M.Sc. Physics **Prospectus No. 2015124**

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान पारंगत (पदार्थविज्ञान)
सत्र-१ ते सत्र -४

PROSPECTUS
OF
MASTER OF SCIENCE IN
PHYSICS
Semester-I & III, Winter, 2014 and
Semester-II & IV, Summer-2014

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M.Sc. (Physics) Prospectus No.2015124

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

SYLLABUS PRESCRIBED FOR M.SC. SEM-I TO IV PHYSICS

M.Sc. (Physics) 4-Semester course contents

(Restructured syllabi finalised by Sub-Committee of BOS (Physics)

CODE	TYPE	TITLE OF THE PAPER/LABORATORY	Remarks
1PHY-1	C	Mathematical Physics	Compulsory
1PHY-2	C	Classical Mechanics	Compulsory
1PHY-3	C	Quantum Mechanics-I	Compulsory
1PHY-4	C	Computational Methods and Programming	Compulsory
1PHY-5	C	General Lab	Compulsory
1PHY-6	C	Computer Lab	Compulsory
2PHY-1	C	Electrodynamics-I	Compulsory
2PHY-2	C	Quantum Mechanics-II	Compulsory
2PHY-3	C	Solid State Physics	Compulsory
2PHY-4	E/GIC	i.Net work Theorems and Solid State Devices	
		ii.Lasers & Laser Applications	
	Elective	Interdisciplinary	
2PHY-5	C	Lab on Solid State Physics	Compulsory
2PHY-6	C	Lab on Electronics	Compulsory
CODE	TYPE	TITLE OF THE PAPER/LABORATORY	Remarks
3PHY-1	C	Electrodynamics -II (Radiation & Plasma Physics)	Compulsory
3PHY-2	C	Statistical Mechanics	Compulsory
3PHY-3	C	Atomic & Molecular Physics	Compulsory
3PHY-4	ES/GIC	i.Digital Techniques	
		ii.Condensed matter Physics-I	
		iii. Analogue Communication	Specialization only
		iv. Photonics-I	
		one to be selected	
3PHY-5	E	Lab on elective (Specialization)	Specialization
3PHY-6	SR	Review +Seminar Report Evaluation(Survey)	Specialization
4PHY-1	C	Nuclear & Particle Physics	Compulsory
4PHY-2	C	OPAMP theory and applications	Compulsory
4PHY-3	E	i.Micro-processor Programming and Interfacing	
		ii.Condense Matter Physics-II	
		iii.Digital Communication	Specialization only
		iv. Photonics-II	
		one to be selected	
4PHY-4	ES/GIC	i. Advance Microprocessors and Microcontrollers	
		ii. Nano-science and Nanotechnology	Elective
			Interdisciplinary
4PHY-5	E	Lab on elective (Specialization)	Specialization
4PHY-6	PR	Experimental Project +Seminar Report Evaluation	Specialization

Notes: 1.C → Core subjects; compulsory

2.E/GIC → Elective as General Interest Course could be offered to non-departmental students

3.ES → Elective Specialization to be selected by the Institution. If a student selects 3PHY-4(i) at the 3rd Semester then 4PHY-5 & 4PHY-5 will be on the elective specializations.

1. 3PHY-6 at the third semester is related with Review +Seminar Report Evaluation (Survey).
2. 4PHY-6 is related with Experimental Project +Seminar Report Evaluation
3. The topic for 3PHY-6 must be related with 4PHY-6.
4. The experimental Projects in 4PHY-6 may be based on research area.
5. The student is required to submit three copies in each case i.e. 3PHY-6 and 4PHY-6 at the time of examination.
6. The performances in 3PHY-6 and 4PHY-6 will be evaluated by an external and an internal examiners appointed by the S.G.B.Amravati University, Amravati.

The topic of the Project which is to be completed by every student during fourth semester under 4PHY-6 is to be decided at the beginning of third semester. Accordingly the students are expected to do literature survey, define the problem of the project work and prepare a report including scope, limitation and objectives and deliver the seminar.

The distributions of Lab activity marks :

Lab Activity codes	60% weightage	20% weightage	20% weightage
1PHY-5, 1PHY-6, 2PHY-5, 2PHY-6, 3PHY5 and 4PHY-5	Performance of the student at the time of examination including report.	Viva-Voce	Record and performance in the Lab assignments
3PHY-6	Performance in the seminar at the time of examination	Viva-Voce	Seminar report
4PHY-6	Outcome of the Project and Presentation & performance	Viva-Voce	Project report

*****

M.Sc. Semester - I

1PHY-1: MATHEMATICAL PHYSICS

UNIT-I : Matrix Algebra :- Vector spaces and transformations, the algebra of matrix, partitioning of matrices. The eigen value problem. Functions of aMatrix, Kronecker sum and product of matrices, Matrices in classical and quantum mechanics.

