Semester V						
Sr No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	PH 201	Electrodynamics	2	1	0	6
2	PH 304	Statistical Physics	2	1	0	6
3	PH 302	Quantum Mechanics-II	2	1	0	6
4	EE 229	Electronic Devices (Pre Mid Sem)	3	0	0	3
5	PH 212	General Physics Laboratory	0	0	3	3
6	EE 202	Introduction to Analog Circuits (post mid sem)	2	1	0	3
7		HSS Elective-II	3	0	0	6
		Total Credits				**33**

1	**Title of the course** (L-T-P-C)	**Electrodynamics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Successful completion of PH102
3	**Course content**	Review of electrostatics and magnetostatics. Electrodynamics: Differential and integral forms of Maxwell's equations, Scalar and vector potentials, gauge transformations, Coulomb and Lorentz Gauge; Maxwell's equations in terms of potentials. Energy and momentum in electrodynamics. Electromagnetic waves: Electromagnetic waves in non-conducting media: Monochromatic plane waves in vacuum, propagation through linear media; Boundary conditions; Reflection and transmission at interfaces. Fresnel's laws; Electromagnetic waves in conductors: Modified wave equation, monochromatic plane waves in conducting media, Dispersion: Dispersion in non-conductors, free electrons in conductors and plasmas. Guided waves. Retarded potentials, Electric dipole radiation, magnetic dipole radiation. Radiation from a point charge: Lienard-Wiechart potentials, fields of a point charge in motion, power radiated by a point charge. Electrodynamics and Relativity: Review of special theory of relativity, Lorentz transformations, Minkowski four vectors, energy-momentum four vector, covariant formulation of mechanics; Transformation of electric and magnetic fields under Lorentz transformations, field tensor, invariants of electromagnetic field, Covariant formulation of electrodynamics, Lorentz force on a relativistic charged particle. Waveguides, Resonant Cavities and Optical Fibers, Basics of Antennas.
4	**Texts/References**	**1.** D. J. Griffith: Introduction to Electrodynamics, 4th edition, Pearson, 2015. **2.** J.D. Jackson: Classical Electrodynamics, Wiley student edition, 3rd edition, 2007. **3.** Modern Electrodynamics, Andrew Zangwill, Cambridge University Press, 2012. **4.** Foundations of Electromagnetic Theory, J. R. Reitz, F. J. Milford, and R. W. Christy, Addison-Wesley, 4th edition, 2008. **5.** W K H Panofsky and M Philips: Classical Electricity and Magnetism Addison Wesley, 2nd edition, 1962. **6.** W Greiner: Classical Electrodynamics, Springer, 1998. **7.** Hayt, William H., Jr., and John A. Buck, "Engineering Electromagnetics", 7th ed. McGraw-Hill, 2006. **8.** M.A. Heald and J.B. Marion, Classical Electromagnetic Radiation, Saunders, 1983.

1	**Title of the course** (L-T-P-C)	**Statistical Physics** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	None
3	**Course content**	Thermodynamics: Thermal equilibrium, the laws of thermodynamics; temperature, energy, entropy, and other functions of state. Probability Theory: Probability densities, cumulants and correlations; central limit theorem; laws of large numbers. Kinetic Theory: Phase space densities; Liouville's theorem, the Boltzmann equation; transport phenomena. Classical Statistical Mechanics: Postulates; microcanonical, canonical and grand canonical ensembles; Gibb’s paradox, non-interacting examples. Maxwell Boltzmann distribution, ideal gas. Quantum Statistical Mechanics: Indistinguishability, Bose-Einstein and Fermi- Dirac distributions and Applications Interacting Systems: Virial and cluster expansions; van der Waals theory; liquid- vapor condensation. Quantization effects in molecular gases; phonons, photons; density matrix formulation. Identical Particles: Degenerate quantum gases; Fermi liquids; Bose condensation; superfluidity.
4	**Texts/References**	**1.** Huang, Kerson. Statistical Mechanics. 2nd ed. Wiley, 1987. **2.** Baierlein, Thermal Physics (Cambridge University Press, 1999). **3.** Pathria, R. K. Statistical Mechanics. Pergamon Press, 1972. **4.** Ma, Shang-keng. Statistical Mechanics. Translated by M. K. Fung. World Scientific Publishing Company, 1985. **5.** J. K. Bhattacharjee, Statistical Physics: Equilibrium and Non-Equilibrium Aspects, Allied Publishes, 2000 **6.** F. Reif, Fundamentals of Statistical and Thermal Physics Statistical Physics :Amit and Verbin, Word Scientific, 1999

