Semester IV						
Sr No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH 202	Classical Mechanics	2	1	0	6
2	PH 203	Quantum Mechanics - I	2	1	0	6
3	EE 224	Digital Systems	2	1	0	6
4	CS 301	Computer Architecture	3	0	0	6
5	CS 311	Computer Architecture Laboratory	0	0	3	3
6	EE 214	Digital Circuits Laboratory	0	0	3	3
7	EE 212	Devices and circuits Lab	0	0	3	3
		Total Credits				27

1	**Title of the course (L-T-P-C)**	**Classical Mechanics (2-1-0-6)**
2	**Pre-requisite courses(s)**	**Nill**
3	**Course content**	Review of Newtonian Mechanics - Newton's Laws of Motion and Conservation Laws. Principles of Canonical Mechanics - Constraints and generalized coordinates, Alembert's principle, Lagrange's equation, Hamilton's variational principle, canonical systems, symmetries, and conservation laws, Noether's theorem, Liouville's Theorem. Central Force: Equations of motion Virial Theorem, Kepler's Laws, Scattering in a Central Force Field. Rigid Body: Euler angles, Coriolis Effect, Euler equations, moment of inertia tensor, motion of asymmetric top. Small Oscillations: Eigen value problem, frequencies of free vibrations and normal modes, forced vibration, dissipation. Special Theory of Relativity: Newtonian relativity, Michelson-Morley experiment, Special theory of relativity, Lorentz transformations and its consequences, addition of velocities, variation of mass with velocity, mass-energy relation, Minkowski four-dimensional continuum, four vectors. Hamiltonian Equation, Gauge transformation, canonical transformation, Infinitesimal transformation, Poisson brackets, Hamilton-Jacobi equations, Separation of variables. Lagrangian and Hamiltonian formulation of continuous systems.
4	**Texts/References**	**1.** Classical Mechanics: H. Goldstein, C. P. Poole, and J. Safko, Pearson 2011. **2.** Classical Mechanics: N. C. Rana and P. S. Joag, Tata McGraw Hill, 2017. **3.** Introduction to Classical Mechanics: David Morin, Cambridge University Press, 2008. **4.** Mechanics: L.D. Landau and E. M. Lifshitz, Butterworth-Heinemann, 3rd edition, 1982. **5.** Mechanics: From Newton's Laws to Deterministic Chaos, F. Scheck, Springer, 5th edition, 2010. **6.** Introduction to Classical Mechanics, R G Takwale and P S Puranik, Tata McGraw Hill, 2008.

1	**Title of the course (L-T-P-C)**	**Quantum Mechanics - I** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	PH101 MA101
3	**Course content**	Review of Wave mechanics, Schrodinger equation, Uncertainty principle, wave packets, group velocity and phase velocity. Postulates of quantum mechanics, probability and probability current density, operators, eigenvalues and eigenfunctions. Bound states, delta-function potential, and harmonic oscillator. Formalism: Hilbert space, Observables, Eigenfunctions of Hermitian operator, Dirac's notation, matrix representations of vectors and operators, parity operation, matrix theory of harmonic oscillator. Theory of Angular Momentum: Spherical harmonics, eigenvalues of L^2 and L_z, addition of angular momentum, commutation relations, degeneracies. Hydrogen atom, quantum numbers, two particle systems
4	**Texts/References**	1. Introduction to Quantum Mechanics, D. J. Griffiths and D. F. Schroeter, Cambridge University Press, 3rd edition, 2019. 2. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press, 2017. 3. Principles of Quantum Mechanics, R. Shankar, Springer, 2014. 4. Quantum Physics, S. Gasiorowicz, John Wiley, 2000. 5. Quantum Mechanics, L. D. Landau and E.M. Lifshitz, Pergamon press, 1965

1	**Title of the course (L-T-P-C)**	**Computer Architecture (3-0-0-6)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The Language of Bits, Assembly Language, Logic Gates, Registers, and Memories, Processor Design, Principles of Pipelining, The Memory System, Multiprocessor Systems, I/O and Storage Devices. Each concept will be first taught on the basis of the fundamental driving principles. Following this, real world examples (e.g., ARM processors) will be used to emphasize the content. .
4	**Texts/References**	**1.** Computer Organization and Architecture, by Smruti Ranjan Sarangi, McGraw Higher Ed, 2017. **2.** Computer Architecture A Quantitative Approach,Sixth edition, by David Patterson and John L. Hennesy,Morgan Kaufmann, 2017.