UNIT-II : The Complex Variables : Complex variables and their representation, functions of a Complex variable, Analyticity, Harmonic functions, Cauchyôs integral theorem and integral formula, series expansion, Taylor and Laurent series, Residue theorem.

UNIT-III : Differential Equations of the Second Order : Linear differential equation with variable coefficients, Series, Solution, The Legendre equation, Legendre function of the second kind, Generating function, Rodrigueôs formula, Orthogonality of generating functions, Recurrence relations.

UNIT-IV : Bessel Differential Equation : Besselôs function of the third kind (Hankel function), Generating function, Recurrence relations, Orthogonality of bessel;s function, Hermite differential equation, Hermite polynomials, Generating function, Recurrence relations, Rodrigueôs formula, Orthogonalaity of Hermite Polynomials.

UNIT-V : Integral Transforms :

Laplace Transforms - Properties of Laplace transform, differential equation method of finding Laplace transform, Inverse Laplace transform. Fourier Transforms - Fourier Series, properties of Fourier Series, Fourier integral, Fourier transform of derivatives, Applications of Fourier transform.

Reference Books :

1. Matrices and Tensors in Physics (2nd Edition), A.W.Joshi, Wiley Eastern Limited.
2. Mathematical Physics, Satya Prakash, S.Chand & Sons.
3. Mathematical Physics, Kalani and Hemrajani, Himalaya Publishing House.
4. Introduction to Mathematical Physics, Charlie Harper, Prentice Hall India Pvt.Ltd.
5. Mathematical Physics (17th Edition), B.S.Rajput, Pragati Prakashan, Meerut.

6. Mathematical Physics, Sisodia, Kachava, Khamesra, Dashora Ramesh Book Dept., Jaipur.
7. Mathematical Physics, P.K.Chottopadhyay, New Age International (P.) Ltd.
8. Mathematical Physics, (2nd Rev.Edition), B.D.Gupta, Vikas Publishing House, New Delhi.
9. Mathematical Methods for Physics George Arfken Wiley Eastern
10. Mathematical Physics Vol. 1 & 2, Joglekar University Press.
11. Laplace Transform Seymour, Lipschutz, Schaum Outline Series
12. Fourier Series Seymour, Lipschutz, Schaum Outline Series

1PHY-2 : CLASSICAL MECHANICS

UNIT-I : Elementary survey of Classical Mechanics: Newtonian mechanics for single particle and system of particles, Types of the forces and the single particle system examples, Limitation of Newtonôs program, conservation laws viz Linear momentum, Angular Momentum & Total Energy, work-energy theorem; open systems (with variable mass). Principle of Virtual work, DôAlembertôs principleô applications,

UNIT-II : Constraints; Definition, Types, cause & effects, Need, Justification for realizing constraints on the system, Difficulties introduced by imposing constraints on the system, Examples of constraints, Introduction of generalized coordinates justification. Lagrangeôs equations; Linear generalized potentials, Generalized coordinates and momenta & energy; Gauge function for Lagrangian and its gauge invariance;.

UNIT-III : Cyclic coordinates, Integrals of the motion, Concepts of symmetry, homogeneity and isotropy, Invariance under Galilean transformations Hamiltonôs equation of motion: Legendreôs dual transformation, Principle of least action; derivation of equations of motion; variation and end points; Hamiltonôs principle and characteristic functions; Hamilton-Jacobi equation.

UNIT-IV : Central force: Definition and properties, Two-body central force problem, closure and stability of circular orbits;

general analysis of orbits; Keplerôs laws and equation, Classification of orbits, diffential equation of orbit, Varial Theorem.

UNIT-V : Canonical transformation; generating functions; Properties; group property; examples; infinitesimal generators; Poisson bracket; Poisson theorems; angular momentum PBs; Transition from discret to continuous system, small oscillations (longitudinal oscillations in elastic rod) ; normal modes and coordinates

Reference Books.

