VIKRAMA SIMHAPURI UNIVERSITY::NELLORE
DEPARTMENT OF PHYSICS

Syllabus for M.Sc. Physics (2 Year Course) for V.S. University Constituent College(s) and Affiliated Colleges under the jurisdiction of Vikrama Simhapuri University, Nellore with effect from the Academic Year 2020-2021

Semester –I

S. No.	Course Code	Course title	Course Focus on (Employability/ Entrepreneurship/ skill development/ project/ Field work/Internship)	Relevant of developmental needs (Local/ Regional/ National/ Global)	Hours/ Week	Credits	Internal assessment marks	University assessment marks	Max. Marks
1.	PHY 101	Classical Mechanics and Theory of Relativity	Employability	Global	5	4	30	70	100
2.	PHY102	Atomic and Molecular Physics	Employability	Global	5	4	30	70	100
3.	PHY 103	Solid State Physics	Employability	Global	5	4	30	70	100
4.	PHY104	Analog and Digital Electronics	Employability	Global	5	4	30	70	100
5.	PHY105	Human Values and Professional Ethics	Skill development	Global	4	0	30	70	100
6.	PHY 106	Paper 1& 3 (General Lab)	Skill development	National	6	4	--	100	100
7.	PHY 107	Paper 3 & 4 (Electronics Lab)	Skill development	National	6	4	--	100	100
					36	24	150	550	700

*All core papers are Mandatory

- Compulsory Foundation choose one paper.
- Elective Foundation – Choose one paper.
- Audit course-100 Marks (Internals) Zero Credits under self-study.
- Interested students may register for MOOC with the approval of the concerned DDC butit will be considered for the award of the grade as open elective only giving extra credits.

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Semester –II

S. No.	Course Code	Course title	Course Focus on (Employability/ Entrepreneurship/ skill development/ project/ Field work/Internship)	Relevant of developmental needs (Local/ Regional/ National/ Global)	Hours/ Week	Credits	Internal assessment marks	University assessment marks	Max. Marks
1.	PHY201	StatisticalMechanics	Employability	Global	5	4	30	70	100
2.	PHY202	EM Theory, Lasers & Modern Optics	Employability	Global	5	4	30	70	100
3.	PHY203	Mathematical Physics	Employability	Global	5	4	30	70	100
4.	PHY204	Computational Methods And Programming	Employability	Global	5	4	30	70	100
5.	PHY205	Personality Enhancement and Leadership	Skill Development	Global	4	0	30	70	100
6.	PHY206	Paper 1& 2 (General Lab)	Skill Development	National	6	4	--	100	100
7.	PHY207	Paper 3 & 4 (Electronics Lab)	Skill Development	National	6	4	--	100	100
					36	24	150	550	700

*All core papers are Mandatory

- Compulsory Foundation choose one paper.
- Elective Foundation – Choose one paper.

- Audit course-100 Marks (Internals) Zero Credits under self-study.
- Interested students may register for MOOC with the approval of the concerned DDC butit will be considered for the award of the grade as open elective only giving extra credits.

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Semester –III

S. No.	Course Code	Course title	Course Focus on (Employability/ Entrepreneurship/ skill development/ project/ Field work/Internship)	Relevant of developmental needs (Local/ Regional/ National/ Global)	Hours/ Week	Credits	Internal assessment marks	University assessment marks	Max. Marks
1.	PHY301	Quantum Mechanics-I	Employability	Global	6	4	30	70	100
2.	PHY302	Nuclear and Particle Physics	Employability	Global	6	4	30	70	100
3.	PHY303	Physics of Semiconductor Devices	Employability	Global	6	4	30	70	100
4.	PHY304	Electronics - Embedded Systems	Employability	Global	6	4	30	70	100
5.	PHY305	Paper 1& 2 (General Lab)	Skill Development	National	6	4	--	100	100
6.	PHY306	Paper 3 & 4 (Electronics Lab)	Skill Development	National	6	4	--	100	100
					36	24	120	480	600

*All core papers are Mandatory

- Compulsory Foundation choose one paper.
- Elective Foundation – Choose one paper.
- Audit course-100 Marks (Internals) Zero Credits under self-study.
- Interested students may register for MOOC with the approval of the concerned DDC butit will be considered for the award of the grade as open elective only giving extra credits.

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Semester –IV

S. No.	Course Code	Course title	Course Focus on (Employability/ Entrepreneurship/ skill development/ project/ Field work/Internship)	Relevant of developmental needs (Local/ Regional/ National/ Global)	Hours/ Week	Credits	Internal assessment marks	University assessment marks	Max. Marks
1.	PHY401	Quantum Mechanics - II	Employability	Global	6	4	30	70	100
2.	PHY402	Analytical Techniques	Employability	Global	6	4	30	70	100
3.	PHY403	Advances in Physics	Employability	Global	6	4	30	70	100
4.	PHY404	Electronics – Wireless Communication Systems	Employability	Global	6	4	30	70	100
5.	PHY405	Elective Lab	Skill Development	National	6	4	--	100	100
6.	PHY406	Project	Skill Development	National	6	4	--	100	100
					36	24	120	480	600

*All core papers are Mandatory

- Compulsory Foundation choose one paper.
- Elective Foundation – Choose one paper.
- Audit course-100 Marks (Internals) Zero Credits under self-study.
- Interested students may register for MOOC with the approval of the concerned DDC butit will be considered for the award of the grade as open elective only giving extra credits.

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M.Sc. Physics

PROGRAM OBJECTIVES & OUTCOMES

Program Educational Objectives of M.Sc. (Physics):

- To impart high quality education in Physical Sciences.
- To prepare students to take up challenges as globally competitive physicists/researchers in diverse areas of theoretical and experimental physics.
- To make the students technically and analytically skilled.
- To provide opportunity of pursuing high end research as project work.
- To give exposure to a vibrant academic ambience.
- To create a sense of academic and social ethics among the students.
- To prepare them to take up higher studies of interdisciplinary nature.

PROGRAM OUT COMES: At the end of the program, the student will be able to:

PO1	Apply the scientific knowledge to solve the complex physics problems.
PO2	Identify, formulate, and analyze advanced scientific problems reaching substantiated Conclusions using first principles of mathematics, physical and natural sciences.
PO3	Design solutions for advanced scientific problems and design system components or processes that meet the specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal consideration.
PO4	Use research-based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Create, select, and apply appropriate techniques, resources, and modern scientific Tools to complex physics problems with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the Professional scientific practice.
PO7	Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to the norms of scientific practice.

PROGRAM SPECIFIC OUTCOMES: At the end of the program, the student will be able to:

PSO1	Understandthebasicandadvanceconceptsofdifferentbranchesofphysics.
PSO2	Performanddesignexperimentsintheareasofelectronics,atomic,nuclear, Condensed matter, and computational physics.

PSO3	Apply the concepts of physics in specialized are as of condensed, nuclear, renewable energies, particle physics, etc. in industry, academia, research and day to day life.

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PHY-101	CLASSICAL MECHANICS AND THEORY OF RELATIVITY	L-4, T-1, P-0	4 Credits

Course Objectives:

- Introduction to basic ideas about Mechanics
- Initiation of mechanical system through derivative and problematic approaches
- View of the object representation in different set of frames convenient for conversion of coordinates
- Reducing the difficulties of rigid body problems through Euler's

Course Out comes: At the end of the course, the student will be able to		
CO1	Understand the necessity of Action, Lagrangian, and Hamiltonian formalism.	K2
CO2	Used' D Alambert principle and calculus of variations to derive the Lagrange equations of motion.	K3
CO3	DescribethemotionofamechanicalsystemusingLagrange-Hamiltonformalism.	K3
CO4	Apply essential features of a relativity problem (like motion under central force, periodic motions) to set up and solve the appropriate physics problems.	K3

Mapping of course outcomes with the program outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	1	1	-	3	3	2
CO2	3	2	2	2	-	1	1	-	3	2	2
CO3	3	3	2	-	2	1	1	-	3	3	2
CO4	3	2	3	2	-	1	1	-	3	2	3

UNIT – I: Lagrangian Mechanics and Hamiltonian Mechanics

Newtonian mechanics of one and many particle systems: Conservation laws, Constraints and their classification, Degrees of freedom: Generalized coordinates: Principle of virtual work, D'Alemberts principle, Lagrange's equations of motion.

Applications: Inclined plane, Linear harmonic oscillator and simple pendulum, Hamiltonian principle, Lagrange's equation from Hamilton's principle, Hamilton's equation of motion, Applications, Simple pendulum, Compound pendulum.

UNIT – II: Canonical Transformations and Hamilton - Jacobi Theory

Canonical Transformations, Generating function and their properties, Condition for transformation to be canonical, Illustration of canonical transformation, Poisson – Brackets, Canonical equations in terms of Poisson, Bracket notation. Lagrange - Brackets and their properties.

Hamiltonian - Jacobi equation, one dimensional harmonic oscillator, Action Angle variables, Kepler problem in action angle variables, Small oscillations and normal modes.

UNIT –III: Motion in a Central Force Field

Reduction to the equivalent one body problem, Motion in a central force field, Conditions for closed orbits: Inverse square law of forces, Kepler's laws of planetary motion- Rutherford scattering.

Rigid body dynamics – Space and body fixed axes, Angular momentum and Torque, Eulerian angles – Euler's equations of a rigid body, Motion of symmetrical top, Expression for slow and fast precessions, Larmour precision, Examples of Gyroscope.

UNIT –IV: Special Theory of Relativity

Introduction – Postulates of Special Theory of Relativity – Principle of constancy of light – Lorentz transformations. Relativistic Kinematics, Velocity transformations – Transfor-mations for the acceleration of a particle. Relativistic Optics: Aberration of light from stars – Doppler effect.