1	**Title of the course (L-T-P-C)**	**Computer Architecture Laboratory (0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	The lab will closely follow the theory course. The idea isto have the students develop a software model of a simple processor, capturing both functionality and timing aspects. They will implement modules as the concepts aretaught in class.
4	**Texts/References**	Nil

1	**Title of the course (L-T-P-C)**	**Digital Systems (2-1-0-6)**
2	**Pre-requisite courses(s)**	None
3	**Course content**	• Introduction to Digital Systems • Number systems and Logic: Number Systems, Different Codes, Boolean logic, basic gates, truth tables. • Introduction to Logic families: TTL, CMOS etc. • Boolean Algebra: Laws of Boolean Algebra, logic minimization using K maps • Combinational Logic Circuits: Adders, Subtractors, Multipliers, MSI components like Comparators, Decoders, Encoders, MUXs, DEMUXs • Sequential circuits: Latches, Flipflops, Analysis of clocked sequential circuits, Registers and Counters (Synchronous and Asynchronous), State Machines • Introduction to Hardware Description Languages • Array based logic elements: Memory, PLA, PLD, FPGA • Special Topics: Asynchronous State machines, Testing and Verification of Digital Systems
4	**Texts/References**	**1.** J. F. Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 **2.** M. Moris Mano; Digital Design, 4th Edition, Pearson,2009 **3.** Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009 **4.** H.Taub and D. Schilling; Digital Integrated Electronics, McGraw Hill, 1977 Charles H Roth; Digital Systems Design using VHDL, Thomson Learning, 1998.

1	**Title of the course (L-T-P-C)**	**Digital Circuits Laboratory (0-0-3-3)**
2	**Pre-requisite courses(s)**	Digital Systems Theory (EE224)
3	**Course content**	The purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab:Experiments with discrete ICs **1.** Introduction of digital ICs **2.** Realizing Boolean expressions **3.** Adder/Subtractor **4.** Shift registers. **5.** Synchronous Counters **6.** Asynchronous Counters + 7- segment display **7.** Finite State Machines (2 weeks) Experiments with CPLDs **8.** Arithmetic and Logic Unit **9.** LCD, Buzzer Interfacing Pipelining
4	**Texts/References**	**1.** M. Moris Mano; Digital Design, 5th Edition, Pearson, 2009 **2.** J. F. Wakerly: Digital Design, Principles and Practices,4th Edition, Pearson Education, 2005 **3.** Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009

1	**Title of the course (L-T-P-C)**	**Devices and circuits Lab (0-0-3-3)**
2	**Pre-requisite courses(s)**	--
3	**Course content**	This lab will reinforce concepts thought in electronic devices and analog circuits. It will have experiments on Device characterization and circuits design and characterization. The following is the tentative list of experiments for this lab: **1.** LED and Photodiode characterization **2.** BJT biasing and CE amplifier. **3.** Solar cell characterization **4.** Diode Temperature characteristics **5.** NMOS characterization and CS amplifier **6.** MOS differential amplifier **7.** basic opamp circuits **8.** Active filters **9.** Multivibrators **10.** Audio amplifiers
4	**Texts/References**	**1.** J.V.Wait, L.P.Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. **2.** J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. **3.** Behzad Razavi, Fundamentals of microelectronics, Wiley Publications **4.** A.S.Sedra and K.C. Smith,Microelectronic Circuits, Saunder's College Publishing, Edition IV, 2017. **5.** Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4thedition, Pearson, 2000.