1. Classical Mechanics, by N C Rana and P S Joag (Tata Mc-Graw-Hill, 1971)
2. Classical mechanics, by H Goldstein (addison Wesley, 1980)
3. Mechanics, by A Sommerfeld (Academic Press, 1952)
4. Introduction to Dynamics, by I Perceival and D Richards (Cambridge Univ. Press. 1982).
5. Classical Mechanics by J.C.Upadhaya (Himalaya Pub).
6. Classical Mechanics by Waghmare (West Wiley)
7. Mathematical Physics - by B.D.Gupta (Vikas Pub.)

1PHY-3 : QUANTUM MECHANICS-I

UNIT-I : Review of (i) failure of classical ideas ï photoelectric effect, Compton effect, blackbody radiation, atomic spectra, (ii) wave-particle duality, (iii) Heisenberg uncertainty relation and (iv) wave function; Schrodingerôs equation, probability, probability current and continuity equation; Wave packets, minimum uncertainty Gaussian wave packets, group velocity and dispersion, simple one-dimensional problems ï infinite and finite potential wells, tunneling probabilities; One-dimensional harmonic oscillator.

UNIT-II : General formalism of quantum mechanics ï linear vector spaces and operators; Representations of states and dynamical variables; Hermitean operators, eigenstates and eigenvalues, completeness of eigenstates; Dirac bra and ket notation, matrix representation of operators; Change of bases and unitary transformations; Diagonalization of the hamiltonian.

UNIT-III : Simple harmonic oscillator using energy representation - raising and lowering operators; Angular momentum and central forces; Representation of angular momentum operators and hamiltonian in spherical coordinates; Hydrogen electron wave functions and energy states - principal, orbital and magnetic quantum numbers, Laguerre polynomials and spherical harmonics; Spatial nature of hydrogen electron orbitals.

UNIT-IV: Pauli spin matrices, angular momentum algebra; Simultaneous eigenstates of L^2 and L_z, L_+ and L_- operators; Addition of angular momenta; Application to spin-orbitals of hydrogen, Clebesch-Gordan coefficients, examples of simple cases.

UNIT-V : Symmetry and constants of motion, time evolution, commutators, complete sets of commuting physical observables; Schrodinger, Heisenberg and Interaction Pictures; Variational principle, Helium atom, WKB approximation, slowly varying potentials.

Books

1. Quantum Mechanics, L I Schiff.
2. Quantum Mechanics, Eugene Merzbacher (John-Wiley, 3rd Ed, 2005)
3. Quantum Mechanics, P M Mathews and K Venkatesan (Tata-McGraw Hill, 1976)
4. Quantum Physics, S. Gasiorowicz (John-Wiley)
5. Quantum Mechanics, L. D. Landau and E. M. Lifshitz

1PHY-4 COMPUTATIONAL METHODS AND PROGRAMMING

UNIT -I : Methods for determination of zeroes of linear and nonlinear equations and transcendental equations, convergence of solutions. Solution of simulataneous linear equations, Gauss elimination, Pivoting, Iterative method, Matrix inversion.

UNIT-II : Eigen values and Eigen vectors of matrices, Power and Jacobi methods.Finite differences, Interpolation with equally spaced and unevenly spaced points, curve fitting, Least squares fitting, Cubic spline fitting. Numerical differentiation and integration, Newton-Cotes formulae, Error estimates, Gauss methods

UNIT-III : Random variate, Monte Carlo evaluation of integrals, Methods of importance sampling, Random walk and metropolis methods. Numerical solution of ordinary differential equations, Eular and Runge Kutta methods, Predictor and Corrector methods, Elementary ideas of solutions of partial differential equations.

Unit-IV : Introduction to programming and study of logic. Elementary information about digital computer principles, compilers, interprets and operating system. C-Programming, Flow charts, C character set, Identifiers and key words, Data types, Declarations, Expressions, statements and symbolic constants, input output statements, Pre-processors commands, storage types, automatic external, register and static variables.

Unit-V : Operators and Expressions : Arithmetic, unary, logical, bit-wise, assignment and conditional operators. Control statements : While, do-while for statements. Nested groups. If-else, switch, break, continue and goto statements, comma operators. Arrays : Defining and processing. Passing arrays to a function. Multidimensional arrays, Functions : Defining and accessing. Passing arguments. Function Prototypes. Recursion. Library functions. Static functions.