Relativistic Mechanics: Mass of a moving particle – Relativistic dynamics of a single particle – Applications of relativistic dynamics of a single particle, Motion in electric field – Motion in a magnetic field – Experimental verification of the variation of mass with velocity – Bucherer's experiment - Transformation of momentum and force.

Text Books:

1. Classical Mechanics, N.C. Rana and P.S. Joag - Tata Mc-Graw Hill, 1991.; 38th Edition, 2014.

2. Classical Mechanics, H. Goldstein - Addison Wesley, 1980: Pearson New Delhi, 3rd Edition, 2014.
3. Classical Mechanics, J.C. Upadyaya - Himalaya Publishing House, 2005., 2nd Edition, 2014.
4. Classical Mechanics, Gupta, Kumar and Sharma - Pragathi Prakashan, 2012.
5. Classical Dynamics of Particles, J.B. Marion Academic Press - Saunders College Publications, 4th edition, 1995.
6. Introduction to Classical Mechanics, R.G. Takwale and P.S. Puranic -Tata McGraw- Hill, 1989., 50th Edition, 2015.
7. Theory of Relativity, W. Pauli - Dover Publications, 1981.
8. Introduction to the Theory of Relativity, P.G. Bergmann – Prentice Hall, 1953.
9. Introductory Relativity, W.G.V. Rosser - CRC Press, 1992.
10. Classical Mechanics, Aruldas, PHI, 2008.
11. Classical Mechanics, Mondal., PHI Learning, 2008.

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PHY-102	**ATOMIC AND MOLECULAR PHYSICS**	**L-4, T-1, P-0**	**4 Credits**

Objectives:

- To understand the consequences of the interaction of radiation with matter and to have a knowledge on the applications of spectroscopy.
- To understand spectroscopy on the basis of quantum mechanics.
- To learn about the intricacies of spectra of Hydrogen-like atoms, various coupling schemes and Hund's rules of multiplicity for equivalent and non-equivalent electronic systems.
- To study the effects of magnetic and electric fields on the energy levels of atoms and the corresponding spectral changes. The Zeeman and Stark effects.
- To study in detail the Zeeman and Stark effects in week and strong fields and the corresponding spectral changes in the spectra of atoms.
- To know about various aspects of rotational, vibrational and electronic spectra of diatomic molecules, and the corresponding instrumentations.
- To understand the details of applications of vibrational and rotational spectroscopy in elucidating the properties of molecules.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Have the basic knowledge of different atomic models, quantum nos and atomic spectra.	K2
CO2	Understand the classical/quantum description of effect of magnetic field and Electric field on spectral lines.	K2
CO3	Know the different types of rotation of the molecules and rotational constants and intern structure of the molecules.	K3
CO4	Study the vibrational spectra of molecules and applications of vibrational spectra of molecules and applications of vibrational spectra	K3

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	-	-	3	2	3
CO2	3	2	3	3	-	2	2	-	3	2	3
CO3	3	2	3	3	2	2	-	-	3	2	3

CO4	3	2	3	3	-	2	2	-	3	2	3

UNIT I:

Atomic Spectra: Introduction: Hydrogen atom (one electron atom) and the three quantum numbers- Spectra of hydrogen atom- Spectra of alkali elements- Fine structure- Elements with more than one valence electron- Forbidden transitions and selection rules- Space quantization- Stern-Gerlach (S-G) experiment-Coupling schemes- Spectral terms and term symbols, Ground states based on electron configuration - LS coupling - JJ coupling- Hund's rule of multiplicity - Pauli's exclusion principle - Equivalent and non-equivalent electronic systems. Width of spectral lines.

UNIT II:

Zeeman and Stark Effects: Introduction: Zeeman effect, Normal and anomalous Zeeman effects, Experimental details, Magnetic moment of the atom and Lande's 'g'-factor, Zeeman effect in sodium atom, Lande g-formula for LS and JJ couplings - Paschen-Back effect, Complete Paschen-Back effect - Splitting of sodium lines and selection rules, Stark effect, Experimental details, Weak and strong field effects, Width of spectral lines.

UNIT III:

Diatomic Molecular Spectroscopy – Rotational Energies: Introduction – Rotational, vibrational, electronic spectra of diatomic molecules –types of molecules – Linear, symmetric top, asymmetric top and spherical top molecules – Rotational spectra of a diatomic molecule as rigid rotator – Energy levels and spectra of non-rigid rotor – Intensity of rotational lines - Rotational spectra of polyatomic molecule – Rotational analysis of electronic spectra- Evaluation of rotational constants - Effect of isotopic substitution on rotational levels – Stark splitting of rotational lines – Stark modulated microwave spectrometer – Applications of rotational spectroscopy - Determination of molecular structure, dipole moment, atomic mass, nuclear quadrupole moment – Microwave oven.

UNIT IV:

Diatomic Molecular Spectroscopy – Vibrational Spectra: Introduction – Vibrational spectra of diatomic molecule – Diatomic molecule as simple harmonic oscillator – Anharmonic oscillator – Energy levels and spectrum – Molecule as vibrating rotator – PQR branches – progressions and sequences – Vibrational analysis of electronic spectra - Deslander's table – Evaluation of vibrational constants – Morse potential energy curve – Frank-Condon principle – Intensity distribution in absorption and emission spectra - Effect of isotopic substitution on vibrational bands – IR spectrometer – FTIR spectroscopy – Principle – Interferometer arrangement – advantages - Applications of vibrational spectroscopy: Identification of molecular constituents – Elucidation of molecular structure – Biological applications.

Text Books:

1. Introduction to Atomic Spectra, H.E. White, McGraw-Hill Kogakusha. Ltd., NewDelhi., International Student Edition, 1934.
2. Fundamentals of Molecular Spectroscopy, C.N. Banwell and E.M.Mc Cash, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1994., 4th Edition, 2012.
3. Spectroscopy, Vol. I & III, B.P. Straughan & S. Walker, John Wiley & Sons, Inc., NY,1976., 7th Edition.
4. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw - Hill Book Co, 1962., 12.Oct.1962.
5. Spectra of Diatomic Molecules, G. Herzberg, D.Van Nostrand Company Inc, New York. 2nd, Edition 1950.
6. Molecular Spectroscopy, J.M. Brown, Oxford Science Pub. Oxford, 1998., 23.July.1998.
7. Molecular Structure and Spectroscopy, G. Aruldhas, Prentice- Hall of India, Pvt., 2005., 2nd, 2014
8. Elements of Diatomic Molecular Spectra by H. Dunford – Addison-Wisely, 1957.

PHY-103	SOLID STATE PHYSICS	L-4, T-1, P-0	4 Credits

Course Objectives:

- To provide extended knowledge of principles and techniques of solid state physics
- To provide an understanding of structure, thermal and electrical properties of matter
- To discuss the Lattice dynamics of the solids briefly to understand the influent of inter atomic forces and Lattice energy calculations.
- To impart the knowledge study mono and diatomic one dimensional infinitely long Lattices.
- To acquire the fundamental knowledge and expose to the field of semiconductor physics.
- Understand the physics of insulators, semiconductor and conductors with special emphasis on the elementary band theory of semiconductors.
- To discuss properties and practical applications of superconductors.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Gain in-depth knowledge about the formation of various crystal structure vaperforming calculations on their elemental parameters.	K2
CO2	Differentiate between various lattice types based on their lattice dynamics and then explain thermal properties of crystalline solids.	K3
CO3	Understand the electron motion in periodic solids and origin of energy bands in semiconductors.	K2
CO4	To explain the basic transport theory for understanding the transport phenomenon in solids	K4

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3

CO1	3	3	2	2	1	2	1	-	3	3	2
CO2	2	3	2	2	2	2	2	-	2	3	2
CO3	3	3	2	2	1	2	2	-	3	3	2
CO4	3	3	2	2	2	2	1	-	3	3	2

UNIT – I: Lattice Energies and Lattice Vibrations

Origin of chemical binding in ionic and vander Waals crystals – Elastic properties – Stress and strain – Elastic moduli - Lattice energy calculations for ionic and van der Waals crystals – Lattice vibrations: Mono and diatomic one dimensional infinitely long lattices – Vibrational spectra – Infrared absorption in ionic crystals – Vibrational spectra of finite lattice – Quantization of lattice vibrations – Phonons – Properties – Experimental measurement of dispersion relation.

UNIT – II: Transport Phenomena and Band Theory

Concept of electrical and thermal resistivity – Expression for thermal and electrical conductivities for metals – Lorenz number - Different scattering mechanisms – Matheissens rule- Formulation of Boltzmann transport equation – Relaxation time approximation – Distribution function. Sommerfeld model – its consequences – electron-lattice interaction (Quantitative only) – Motion of electron in periodic potential – Bloch function - Kroning - Penny model – Formation of energy bands in solids – Concept of effective mass – Brillouin zones – Different schemes of representation of E versus K curves – Distinction between metals, insulators and semiconductors.

UNIT – III: Semiconductor Physics

Intrinsic and extrinsic semiconductors - Expression for position of Fermi levels and carrier concentrations – Variation of Fermi level with temperature - np product - Carrier mobility, conductivity and their variation with temperature – Direct and indirect band gap semiconductors - Differences and examples - Hall effect - Continuity equation - Drift and Diffusion - Einstein relation - Generation, Recombination and life time of non-equilibrium carriers - Heyness-Schockley experiment - Determination of life time, diffusion length of minority charge carriers.

UNIT – IV: Superconductivity

Concept of zero resistance – Magnetic behavior – Distinction between a perfect conductor and superconductor – Meissner effect – Isotope effect – Specific heat behavior – Two-fluid model – Expression for entropy difference between normal and superconducting states – London’s equations

– Penetration depth – BCS theory –Josephson junctions – SQUIDS and its applications - Applications of superconductors – High T_C superconductors – Preparation – Properties.

