools and algorithms).

	Scientific Report writing: The LaTeX ecosystem, Document structure, Commands and Environments, Typesetting Mathematics, Including graphics and generating bibliographies. [36lectures]
References	**Group A:** 1. Foundation of solid state devices by Streetman and Banerjee, Pearson 2.Digital Electronics by Malvino and Leach, Tata McGraw Hill 3. Electronic Communication by Roddy and Coolen , Pearson 4. P. B. Zbar and A. P. Malvino – Basic Electronics: A text-lab manual (Tata-McGraw Hill Publ. Co.) **Group B:** 1. Leslie Lamport, A Document Preparation System LATEX, Users guide and Reference Manual 2. John W. Eaton, David Bateman, Søren Hauberg, Rik Wehbring, GNU Octave: Free your numbers 3. Jason Lachniet, Introduction to GNU Octave:
Evaluation	Total: 100 Group A: CIA: 30 marks (10 (LNB) + 20 (Lab performance)) Group B: CIA: 30 marks (10 (LNB) + 20 (CIA Exam)) End Semester Examination: 20 marks (Group A) + 20 marks (Group B)