TEXT AND REFERENCES BOOKS

1. Introductory methods of numerical analysis Sastry
2. Numerical analysis Rajaraman
3. Computer oriented numerical methods Rajaraman
4. A first course in computational Physics, Paul L. DeVries & Javier E. Hasbun (Jones & Barlett Pub.
5. Mastering C by Venugopal, Prasad, TMH.
6. Complete reference with C, Tata McGraw Hill.
7. C Programming, E-Balagurusamy, Tata McGraw Hill.
8. Schaums outline of theory and Problems of programming with C. Gottfried.
9. Let us C by Kanetkar.

1PHY-5 : LABORATORY COURSE -1

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1) Develop and execute a program to obtain volumes and areas of regular bodies and figures.
2) Develop and execute a program to convert temperature from one system to other system (at least three).
3) Develop and execute a program to fit a straight line to experimental data.
4) Develop and execute a program to fit exponential function to experimental results.

5) Develop and Execute a program to obtain integral of a tabular function.
6) Develop and execute a program to obtain inverse of a matrix.
7) Develop and execute a program to obtain roots of a polynomial by a) Newton-Raplson Method and b) Bisection Method.
8) Develop and execute a program to obtain product of two matrices.
9) Develop and execute a program to obtain solution of differential equation by a) Euler and B) Runge Kutta Method.
10) Develop and execute a program to obtain value of an equation using subroutine.

1PHY-6 : LABORATORY COURSE -2

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1) Measurement of wavelength of He-Ne laser using ruler
2) Measurement of thickness of a thin wire using laser.
3) To study the Faraday effect using He-Ne laser.
4) Experiments using Babinator.
5) Develop and Execute a program to obtain integral of a function.
6) To measure the intensity distribution across the laser beam.
7) To study the florescence spectrum of a dye
8) Study of Electron spin resonance spectrometer.
9) Determination of h/e by using photocell.
10) Chi-square test
11) To determine Range of Beta particles in Aluminium.
12) Random nature of radioactivity.
13) Determination of wavelength of sodium light using Fabry Perot Etalon.

M.Sc. Semester- II

2PHY-1 : ELECTRODYNAMICS – I

UNIT-I : Review of vector differential calculus Gaussô law; Electrostatic potential, Poisson and Laplace equations; Eelectrostatic energy density, electric energy of a charge distribution

UNIT-II : Laplace equation and boundary value problems ï Potentials under Cartesian, cylindrical and spherical symmetries, two-dimensional problems ï separations of variables, method of images, simple illustrative problems ï point charge, linear conducting plane, cylinder ,sphere. Introduction to Greenôs function method.

UNIT-III : Magnetostatics, Biot-Savart Law, Ampereôs law; Magnetic fields of arbitrary current distributions, straight wire, loop, solenoid, toroid, current sheet; Magnetic moment, magnetic force and torque on a circuit.

UNIT-IV : Charge distribution in finite region, multipole expansion of potential and field; Material media, boundary conditions; Dielectric sphere in uniform field; Susceptibility and polarizability, molecular model.

UNIT-V : Time varying fields, displacement current, Faraday induction; Maxwellôs equations for time varying fields, scalar and vector potentials, gauge invariance, wave equation, Poynting theorem.

Books

1. Classical Electrodynamics, J.D. Jackson (John-Wiley, 3rd Ed. 1998)
2. Introduction to Electrodynamics, D. J. Griffiths (Prentice-Hall, 3rd Ed. 1999).
3. Electricity and Magnetism, A Mahajan and A Rangwala, Tata-McGraw Hill, 2004).
4. Numerical Methods in EM fields, V. Subbarao (Narosa Pub. House Pvt. Ltd.)

2PHY-2 : QUANTUM MECHANICS – II

UNIT-I : Time independent perturbation theory, non-degenerate and degenerate cases, secular equation, first and second order corrections to energy and wave functions, simple examples, Zeeman effect ï normal and anomalous, Stark effect, example of hydrogen.

UNIT-II : Time dependent perturbation theory, transition probabilities, harmonic perturbation, Fermiôs golden rule.

Transition probabilities for induced emission and absorption; Electric dipole interaction, forbidden transitions, selection rules; Application to atomic spectra.

UNIT-III : Scattering from finite range potentials, differential and total scattering, cross-sections; Scattering in a central potential; Partial wave analysis, phase shifts, Born approximation, scattering from a square well potential and a perfectly rigid sphere.

UNIT-IV : Systems of identical particles, symmetry with respect to interchange, indistinguishability of particles, Symmetric and antisymmetric wave functions, spin functions for many particles, spin-statistics relations; Creation and annihilation operators and their algebra for fermions and bosons; Representation of general one and two particle operators in this algebra.