Text Books:

1. Introduction to Solid State Physics, C. Kittel, John Wiley & Sons, 8th Edition, 2013.
2. Solid State Physics, A.J. Dekkar, Macmillan India Ltd., First Prentice Hall edition, 1957.
3. Elementary Solid State Physics, M. Ali Omar, Addison-Wesley., 1999., Pearson, 2015 1st Edition, 2006.
4. Solid State Physics, M.A. Wahab, Narosa Publishing House., 2nd Edition 2005.
5. Solid State Electronic Devices, B.G. Streetman., Sanjay K. Banerjee, PHI Learning Pvt. Ltd., 7th Edition, 2014.
6. High T_C Superconductivity, C.N.R. Rao and S.V. Subramanyam.
7. Solid State Physics, S.O. Pillai., New Age Publishing, 6th edition, 2012.
8. Solid State Physics, (Theory, applications and ptoblems) S.L. Kakani and C. Hemarajan., Sulthan Chand and Sons, 4th edition 2005.
9. Electrons in Solids, Richard H. Bube., Academic Press, 3rd edition, 1992.
10. Elements of Solid State Physics by Srivastava., PHI, 4th edition, 2014.

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PHY-104	**ANALOG AND DIGITAL ELECTRONICS**	**L-4, T-1, P-0**	**4 Credits**

Course Objectives:

- Introduction of transistors and applications
- Discuss about the working and characteristic of JFET
- Applications of FET
- Working and characteristics of MOSFET and UJT
- Concept of the CMOS
- To be able to perform the mathematical operations such as Addition, subtraction, logarithmic, Integration, Differentiation etc.,
- Understand the general properties & Electrical characteristics of an operational amplifier.
- To construct the digital systems such as microprocessors & microcontrollers for transferring the data in the short time.
- Introduction to Microprocessor.
- Architecture of 8086 Microprocessor.
- Instruction set and Addressing modes of 8086 Microprocessor
- Discuss about the Machine cycle and instruction cycle
- Explain about the timing diagram for simple instructions and generation of delays.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand working of Different Semiconductor devices (Construction, Working Principles and V-I characteristics) and their applications.	K2
CO2	Explain the construction and working of Operational amplifiers and applications	K4
CO3	Design Digital circuits and their applications.	K4
CO4	Understand the working of various analog communication techniques	K2

Mapping of course outcomes with the program outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	-	3	3	2
CO2	3	3	2	1	2	2	1	-	3	3	2
CO3	2	2	3	2	2	2	1	-	2	2	3

CO4	3	3	2	2	2	2	1	-	3	3	2

UNIT – I: Introduction to Electronic Devices

Field Effect Transistor (FET): Structure and working of JFET, Characteristics, and parameters of JFET. Advantages of FET over BJT. FET as switch and Amplifier, Application of FET as voltage variable resistor. Structure of MOSFET, depletion type and enhancement type, MOSFET Characteristics, MOSFET as variable resistor, Concept of CMOS. Structure, working and Characteristics of UJT. Application of UJT as a Relaxation oscillator.

UNIT – II: Operational Amplifiers

Block diagram of a typical Op-Amp, differential Amplifier, Comparator open loop configuration, inverting and non-inverting amplifiers. Op-amp with negative feedback, voltage shunt feedback, effect of feedback on closed loop gain, input resistance, output resistance, CMRR, frequency response slew rate.

Instrumentation- Amplifier, integrator and differentiator. Waveform generators: Square and triangle. Filters: Low pass, High pass and Band pass. ADC&DAC

UNIT – III: Digital Electronics

Combinational Logic: Multiplexers, Decoder, Demultiplexer, Data Selector, Multiplexer, Encoder.Sequential Logic: Flip-flops, a 1-bit memory, The RS Flip-Flop JK Flip – Flop, JK Master Slave Flip–Flops, T Flip-Flop, D Flip-Flop. Shift Registers: Serial in Serial out, Serial in Parallel out, parallel in Serial out, Parallel in Parallel out Registers. Counters: Asynchronous and Synchronous Counters, MOD-3 Counter, MOD-5 Counter. Converters: R - 2R Ladder D/A Converter, Successive Approximation A/D Converter.

UNIT – IV: Microprocessors 8086

Introduction to Microprocessors, development of microprocessors, 8086 microprocessor. Architecture. Instruction set. Addressing modes, interrupt system, System timing of 8086, Clock, Machine cycle and instruction cycle, timing diagram for simple instructions, generation of delays

Text Books:

1. Micro Electronics, Milliman and Halkias. TMH Publications., 2nd Edition, 2010.
2. OP-Amps & Linear Integrated Circuits, RamakanthA. Gayakwad, PHI, 2nd Edition, 1991.
3. Digital Systems: Principles and Applications, Ronald J. Tocci, Neal Widmer and Gregory L. Moss, 10th Edition, PHI, 2007., 11th Edition, 2013.
4. Digital Principles and Applications, A.P. Malvino and Donald P. Leach, Tata Mc Graw-

5. Hill, New Delhi, 1993., 8th Edition, 2014.
6. "Microprocessor Architecture, Programming &Appplications with 8085/8086 by Ramesh S.Gaonkar, Wiley - Eastern Ltd, 1987 (UNIT-VI), 5th Edition, 2008. Penran International Pub., New Delhi.
7. Electronic Devices and Circuit Theory, R. Boylested Pearson and L. Nashdsky, PHI, New Delhi, 1991., 6th Edition, 2013.
8. Micro Electronics, Sedra and Smith., Oxford University Press, 5th Edition, 2015.
9. Electronic Principles, Malvino, 6th Ed. TMH., 2006.
10. Linear Integrated circuits, Roy Choudhry., New age international Publishers, 4th Edition, 2010.
11. Operational amplifiers, Collins.
12. Microprocessors Interfacing-Douglas V.Hall, 2nd edition, 2007.

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PHY-105	**HUMAN VALUES AND PROFESSIONAL ETHICS**	**L-4, T-1, P-0**	**0 Credits**

Course Objectives:

- The aim of this course is to familiarize students with the concepts of human values, self introspection and self esteem to avoid harm to others.
- It helps the students to appreciate the responsibilities of family and the role of woman in family and society.
- The course will focus on significance of human rights in the development of society and the violation of human rights.

Course Outcomes: On successful completion of this course, students will be able to

CO1	Acquiring the knowledge and to understand the significance of human values and family values	K2
CO2	Understand the moral responsibility of medical practitioners	K2
CO3	Demonstrate the characteristics of ethical problems in business	K3
CO4	To understand the consequences of environmental pollution and to practice the remediation	K3
CO5	Understand the Human rights violation and social disparities	K3

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1	-	3	2	1
CO2	2	3	3	1	2	2	1	-	2	1	2
CO3	3	2	3	2	2	2	1	-	2	3	1
CO4	2	3	2	3	2	2	1	-	3	2	2
CO5	2	2	3	1	3	-	1	-	1	3	3

UNIT-I : VALUE EDUCAT ION

Definition Relevance to present day — Concept of human values — Set introspection — Self esteem. Family values — Components, Structure and responsibilities of family — Neutralization of

anger Adjustability Threats of family life Status of women in family and society — Caring for needy and elderly — Time allotment for sharing ideas and concerns. (Theory only)

UNIT-II : MEDICAL ETHICS

Views of Charaka, Sushruta and Hippocrates on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Eluthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in healthcare, human cloning, problem of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge. (Theory only)

UNIT-III : BUSINESS ETHICS

Ethical standards of business Immoral and illegal practices and their solutions. Characteristics of ethical problems in management, Ethical theories, causes of unethical behavior, Ethical abuses and work ethics. (Theory only)

UNIT - IV : ENVIRONMENTAL ETHICS

Ethical theory, man and nature — Ecological crisis, Pest control. Pollution and waste, Climate change, Energy and pollution, Justice and environmental health. (Theory only)

UNIT-V : SOCIAL ETHICS

Organ trade, Human trafficking, Human rights violation and social disparities. Feminist ethics, Surrogacy pregnancy. Ethics of media Impact of Newspapers, Television, Movies and Internet (Theory only).

References:

1. Johns S Mackenjie: A Manual of ethics
2. “The Ethics of Management” by Larue Tone Hosmer, Richard D. Irwin Inc.
3. Management Ethics – Integrity at work by Joseph A. Petrick and John F. Quinn, Response Books, New Delhi.
4. “Ethics in Management” by S.A. Shelekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics

7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manava Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed) G.C. Haughton.

VIKRAMA SIMHAPURI UNIVERSITY::NELLORE
DEPARTMENT OF PHYSICS

Syllabus for M.Sc.Physics (2 Year Course) for V.S. University Constituent College(s) and Affiliated Colleges under the jurisdiction of Vikrama Simhapuri University, Nellore with effect from the Academic Year 2020-2021

PHY-201	STATISTICAL MECHANICS	L-4, T-1, P-0	4 Credits

Course Objectives:

- This course in statistical mechanics provides the basic idea of probability and calculating probability for various statistical system of particles.
- To apply the principles of probability in distribution of particles in various systems
- To learn the different types of statistics distribution and particles.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Use ensemble theory to explain the behavior of Physical systems	K4
CO2	Understanding the Applications of Rotational partition function	K3
CO3	Explain the statistical behavior of Bose-Einstein and their applications.	K2
CO4	Fermi –Dirac Statistics & Fluctuations	K4

Mapping of course outcomes with the program outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	2	1	-	3	2	2
CO2	3	3	3	1	3	-	1	-	3	3	3
CO3	3	3	3	-	2	-	1	-	3	3	3
CO4	3	3	3	-	2	2	1	-	3	3	3

UNIT- I: Ensembles

Phase space – Concept of ensembles – Types of ensembles - Ensemble average - Liouville's Theorem – Micro canonical ensemble: ideal gas – Gibb's paradox – Entropy and probability – Canonical ensemble – Ideal gas in canonical ensemble – Grand canonical ensemble – Ideal gas in grand canonical ensemble – Comparison of various ensembles.