1	**Title of the course** (L-T-P-C)	**Quantum Mechanics-II (2-1-0-6)**
2	**Pre-requisite courses(s)**	PH101-Quantum Physics and Applications Quantum Mechanics - I
3	**Course content**	Time independent Perturbation Theory – Zeeman and Stark effects. Wentzel–Kramers–Brillouin approximation Variational method Time dependent perturbation theory, Scattering Theory, Born Approximation, Partial Wave analysis, Path Integral approach to Quantum Mechanics, Relativistic Quantum Mechanics Introduction to Quantum Field Theory, Quantization of free scalar field. Master equations, open and closed quantum system dynamics.
4	**Texts/References**	1. Modern Quantum Mechanics, J J Sakurai, Addison-Wesley, Reading, MA, 1994 2. Advanced Quantum Mechanics, J J Sakurai, Pearson, 1967. 3. Quantum Mechanics (Vol 1 and 2), C. Cohen-Tannoudji, B. Diu, and F. Laloe, Wiley VH; 2nd edition 2019. 4. R. Shankar, Principles of Quantum Mechanics, 2nd Ed. (Plenum Press, New York, 1994) 5. Quantum Mechanics and Path Integrals, R. P. Feynman and A. R. Hibbs, McGraw-Hill, New York, 1965. 6. An Introduction to Quantum Field Theory, M.E. Peskin, D. V. Schroeder, Westview Press, 1995. 7. The theory of open quantum systems, H. P. Breuer and F. Petruccione, Oxford University Press, 2002.

1	**Title of the course** (L-T-P-C)	**Electronic Devices** **(3-0-0-3)**
2	**Pre-requisite courses(s)**	EE 102
3	**Course content**	• Introduction of Semiconductor Equations: Fermi- **Dirac Distribution, Boltzmann's approximation** • Semiconductor Diodes: Barrier formation in metal- semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. • Field Effect Devices: JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion and inversion; MOSFET characteristics and small signal models. • Bipolar transistors: IV characteristics and Elers-Moll model; small signal models; Charge storage and transient response
4	**Texts/References**	1. D. A. Neamen, Semiconductor Physics and Devices, 4e Edition, McgrawHill, 13th reprint, 2016. 2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988. 3. B.G. Streetman, Solid State Electronic Devices, 7th Edition, Pearson, 2016. 4. J. Millman and A. Grabel, Microelectronics, II edition 34th reprint McGraw Hill, International, 2017. 5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991. 6. R.T. Howe and C.G. Sodini, Microelectronics : An integrated Approach, Prentice Hall International, 1997.

1	**Title of the course** (L-T-P-C)	**Introduction to Analog Circuits (3-0-0-3)**
2	**Pre-requisite courses(s)**	Network theory, Electronic Devices
3	**Course content**	**Part 1: Linear circuits** • Introduction to feedback control – Integral control and proportional control • Linear circuits using Op-amps (amplifiers, arithmetic circuits, filters and oscillators) **Part 2: Need for Non-linearity for amplification** Single stage amplifiers, frequency response, Current mirror circuits, Differential amplifier.
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.** Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4th edition, Pearson, 2000. **4.** P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989. **5.** Behzad Razavi , "Fundamentals of Microelectronics," John Wiley, 2013.