UNIT – II: Partition Functions

Canonical partition function – Molecular partition function – Translational partition function – Rotational partition function – Vibrational partition function – Electronic and Nuclear partition functions – Applications of Rotational partition function – Applications of vibrational partition function to solids.

UNIT – III: Maxwell – Boltzmann and Bose – Einstein Statistics

Maxwell - Boltzmann distribution - Distribution of velocities – Experimental verification - Calculation of mean values – Equipartition theorem. Bose – Einstein distribution, Bose – Einstein condensation, Black body radiation and the Planck's radiation law - Dulong and Petit's law - Einstein and Debye's theories of heat capacities - Liquid helium – Two fluid model of liquid helium II – Super fluid phase of ^{3}He.

UNIT – IV: Fermi – Dirac Statistics & Fluctuations

Fermi - Dirac distribution – Electrons in metals – Thermionic emission – Magnetic susceptibility of free electrons – White dwarfs – Fluctuations in ensembles, Onsagar's one dimensional and reciprocal rotations and their applications to thermoelectric phenomena, Kelvin's first and second equations: One dimensional random walk – Random walk and Brownian motion.

Text Books:

1. Statistical Mechanics, B.K. Agarwal, Melvin Eisner, 2nd Edition, New Age International (P) Ltd., 1998.
2. Statistical Mechanics and properties of Matter by ESR Gopal - Student Edition (Ellis Horwood), 1974.
3. Fundamentals of Statistical and Thermal Physics, F. Reif—4th Edition, Mc Graw Hill, International Editions 1985.
4. Elementary Statistical Physics, C. Kittel, Dover Publications, 2004.
5. Statistical Mechanics, Satya Prakash, Kedar Nath Ram Nath & Co., 6th Edition, 1989-90.
6. Statistical Physics, Bhattacharjee, Allied Publishers Pvt. Ltd., June 2000.

7. Thermal Physics, C. Kittel and H. Kremer; W.H. Freeman, 2nd Edition, 1980.

PHY-202	ELECTROMAGNETIC THEORY, LASERS AND MODERN OPTICS	L-4, T-1, P-0	4 Credits

Course Objectives:

- To know the concepts of EM theory, the significance of Maxwell's equations and use them in analysing nature of electromagnetic wave and its propagation through different media and interfaces.
- To understand the various mechanisms involving operation of lasers. To classify different types of lasers with respect to design and working principles
- To identify the phenomenon of the nonlinear optical interaction of light with matter and to understand the higher harmonic generations of light.
- To identify nonlinear optical phenomenon for applications in optical devices
- To understand the theory behind recording and reconstruction of holograms, to differentiate between holography and photography and to understand the applications of holography.
- To acquire the knowledge of different types of holograms.
- To understand the concepts and applications of Fourier optics.
- To understand the principle of working of fiber optical materials and their various applications.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand the electro statistics and magneto statistics and also the properties of propagation of electromagnetic radiation in different media	K2
CO2	Know about the properties of laser beam and the working of different lasers and applications	K3
CO3	Describe the fourier analysis in optics problems and to understand the concept of holography	K4
CO4	Analyze the propagation of light in optical fibers and to know the various applications of optical fibers	K4

Mapping of course outcomes with the program outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	1	1	-	3	3	2
CO2	3	2	2	1	2	1	-	-	3	2	2
CO3	3	3	3	-	2	1	2	-	3	3	3
CO4	3	2	3	2	3	-	2	-	3	2	3

UNIT – I: Electromagnetic Theory

Maxwell's equations, The wave equation, Propagation of light in isotropic dielectric medium – Dispersion, Propagation of light in conducting medium-skin depth, Reflection and refraction at the boundary of a dielectric interface – Fresnel's equations, Propagation of light in crystals-Double refraction.

Electromagnetic radiation; Retarded potentials, Radiation from moving point charge, Radiation from oscillating dipole (electric and magnetic dipoles), Radiation from linear antenna – Lienard – Wiechert potentials.

UNIT – II: Lasers and Non-Linear Optics

Basic principles of lasers – Spontaneous and stimulated emission – Coherence - Population inversion- Einstein coefficients – Pumping schemes – Threshold condition for laser oscillation – Role of Feedback (Laser cavity) Losses and Q-factor –Three and four level laser systems – Ruby, He-Ne and GaAs lasers –Laser applications.

Basic Principles – Origin of optical nonlinearity - Harmonic generation – Second harmonic generation – Phase matching condition – Third harmonic generation – Optical mixing – Parametric generation of light – Parametric light oscillator – Frequency upconversion – Self focusing of light - Guided wave optics - Pulse compression - Optical solutions.

UNIT – III: Holography and Fourier Optics

Introduction to Holography – Basic theory of Holography – Recording and reconstruction of Hologram – Diffuse object illumination – Speckle pattern – Fourier transform Holography – Applications of Holography.

Introduction to Fourier optics– Two dimensional Fourier transforms – Transforms of Dirac-Delta function – The convolution integral – convolution theorem- Spectra and correlation – Parsevel's formula – Auto correlation and cross-correlation – Apodization – Array theorem – Fourier methods in diffraction - Fraunhouffer diffraction of single slit, double slit and transmission grating using Fourier method.

UNIT – IV: Fiber Optics

Total internal reflection - Optical fiber modes and configuration – Single mode fibers – Graded index fiber structure – Fiber materials and fabrication – Mechanical properties of fibers – Fiber optic cables – Attenuation – Signal distortion on optical wave guides- Erbium doped fiber amplifiers – Solitons in optical fibers - Block diagram of fiber optic communication system - Applications of optical fibers in communication and medicine.

Text Books:

1. Introduction to Electrodynamics, D.J. Griffiths, 4 th Edition, Prentice-Hall of India, ND, 2013.
2. Electromagnetics, B.B. Laud, 3rd Edition, New Age International Publishers Ltd, N D, 2011.
3. Fundamentals of Electromagnetic theory, 2nd Edition, S.K. Dash and S.R. Khuntia, ND, 2011.
4. Introduction to Modern Optics by G.R. Fowels, Dover Publications, 2nd Edition, 1989.
5. Laser and their Applications, M.J. Beesly, Taylor and Francis, 1976
6. Lasers and Non-Linear Optics, B.B. Laud, 3rd Edition, New Age International Publishers Ltd, New Delhi, 2011.
7. Optics, E. Hecht, Addison Wiley, 1974., 2nd Edition.
8. Optical Fiber Communications, Gerel Keiser, McGraw Hill Book, 2000., 5th Edition, 2014.

PHY-203	MATHEMATICAL PHYSICS	L-4, T-1, P-0	4 Credits

Learning Objectives:

- Student should be able to understand basic theory of Complex Analysis, Special functions, Fourier transforms and Laplace transforms.
- To learn mathematical tools required to solve physical problem.
- To understand mathematical concepts related to physics.
- To understand the invariance of the physical variables under co-ordinate transformation.
- To understand the relevance of higher mathematics and concepts of physics.

Course Outcomes: At the end of the course, the student will able to		
CO1	Understand the basics and applications of special functions in all the branches of Physics.	K2
CO2	Use Fourier series and transformations as an aid for analyzing physical problems.	K3
CO3	Apply integral transform to solve mathematical problems of Physics interest.	K3
CO4	Formulate and express a physical law in terms of complex variables and simplify it by use of coordinate transforms.	K4

Mapping of course outcomes with the program outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	-	-	-	3	3	2
CO2	3	3	2	2	-1	-	1	-	3	3	2
CO3	3	3	2	-	1	1	1-	-	3	3	2
CO4	3	3	2	2	2	1	1	-	3	3	2

UNIT - I: Special Functions

Beta and Gamma Functions – Definitions and properties – Evaluation of integrals, Legendre, Bessel and Hermite differential equations – Solutions – Generating functions – Orthogonal properties of Legendre, Bessel and Hermite Functions (Proof not necessary) – Recurrence relations – (Proof for Legendre polynomials only)

UNIT - II: Integral Transforms

Fouriers Transforms: Properties of Fourier transforms – Fourier sine and cosine transforms- Power in Fourier series **–** Modulation theorem, Fourier transform of impulse function, Constants, Unit step function and Periodic (square wave, triangular wave & sawtooth wave) functions.

Laplace Transforms: Definition and notation – Properties of Laplace transforms – Laplace transforms of Dirac delta function and periodic functions (Square wave, sawtooth wave and triangular wave) – Inverse Laplace transforms – properties – Solution of linear differential equations with constant coefficients - Applications to LCR circuits, Operational amplifiers and resonance of simple pendulum.

UNIT - III: Partial Differentiations and Tensors

Partial Differentiations: Laplace equation – Method of separation of variables – Application of Laplace equation to two dimensional steady state of heat flow in a thin rectangular plate and a long cylinder. Wave equation in two dimensions – Application to the vibration of a rectangular membrane and circular membrane.

Tensors: Definition – Contravariant, Covariant and Mixed tensors – Dummy suffix notation- Addition, subtraction, contraction, inner product, outer product, symmetric and anti-symmetric tensors - Application of Tensor theory to strain, thermal expansion and piezoelectricity.

UNIT – IV: Complex Variables

Functions – Complex differentiation - Analytic function - Cauchy – Reimann equations – Derivatives of elementary functions – Singular points and classification. Complex integration - Cauchy's theorem – Integrals of special functions – Cauchy's integral formula – Taylor's and Lorentz theorem (statements only) – Residues, calculations of residues - Residue theorem – evaluation of definite integrals.

Text Books:

1. Special Functions for Scientists and Engineers, W.W. Bell, Dover Publications, 2004.
2. Fourier Analysis, Hsu P. Hwei, Simon & Schuster, 1967.
3. Laplace Transforms, Murray Spiegle, Schaum's outline series, McGraw Hill, New York., 1st Edition, 1965.
4. Applied Mathematics for Engineers, Pipes and Harval, III Edition, McGraw Hill Books Co., 1946.
5. Vector Analysis & Introduction to Tensor Analysis, M. R. Spiegel, Schaum's Series 1959.
6. Physical Properties of Crystals, J.F. Nye, Schaum's Series, Oxford Univ. Press, 1957.
7. Theory and Properties of Complex Variables, S. Lipschutz, Schaum's Series, Mc Graw Hill., 2nd Edition, 2009.
8. Mathematical Physics, H.K. Das and Ramaverma, S. Chand & Co. Ltd., New Delhi (2011).
9. Mathematical Physics, B. Bhattacharyya, New Central Book Agency Pvt. Ltd., (2010).

PHY-204	COMPUTATIONAL METHODS AND PROGRAMMING	L-4, T-1, P-0	4 Credits

Course objective:

- Introduction and use of MS Word, MS Excel and MS power point
- The basics of C-language, C- character set, arithmetic expressions and some simple programs
- Controlling statements
- Functions and arrays
- To learn solving simultaneous nonlinear and transcendental equations using iterative methods such as Bisection, Regula falsi and Newton Raphson's etc.
- To learn to solve Linear equations that is finding the unknowns using computer Oriented methods where there are large number of unknowns.
- To be able to write the algorithm and develop the computer programs by writing code for the program and testing in the computer for accurate results.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Apply basics knowledge of computational physics in solving the physics problems.	K3
CO2	Programme with the C or any other high-level language.	K3
CO3	Use various numerical methods in solving physics problems.	K3
CO4	Analyze the outcome of the algorithm/program graphically.	K4

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	1	-	3	3	3
CO2	3	3	3	1	2	1	-	-	3	3	3
CO3	3	3	3	2	2	1	1	-	3	3	3
CO4	3	3	3	-	-	2	-	-	3	3	3

UNIT – I: MS Office

MS-Word: Introduction - Creating & Editing Document - Formatting Document - Page Formatting – MS-Word - Mail Merge - Macros - Tables - Printing - Template.

MS-Excel: Introduction - Creating & Editing Worksheet - Formatting - Formulas and Functions – Charts - Sorting - Filtering - Data Validation.

MS-PowerPoint: Introduction - Creating & Editing Presentation - Layouts - Animations and Sounds - Background to slides - Transitions to the slide - Inserting Media clips.

Unit – II Programming in C

Fundamentals- Character set - Identifier and keywords - data types – constants - Variables - Declarations - Expressions - Statements - Arithmetic, Unary, Relational and logical, Assignment and Conditional Operators, Data input - output functions.

Controlling Statements: if, if-else, while, do-while, for loop, Nested control structures, Switch, break and continue, go to statements.

Functions: Definition - prototypes - Passing arguments – Recursion, Arrays - Defining Arrays- Multi-dimension arrays.

UNIT – III: Linear, non-linear equations and curve fitting

(a) Solution of Algebraic and transcendental equations – Bisection, Falsi position and Newton-Rhapson methods – Basic principles – Formulae – Algorithms.

(b) Simultaneous equations: Solutions of simultaneous linear equations – Gauss elimination and Gauss-Seidel iterative methods - Basic principles – Formulae – Algorithms

UNIT – IV: (a) Interpolations: Concept of linear interpolation – Finite differences – Newton's and Lagrange's interpolation formulae –Principles and Algorithms

Curve fitting – Least square fitting – Linear and quadratic equations.

(b) Numerical differentiation and integration: Numerical differentiation – algorithm for evaluation of first order derivatives using formulae based on Taylor's series – Numerical integration – Trapezoidal and Simpson's 1/3 rule – Formulae – Algorithms.

(c) Numerical solution of ordinary differential equations: Euler, method, fourth order Runga-Kutta Method.

Text Books:

1. Learn Microsoft Office – Russell A. Stultz – BPB Publication.
2. Ashok N.Kamthane, Programming with ANSI and Turbo C, Pearson Education, 2006.
3. Balagurusamy, E., Computing Fundamentals and C Programming, Tata McGraw-Hill
4. Microsoft Office – Complete Reference – BPB Publication
5. PC Software – Shree Sai Prakashan, Meerut
6. Programming with 'C', Byron Gottfried, Tata McGraw Hill., 2nd Edition, 2006.
7. Programming in 'C', Balaguruswamy., Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 1989.
8. Numerical Methods, E. Balaguruswamy, Tata McGraw Hill., 1999, 39th Reprint 2014.
9. Computer oriented numerical methods, Rajaraman., PHI, 3rd Edition, 2015.
10. Let Us C, Yeswanth Kanetkar.BPB Publications, 2nd Revised Edition, 1995. New 13th Edition, 2014.

PHY-205	PERSONALITY ENHANCEMENT AND LEADERSHIP	L-4, T-1, P-0	0 Credits

Course Objective:

- The central focus of this course is intra-personal development.
- The students will undergo intellectual and values-centered formation through which they will be able to: identify their own potentials and limitations; apply ethical and moral principles in personal and professional forefronts; and develop leadership qualities.
- This course makes the students groom their personality and prove themselves as good Samaritans of the Society

Course Outcomes: On successful completion of this course, students will be able to

CO1	Understand the significance of personality development in achieving success	K2
CO2	Understand the advantages of positive attitude and disadvantages of negative attitude	K2
CO3	Know the do's and don’ts to develop positive self-esteem	K3
CO4	Gain the Leadership and Management qualities	K3
CO5	Develop leadership characteristics	K3

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	1	1	-	2	2	3
CO2	3	2	2	1	2	2	1	-	3	2	1
CO3	2	2	3	2	2	2	1	-	2	2	3
CO4	2	3	2	2	2	2	1	-	2	3	1
CO5	2	2	3	1	1	-	1	-	2	2	1

UNIT-I : INTRODUCTION TO PERSONALITY ENHANCEMENT

The concept personality — Dimensions of theories of Freud & Erickson- personality — significant of personality development. The concept of success and failure: What is success? — Hurdles in achieving success — Overcoming hurdles — Factors responsible for success — What is failure — Causes of failure. SWOT analyses.

UNIT – II : ATTITUDE & MOTIVATION

Attitude - Concept — Significance — Factors affecting attitudes — Positive attitude — Advantages Negative attitude — Disadvantages — Ways to develop positive attitude — Difference between personalities having positive and negative attitude. Concept of motivation — Significance — Internal and external motives — Importance of self inotivation — Factors leading to de-motivation.

UNIT –III : SELF-ESTEEM

Term self-esteem — Symptoms — Advantages — Do's and Don'ts to develop positive self-esteem — Low self esteem — Symptoms — Personality having low self esteem — Positive and negative self-esteem. Interpersonal Relationships — Defining the difference between aggressive, submissive and assertive behaviours — Lateral thinking.

UNIT –IV : INTRODUCTION TO LEADERSHIP

Definition and meaning, Importance, Leadership and Management, Leader vs Manager, Essential qualities of an effective leader. Theories of Leadership: Trait theory, Behavioral theories, Contingency theory.

UNIT-V : LEADERSHIP CHARACTERISTICS

Types of Leaders Importance of Leadership — Leadership Skills — Building and Leading Efficient Teams Leadership styles: Traditional, Transactional, Transformational, Inspirational and servant leadership and Emerging issues in leadership: Emotional Intelligence and leadership, Trust as a factor, Gender and Leadership. Leadership Qualities of Abraham Lincoln, Mahatma Gandhi, Prakasam Pantulu, Dr. B.R. Ambedkar and J.R.D. Tata.

References:

1. Girish Batra, Experiments in Leadership, Chennai: Notion Press, 2018.
2. Mitesh Khatri, Awa ken the Leader in You. Mumbai: Jaico Publishing House, 2013.
3. Carnegie Dale. Become an Effective Leader. New' Del hi: Amaryllis, 2012
4. Hall. C.S.. Lindzei'. Ci. & Campbell, J.B Theories of Personality. John Wiley & Sons, 5. 1998.
5. Organizational Behaviour, M. Parikh and R. Gupta, Tata-McGraw-Hill Education Private Limited.
6. Organizational Behavior, D. Nelson, I.C Quick and P. Khandelwal, Cengage Publication.

PHY-301	QUANTUM MECHANICS – I	L-4, T-1, P-0	4 Credits

Course Objectives:

- Introduction of Quantum Mechanics and the Schrodinger equation
- To acquire mathematical skills require to develop theory of quantum mechanics
- To develop understanding of postulates of quantum mechanics and to learn to apply them to solve some quantum mechanical systems
- To offer systematic methodology for the application of approximation methods to solve complicated quantum mechanical systems
- To acquire the knowledge of the basics of scattering theory.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand the need for quantum mechanical formalism and its basic principles.	K3
CO2	Appreciate the importance and implication of vectors paces, Dirac Ket Branotations, eigen value problem.	K3
CO3	Understand the need of approximate methods in solving problems	K2
CO4	Understanding scattering theory and its importance.	K2

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	1	-	2	1	-
CO2	3	2	2	2	2	2	1	-	-	2	2
CO3	3	2	2	2	2	2	1	-	-	-	-
CO4	3	2	2	2	2	2	2	-	2	2	-

UNIT - I: Formulation and Simple Problems

Wave particle duality – Wave functions in coordinate and momentum representation- Postulates of quantum mechanics -Linear vector space: Hilbert space - Dirac's Bra and Ket notations- Hermitian operators and their properties- Matrix representation of an operator- Unitary operators- Unitary transformation - The Kronicker Delta and Dirac delta functions

Eigen values and Eigen functions for finite potential well and step barrier – Quantum mechanical tunneling

UNIT - II: Quantum Dynamics and Simple Problems

Equations of motion - Schrodinger Picture- Heisenberg Picture- Interaction Picture- Equivalence of various Pictures- . Poisson and Commutation brackets- Their Properties

Eigen values and Eigen functions for Simple harmonic oscillator- Polynomial method and abstract operator method in one dimension- Eigen values and Eigen functions for a free particle and particle in a box in three dimensions.

UNIT - III: Approximate Methods

Time independent perturbation theory for non-degenerate levels: Perturbed harmonic oscillator, Normal Helium atom, Stark effect of the plane rotator. First order perturbation theory for degenerate levels: First order Stark effect in hydrogen atom; Time dependent perturbation theory: Transition to continuum (Fermi Golden rule).

WKB approximation – Turning points and connecting formulae: Application to potential barrier. Variational methods.

UNIT - IV: Scattering Theory

Introduction: classical theory of scattering - Quantum theory of scattering - Method of partial wave analysis - Scattering by a perfectly rigid sphere - Greens function in scattering theory - Born approximation - Validity of Born approximation - optical theorem.

Text Books:

1. Quantum Mechanics: S. L.Kakani and H.M.Chandalia. Sultan Chandand Sons 4th Edition, 2004.
2. Advanced Quantum Mechanics: B.S. Rajput, Pragatiprakasan., 5th Edition, 1990.
3. Quantum Mechanics: V.K. Thankappan, Wiley Eastern Limited, 2nd Edition, 1993.
4. A Textbook of Quantum Mechanics: P.M. Mathews and K.Venkatesan, Tata McGraw Hill Publishing Company., 2nd Edition, 1976, 9th Reprint 2014.
5. Quantum Mechanics: S.L. Gupta, V. Kumar, H.V. Sharma and R.C. Sharma Jai Prakash Nath and Company, 26th Edition, 2007.
6. An introduction to Quantum Mechanics, P.T. Mathews c Graw Hill Publishing Company., 3rd Edition, 1974.
7. Quantum Mechanics by Aruldas. PHI, 7th, 2007.

PHY-302	NUCLEAR AND PARTICLE PHYSICS	L-4, T-1, P-0	4 Credits

Course Objective:

- To impart the knowledge regarding the fundamental and basics of nuclear size, shape and characteristics of nuclear forces and various models describing the energetics of nucleus.
- Study the basic concepts of nuclear reactions and the laws governing nuclear reactions. Primary concepts of nuclear decays.
- Learn the concept of nuclear accelerators and applications of accelerators
- Study the prominent nuclear reactions. Analysis of characteristics of fission and fusion reactions, emission of neutrons and energy released during these reactions.
- To study the significance of nuclear fission and fusion reactions and their applications in various aspects.
- To impart primary but wide theoretical knowledge about nuclear reactor and related topics. Select materials relevant for reactor design and energy production. Categorize different nuclear reactors.
- To have an elementary idea of particles and their classification.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand the basics of nuclear forces and their characteristics and also about various nuclear models	K2
CO2	Know the various types of nuclear reactions and nuclear decay system	K3
CO3	Understand the basic principles in nuclear accelerators and rectors and also their applications	K2
CO4	Describe the various elementary particles and their conservation layers.	K4

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	1	1	-	2	1	-
CO2	3	3	2	1	2	1	1	-	2	1	-
CO3	3	3	2	1	2	1	1	-	2	1	-
CO4	3	3	2	1	2	1	1	-	2	1	-

UNIT – I: Nuclear Forces and Nuclear Models

Nuclear Forces: Characteristics of nuclear forces – Ground state of Deuteron – Proton – Proton scattering – Neutron – Proton scattering – Meson theory of nuclear forces.

Introduction-The liquid drop model- Bethe-Weizsacker semi-empirical binding energy equation and its applications. Nuclear shell model- Energy levels and calculation of angular momentum-collective model.

UNIT – II: Nuclear Reactions and Nuclear Accelerators

Nuclear Reactions: Types of nuclear reactions – Compound nuclear reactions – Direct reactions - Nuclear cross section – Resonance theory – Briet Wigner formula. Introduction –Linear accelerators – Drift tube and Wave guide accelerators – Low energy circular accelerators – Cyclotron and Betatron – High energy circular accelerators – Synchrotron and Microtron.

UNIT – III: Nuclear Reactors

Nuclear fission reactions – Types of fission - Distribution of fission products – Neutron emission on fission – Spontaneous fission – Nuclear fission and thermonuclear reactions – Hydrogen bomb.

Nuclear fusion reactions - Nuclear chain reactions – Four factor formula – The critical size of a reactor – General aspects of reactor design – Classification of reactors – Research reactors and Power reactors (elementary aspects only).

UNIT – IV: Elementary particles

Discovery and classification of elementary particles – Types of interactions – Conservation laws – Iso-spin, parity, charge conjugation – Time reversal – CPT theorem – Properties of leptons, mesons and baryons – Elementary particle symmetries (SU_2 and SU_3 symmetries) – Quark model – Search for Higg's particle – Elementary ideas.

Text Books:

1. Nuclear Physics, Irving Kaplan, Narosa Pub. (1998)., 2nd Edition, 2007.
2. Nuclear Physics, Theory and experiment – P.R. Roy and B.P. Nigam, New Age Int.1997.
3. Atomic and Nuclear Physics (Vol.2), S.N. Ghoshal, S. Chand & Co. (1994).
4. Nuclear Physics, D.C. Tayal, Himalaya Pub. (1997).
5. Nuclear Physics by Dr.R.C. Sharma, K. Nath & Co., 3rd Edition, 1985-86.
6. Nuclei and Particles, E. Segre., W.A. Benjamin, 2nd Edition, 1977.
7. Introduction to Nuclear Physics, H.A. Enge, Addison Wesley (1975).
8. Introduction to Nuclear Physics, K.S. Krane., Wiely, 2008.

PHY-303	PHYSICS OF SEMICONDUCTOR DEVICES	L-4, T-1, P-0	4 Credits

Course Objectives:

- Introduction to pn junction and bias effect
- Discuss about the depletion layer capacitance
- Explain the difference between the ideal and real diode
- Introduction and application of electrical breakdown in pn junction
- Study the different types of diodes and applications
- Study the optoelectronic devices
- Study the BJT and terminal currents and parameters
- Explain the real transistor
- To define the working principle and I-V characteristics of JFET
- To explain the MOS transistors and charge couple devices
- To explain the structure, working principle and I-V characteristics of MOSFET
- Study the different types of crystal growth techniques
- To explain the different pn junction formation methods and deposition of dielectric methods
- To define the masking and lithography
- To explain the different metal deposition techniques
- Introduction to rectifiers and thyristors
- Study the different types of thyristors.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand various experimental techniques for semiconductor junctions and interfaces	K2
CO2	Use I-V characteristics to understand the function of devices	K3
CO3	Apply the knowledge of Junction transistors for various applications	K3
CO4	To get familiarization with Power Devices and Semiconductor Technology	K4

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	2	2	-	1	1	1
CO2	3	2	1	3	2	1	-	-	1	1	-
CO3	3	2	1	2	3	2	1	-	2	2	-
CO4	3	2	1	3	3	1	1	-	-	2	2

UNIT - I: Junctions and Interfaces

p-n Junctions: Description of p-n Junction action – Junction in equilibrium- application of bias – energy band diagrams. Abrupt junction – calculation of the built-in voltage - electric field and potential distributions – Expression for Depletion layer capacitance, Static I-V characteristics of p-n junction diodes: Ideal diode model- Derivation of ideal diode equation. Real diodes – Carrier generation – recombination in the junction depletion region, I-V characteristics of Real Diodes.

Electrical breakdown in p-n junctions: Zener and Avalanche breakdown in p-n junctions, Distinction between the Zener and Avalanche breakdown, Applications of breakdown diodes. Metal-Semiconductor interfaces, Ohmic and Schottky contacts.

UNIT- II: Junction Diodes

Tunnel diode- I-V characteristics, Backward diode-Schottky barrier diode - operation and applications. Varactor diode, Gunn diode, IMPATT diode, TRAPATT diode, BARITT diode - basic principle, operation and its applications. Solar cell – Structure - Principle of operation – Solar cell parameters – Light Emitting Diodes (LEDs), Semiconductor lasers – principle of operation and applications.

UNIT - III: Junction Transistors

Bipolar junction transistors: Principle of operation- Analysis of the ideal diffusion transistor – Calculation of terminal currents, DC parameters. Ebers-Moll Equations – Four regions of operation of a bipolar transistor. Real transistors - carrier recombination in the Emitter-Base junction depletion region – Effect of collector bias variation, avalanche multiplication in the collector – base junction and base resistance.

Junction field-effect transistors: JFET Principle of operation, Static I-V Characteristics of the idealized model.

MOS transistors and charge-coupled devices: MOS capacitor – Surface field effect – Energy band diagrams of an MOS capacitor for different bias conditions. C-V characteristics of the MOS capacitors. Basic Structures and the operating principle of MOSFET, I-V characteristics of an ideal MOSFET, Charge Coupled Devices (CCD)- principle of operation.

UNIT – IV: Power Devices and Semiconductor Technology

Technology of Semiconductor Devices: Crystal growth and Wafer preparation, Methods of p-n junction formation, Growth and deposition of dielectric layers, Planar technology, Masking and lithography, Pattern definition, Metal deposition techniques.

Power rectifiers and Thyristors: Power rectifiers, Thyristors, Some special thyristor structures, Bidirectional thyristors, Field-controlled thyristor.

Text Books:

1. Introduction to Semiconductor Materials and Devices, M.S. Tyagi, John Wiley & Sons (Asia) Pvt. Ltd., Singapore, 2000.
2. Microwave Devices and Circuits, Samuel and Y. Lao, Prentice-Hall of India, 1999.
3. Microwave and Radar Engineering, M.Kulkarni, UMESH Publications, New Delhi, 1999, 2003.
4. Physics of Semiconductor Devices, S.M. Sze, 3rd Edition , Oct.2006, John Wiley.
5. Solid State Electronic Devices, B.G. Streetman, PHI, New Delhi., 6th Edition, 2007.

PHY-304	ELECTRONICS - EMBEDDED SYSTEMS	L-4, T-1, P-0	4 Credits

Course Objectives:

- To have knowledge about the basic working of a microcontroller system and its programming in assembly language.
- To learn about Instructions set of pic microcontroller, assembler and its formats
- To develop programs with the help of MPLAB IDE.
- To have the knowledge about the details of hardware to know the functioning of internal organization of the embedded systems. To understand the transfer of the data and working functionality of how the ports, interrupts, timing generation and remaining peripherals.
- To provide experience to integrate hardware and software.

Course Outcomes: At the end of the course, the student will be able to		
CO1	understand about the basic functions and structure of embedded systems	K2
CO2	Get familiarized with Embedded system Design Tools and Hardware	K3
CO3	understand about the basic programming concepts of embedded systems	K2
CO4	know about the applications of PIC microcontrollers	K3

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	-	-	-	2	-
CO2	3	2	3	3	2	1	2	-	2	-	2
CO3	3	2	3	3	2	-	-	-	-	2	-
CO4	3	2	3	3	2	1	2	-	1	-	2

Unit - I: Introduction to Embedded Systems

Embedded systems in today's world – examples of Embedded systems – Microprocessors and Microcontrollers – Microchip and PIC microcontroller – Introduction to PIC microcontrollers using the 12 series.

Architecture of 16F84A – Memory organization – in 16F84A – Timing generation – Power-up and Reset functions in 16F84A.

Unit - II: Hardware Details of 16F84A

Parallel ports : Basic idea – Technical challenge – connecting to the parallel port – Parallel ports of PIC16F84A – Clock oscillator – Power supply – Interrupts – Timers and counters – watch dog timer – Sleep mode.

Unit - III: Assembler and Assembler Programs

Basic idea – PIC 16 series instruction set and ALU – Assemblers and Assembler format – creating simple programs – Adopting a development environment – Building structured programs – Flow control : Branching and Subroutines – Generating time delays and intervals – Logical instruction – Arithmetic instructions.

Unit - IV: PIC Microcontroller PIC 16F873A

Block diagram and CPU – Memory and memory maps – Interrupts – Oscillator, Reset and Power supply – Parallel ports.

PIC 16F87XA Timer 0 and Timer 1 – 16F87XA Timer 2, Comparator and PR2 register – capture/Compare/PWM (CCP) Module – Pulse width modulation – ADC module.

Interface: LED displays – Liquid crystal displays-Sensors-Acutuators.

Text Books:

1. Designing Embedded Systems with PIC Microcontrollers: Principles and Applications by Tim Wilmshurst, First Edition, 2007, Newnes – Elsevier – Publishers., 2nd Edition, 2010.
2. Microcontrollers: Theory and Applications, Ajay V. Deshmukh, , Tata Mc Graw- Hill, New Delhi, 2005., 20th Edition, 2012.
3. Designing with PIC Microcontrollers, John B. Peatman, Pearson Education, Inc., 1998., 20th Edition, 2013.

PHY-401	QUANTUM MECHANICS - II	L-4, T-1, P-0	4 Credits

Course Objectives:

- Understanding of Physical significance of identical particles.
- Introduction of Spin and Total angular momentum.
- Understanding of relativistic quantum mechanics with different aspects in the presence of electromagnetic fields
- Introduction on field quantization and effect of quantization on different fields, second quantization.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand the concept of identifiable particles	K2
CO2	Understand the Orbital Angular momentum spin angular momentum and general angular momentum and their importance in spectroscopy	K2
CO3	Give the significance of Klein Gordon and Dirac equation and explain the existence of antiparticles.	K3
CO4	Apply the symmetries principles in calculating the conserved currents and charges.	K3

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	-	1	1	1	-	2	1	2
CO2	3	2	3	-	1	1	1	-	2	1	2
CO3	3	2	2	2	1	1	1	-	2	1	2
CO4	3	3	2	2	1	1	1	-	2	1	2

UNIT- I: Identical Particles and Molecules

Identical particles- In distinguish ability of Identical particles- Construction of Symmetric and Anti-symmetric wave functions for two and three particle systems - Pauli's Exclusion Principle- Hydrogen molecule- Spin-orbit interaction- Ortho and Para hydrogen- Spin statistics connection.

UNIT - II: Angular Momentum

Introduction: Definition of angular momentum operator - Commutation rules for angular momentum - Eigen values and Eigen functions of L_z and L^2 - Angular momentum in general - Allowed values of angular momentum J - Eigen values of J_+ and J_- angular momentum matrices - Addition of angular mometa and Clebsh -- Gorden co-efficients: Clebsh – Gorden co-efficient for $J_1=J_2=1/2$ and $J_1=1$, $J_2=1/2$ - spin angular momentum and Pauli's spin matrices.

UNIT - III: Relativistic Quantum Theory

Klein – Gorden Equation – Probability Current Density – Inadequacies of K.G. Equation – Dirac's Relativistic Equation for a Free Particle - Dirac`s Matrices – Dirac`s Equation in Co-variant form – Plane wave solution – Negative Energy States – Spin Angular Momentum -Existence.

UNIT - IV: Quantization of Wave Fields

Concept of Field - Method of Canonical Quantization: Lagrangian Formulation of Field, Hamilton Formulation of Field - Second Quantization – Field equation - Quantization of Non-relativistic Schroedinger equation – Commutation and Anti-commutation Relations, The N-representation - System of Fermions and Bosons – Creation and Annihilation.

Text Books:

1. Quantum Mechanics: S.L.Kakaniand H.M. Chandalia Sultan Chandand Sons 4th Edition, 2004.
2. Advanced Quantum Mechanics: B.S. Rajput, Pragati prakasan, 5th Edition, 1990.
3. Quantum Mechanics: V.K. Thankappan, Wiley Eastern Limited, 2nd Edition, 1993.
4. A Textbook of Quantum Mechanics: P.M. Mathews and K. Venkatesan, Tata Mc Graw Hill Publishing Company, 9th Edition, 2014.
5. Quantum Mechanics: S.L. Gupta, V. Kumar, H.V. Sharma and R.C. Sharma, Jai Prakash Nath and Company 26th Edition, 2007.
6. An Introduction to Quantum Mechanics, P.T.Mathews McGraw Hill Publishing Company, 3rd Edition, 1974.

PHY-402	ANALYTICAL TECHNIQUES	L-4, T-1, P-0	4 Credits

OBJECTIVES:

- To make students acquainted with the essence of analytical techniques in elucidating the properties of materials.
- To describe the students the principles of various analytical techniques; UV-Vis spectroscopy, X-ray diffraction, ESR, Mossbauer, NMR, NQR and various electron microscopic techniques such as FE-SEM, XPS etc..
- To delineate the methods of using different analytical methods and techniques for material characterization and modelling for various applications.
- To enable the students to analyse the crystal structure using XRD, TEM and study of microstructure using FE-SEM. Analysis of the data acquired by the resonance methods ESR, NMR, NQR, Mossbauer Spectroscopy and their applications in elucidating the properties of materials.
- To study the various aspects of materials characterization for their technological applications.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Determining crystal structure of specimen and estimate its crystallite size and stress.	K3
CO2	Use an appropriate resonance technique to elucidate the required properties of the materials like cooridnations and bonding of ligands around the metal ions.	K3
CO3	Use an appropriate spectroscopic technique to measure vibrational / electronic transitions to estimate parameters like energy band gap, elemental concentration, etc.	K3
CO4	Applying appropriate electron microscopy techniques to investigate the microstructure examination at different magnification level and use them to understand the microstructure of various materials.	K3

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	-	1	1	1	-	2	1	2
CO2	3	2	2	-	1	1	1	-	2	1	2
CO3	3	2	3	2	1	1	1	-	2	1	2
CO4	3	3	2	2	1	1	1	-	2	1	2

UNIT- I: Diffraction Methods for Structure Analysis

Crystal systems: Symmetry elements, Concept of point groups and space groups. Reciprocal Lattice: Geometrical construction, Relation between direct – Reciprocal Lattice X- ray diffraction, Bragg's law, Laue methods, Powder X-ray Diffractometer– Focusing circle geometry- Determination of lattice constant of a cubic and tetragonal structures using d-spacings, Single crystal X-ray Diffractometer- Electron diffraction and Neutron diffraction: Basic principles and applications.

UNIT - II: Electron Spin Resonance and Mossbauer Spectroscopy

Electron spin resonance spectroscopy: Magnetic moment of an electron, two states of an electron in a magnetic field, ESR theory- Spin-spin interaction, Spin-lattice interaction - Hyperfine interaction- g factor, Line widths and Intensities, Relaxation effects, Experimental methods and applications.

Mossbauer spectroscopy: Introduction-Mossbauer effect, Recoilless emission and absorption, Mossbauer spectrum, Lamb-Mossbauer factor-Mossbauer nuclides- Experimental methods and applications.

UNIT – III: NMR and NQR Techniques

Introduction to NMR: Nuclear spin and magnetic moment, Quantum description of NMR, theory of NMR, chemical shift, Spin-lattice (T_1), spin-spin (T_2) couplings, Bloch equations, Theory of relaxation mechanisms for spin ½ nuclei, Proton NMR, Carbon-13 NMR and NMR applications.

Basic concepts of NQR spectra: Half integral and integral spins, Instrumentation, Super regenerative oscillator, CW oscillator, Pulse RF detection and applications.

UNIT – IV: Advanced Spectroscopic and Microscopic Techniques

Basic principles, Instrumentation and applications of X ray fluorescence spectroscopy, Photo acoustic spectroscopy and X-ray photoelectron spectroscopy.

Basic principles, Instrumentation and applications of Scanning electron microscopy, Transmission electron microscopy, Atomic force microscopy.

Text Books:

1. Elements of X-ray Diffraction, B.D. Cullity., Nabu Press, 2014.
2. Elements of X-ray crystallography, L.V.Azaroff., Tech Books, 1968.
2. Methods of Surface Analysis, Techniques and Applications, J.M. Walls Cambridge University Press, 1990.
3. Neutron Diffraction, G.E. Bacon, Oxford University Press, London, 1962.
4. Electron Diffraction, T.B. Rymer, Methnen, London, 1970.
5. X-ray Structure Determination, H. Stout and LH. Jenson, Macmillan, London, 1968.
6. An Introduction to Electron Paramagnetic Resonance, M. Bersohn, J.C. Baird, Benjamin Inc., London, 1966.
7. Instrumental Methods of Analysis, Willard Merritt, Dean Settle, CBS publishers, New Delhi, 1986

8. Spectroscopy, B.P. Straughan and S. Walker, John Wiley & Sons Inc., New York,1976.
9. Spectroscopy, G. Chatwal and S. Anand, Himalaya Pub., 2002.
10. Spectroscopy, B.K. Sharma, Goel Publishers House, Meerut, 1975.
11. NMR Spectroscopy, R.K. Harris, Longman Sci. Tech, 1983.

PHY-403	ADVANCES IN PHYSICS	L-4, T-1, P-0	4 Credits

Course Objective:

Course enables the students:

- To make the students acquire an understanding the Nanoscience and Applications.
- To identify optical phenomenon and tools to understand physics at nanoscales.
- To evaluate different quantum systems in zero, one, two and three-dimensional system at the nanoscale.
- Introduction to Microelectromechanical systems and its applications
- To discuss the Nano devices and applications
- Construction and importance of photoelectric cells
- Structure and application the photonic crystals
- Microcontrollers (8051), its architecture and working is subject of module-3
- The 4th module contains Real time control sequences and programming of 8051-microcontroller.
- The AVR RISC microcontroller architecture is covered in module-5.
- To study the concepts of remote sensing and remote sensing systems.
- To understand the characteristics of remote sensing images and the advantages of remote sensing.
- To study the applications of remote sensing in different aspects.

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand the concepts of nanotechnology	K2
CO2	Physical and chemical techniques of nanomaterial synthesis	K2
CO3	Concepts of Nano materials and Nano devices	K3
CO4	Basics of remote sensing and understanding the concepts of Geographical Information system	K3

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	-	1	-	-	2	-	1
CO2	3	2	3	3	2	1	2	-	3	2	1
CO3	3	2	3	3	-	1	-	-	3	-	1
CO4	3	2	3	-	2	1	2	-	-	2	1

UNIT – I: Nano Technology

Introduction to Nanomaterials – Zero, One and Two Dimensional Nanostructures - Quantum confinement - Density of states and Dependence of dimensionality – Properties of Nanomaterials (physical, chemical, electrical, mechanical and optical) – Carbon Nanotubes, Fullerenes.

Synthesis of Nanomaterials – Physical Techniques: Ball Milling – Plasma Arc Deposition – Inert Gas Condensation – Pulsed Laser Deposition – Molecular Beam Epitaxy.

Chemical Techniques: Hydrothermal synthesis– Sol-Gel Process – Chemical Vapour Deposition. Applications: Single Electron Transistor – Solar Cells – Light Emitting Diodes – Nano-filtration-Medical, Scientific and Industrial- Energy storage.

UNIT – II: Micro and Nano devices

Microelectromechanical systems (MEMS): Introduction to MEMS, Basic MEM structure. Applications of MEMS: Pressure sensors, Accelerometers, Inertial sensors, Mass flow sensors.

Nanodevices: Nano boats- Quantum well and quantum dot devices: Infrared Detectors-Quantum Dot Lasers. Catalysis by Gold nanoparticles - Carbon nanotube emitters - Photoelectrical cells - Photonic crystals.

UNIT – III: 8051 Microcontrollers

Microcontrollers and Embedded Processors: Introduction, 8051 Internal Architecture, Register Structure, I/O pins, Memory Organization, 8051 Addressing modes. 8051 Assembly Language Programming Tools. 8051 Instruction set: Data Transfer Instructions, Arithmetic instructions, Logical instructions, Boolean Variable Manipulation Instructions-Bit Addressability, Single-Bit instructions, Program Branching instructions-Jump, Loop, and Call instructions, Rotate Instructions, Stack Pointer.

UNIT - IV: Remote Sensing

Definition of remote sensing; introduction to concepts and systems; Electromagnetic radiation; electromagnetic spectrum; image characteristics; remote sensing systems; remote sensing platform; Sources of remote sensing information; Advantages of remote sensing. Application of Remote sensing in Environmental Management, Natural resource management – forest resources, water resources, land resources and mineral resources.

Text Books:

1. Nano structures and Nanomaterials: Synthesis, Properties and Application By Guozliong Cao, Imperial College Press, 2004.
2. Introduction to Nanotechnology, Charles P. Poole, Jr & Frank J. Owens, Wiley India, 2006.
3. An Introduction to Microelectromechanical Systems Engineering, Nadim Maluf. 2009.
4. Nanomaterials Synthesis Properties and Applications, Alen. S. Edelstein and Robert C. Cammarata, 1998.
5. The 8051 Microcontroller and Embedded systems, Mahammad Ali Mazidi and Janice Gillispie Mazidi, Pearson Education Asia, Pvt. Ltd., 2000, 2nd Edition, 2013.
6. Floyd F. Sabins Jr., Remote Sensing Principles and interpretation, W.H. Freeman and Company, 2nd Ed., New York, 1987.
7. T.M. Lillesand & R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons, New York, 1994.
8. An Introduction to GIS by Ian Heywood et al., Addison Wesley, Longmont Limited, England.

PHY-404	ELECTRONICS - WIRELESS COMMUNICATION SYSTEMS	L-4, T-1, P-0	4 Credits

Course Objective:

- Introduction to Digital communication systems and data transfer with different digital modulation techniques.
- Knowledge on ways to detect and correct the errors during the transmission of data in digital communication.
- Introduction to wireless communication systems
- To discuss about the cellular concept and roaming
- To explain about the frequency re-use and spread spectrum modulation
- To discuss about the multiple access techniques
- Introduction of wireless network generations
- Introduction the satellite systems
- Discuss about the multiple access format-satellite systems
- Explain about the satellite receiving systems
- Discuss about the application of communications and remote sensing
- Introduction to optical communication systems

Course Outcomes: At the end of the course, the student will be able to		
CO1	Understand the basics of digital modulation techniques	K2
CO2	Understand various coding and error correction techniques	K2
CO3	Know GSM mobile communication standards, its architecture, logical channels, advantages and limitations.	K3
CO4	Familiarize with optical and satellite communication techniques	K3

Mapping of course outcomes with the program outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	1	2	2	-	2	-	2	2	-
CO2	3	2	1	2	2	2	-	-	2	2	-
CO3	3	2	1	2	1	2	2	-	2	2	-
CO4	3	2	1	2	2	-	-	-	2	2	1

Unit – I: Base band data transmission

Digital Modulation techniques: BPSK, QPSK, DPSK, QASK, BFSK, MSK, M-ary techniques. Base band binary data transmission system – Inter symbol interference – Nyquist pulse shaping criteria – line coding, pulse shaping, and scrambling techniques.

Unit – II: Codes for error detection and correction

Detection of error probability: Gaussian probability function – properties – error function complementary – error function. Parity check coding- Linear block codes, Convolutional codes – Cyclic codes. Encoding, Decoding of convolutional codes, State, Tree and Trellis diagrams. Maximum likelihood – Viterby algorithm, Sequential decoding - Burst error correction - Interleaving techniques – Block and convolutional interleaving, Types of ARQ. Performance of ARQ- Comparison of coded & uncoded systems.

Unit – III: Introduction to wireless communication systems

Global system for mobile (GSM): cellular concept, system design. Roaming, Transmission system, Receiving system; frequency re-use; Spread spectrum modulation; Multiple access techniques as applied to wireless communications; 1G, 2G, 3G wireless networks.

Unit – IV: Satellite and Optical communications

Introduction Satellite systems: Orbiting satellites, satellite frequency bands, communication satellite system-modulation and multiple access format-satellite systems in India, Satellite receiving systems, G/T ratio, satellite uplink and down link analysis. Applications to communications and remote sensing.

Introduction to Optical communications systems: Optical fibers, sources and detectors, analog and digital systems.

Text Books:

1. Modern Digital and Analog communication system, B.P. Lathi: Oxford 3 rd Edition.
2. Digital Communications Fundamentals and Applications, Bernard Sklar, Sklar Pearson Education.
3. Principles of Communication, R.E. Ziemer, WH Tranter 5th Edition John Wiley (Fifth module).
4. Advanced Electronic Communication Systems, Wayne Tomoasi, Person Education/PHI., 6th Edition, 2015.
5. Digital Communication, John G Proakis, MGH., 5th Edition, 2015.
6. Digital Communication Techniques Simon, Hindey Lindsey PHI., 1995.
7. Communication Systems, Simon Haykin, John Wiley & Sons. Pvt. Ltd., 4th Edition, 2014.
8. Principles of Communication Systems, Taub and Schilling, Tata McGraw-Hill., 3rd Edition, 2012.
9. Digital and Analog Communication System, K. Sam Shanmugam. John Wiley., 5th Edition, 2014.
10. Communication Systems Engineering, Proakis, Pearson Education., 2nd Edition, 2013.
11. Digital and Analog Communication System, Leon W Couch, Pearson Education/PHI., 7th Edition, 2008.
12. Introduction to Statistical Signal Processing with Applications, M.D. Srinath, P.K. Rajasekaran, R.E. Viswnathan PHI., 1st New Edition, 1995.
13. Analog and Digital Communication Systems, M.S. Roden, Pearson Education (US), 4th Edition, 1995.
14. Digital Modulation and Coding. Wilson, Pearson Education., 1996.
15. Applied Coding and Information Theory for Engineers, Wells, Pearson Education.