UNIT-V : Semi classical theory of radiation, Relativistic Wave Equations ï The first order wave equations, the Dirac Equation. Properties of Dirac Matrices. Free Dirac Particles equation of continuity. Second order wave equations. The Klein-Gordon Equation.

Books :

1. Quantum Mechanics, L I Schiff.
2. Quantum Mechanics, Eugene Merzbacher (John-Wiley, 3rd Ed, 2005)
3. Quantum Mechanics, P M Mathews and K Venkatesan (Tata-McGraw Hill, 1976)
4. Quantum Physics, S. Gasiorowicz
5. Quantum Mechanics, L. D. Landau and E. M. Lifshitz
6. Advanced Quantum Theory and Fields, S.I.Gupta and I.D. Gupta, S.Chand and Company Ltd.

2PHY-3: SOLID STATE PHYSICS

UNIT-I : Crystallography: Single Crystal and Poly Crystals, Crystal Symmetry, Symmetry Elements, Crystal Types, Bravais Lattices in 2D and 3D, Point Groups and Space Groups in 2D and 3D.

UNIT-II : Diffraction of X-Rays: Braggôs Law in 1D and 3D, Laue Diffraction Equation, Atomic Scattering Factor, Structure Factor.

X-Ray Diffractions Techniques: Laue, Rotating Crystal Method, Oscillation and Burger Precession Method, Powder-Photograph Method,

UNIT-III : Interpretation of Powder Photograph, Measurement of Braggôs Angle, Interplaner Spacing (d), Accurate Lattice Parameter Determination. Analytical and Graphical Methods for (Known Unit Cell), Bernel Chart, Interpretation of Oscillation Photographs.

Concept of Reciprocal Lattice, Vector Demonstration of Reciprocal Lattice In Two Dimensions, Braggôs Diffraction Condition In Terms of Reciprocal Lattice, Brllioun Zones.

Diffraction of Electrons and Neutrons, Inelastic Scattering, Applications.

UNIT-IV : Inter-Atomic Forces Cohesive Energy of a Solid, Molecular Crystals, Ionic Crystals and Madelung Constant, Covalent Crystals and Metals, Lattice Dynamics of Mono Atomic and Diatomic Lattices. Infrared Absorption by Ionic Crystal Lattice, Localized Lattice Vibrations, Localized States and Associates Wave Function, Anharmonicity and Thermal Expansion, Thermal Conductivity.

UNIT-V : Specific Heat: Dulong and Petit Law, Lattice Specific Heat, Temperature Dependence of Specific Heat, Einstein and Debye Theories, Electronic and Lattice Contributions to Specific Heat.

References:

1. Crystallography Applied to Solid State Physics, Verma, A.R., Srivastava, O.N., New Age International.
2. Solid State Physics,N W Ashcroft and N D Mermin (Cenage Learning India Pvt Ltd, 2009).
3. Introduction to Solid State Physics, C. Kittel (John-Wiley, 8th Ed. 2005).
4. Introduction to Solids, L V Azaroff (Tata-McGraw Hill, 1984).
5. Introduction to Modern Solid State Physics, Yuri M Galperin.
6. Solid State Physics, R. L.Sighal, Ram Nath Kedar Nath & Co., Publishers Meerut.

2PHY-4(i) : NET WORK THEOREMS AND SOLID STATE DEVICES

Unit-I : **Network Analysis:** Kirchoffôs Voltage Law, Kirchoffôs Current Law, Loop and Node Method, Thevininôs Theorem, Nortonôs Theorem, Superposition Theorem, Maximum Power Transfer Theorem,

Passive Components: Resistors, Capacitors, Inductors, Transformers, Relays, Fuses (their types, applications, common faults & testing).

Unit-II : **Introduction to Semiconductors:** Energy Band Diagram, Conductors, Semiconductors, Insulators, Intrinsic and Extrinsic Semiconductors(P&N), currents in semiconductors, Diffusion Junction, Depletion Layer, Barrier Potential.

Junction Diodes: Rectifying diode, Forward and reverse bias characteristics, breakdown phenomenon, Zener Diodes, Varactor Diode, Photo Diode, Light Emitting Diode.

Unijunction Transistor: Basic Working Principle, Characteristics, Applications as a switch and as time base generator.

Field Effect Transistors: JFET, basic working principle, I/O Characteristics, pinch off voltage, parameters, MOSFET, basic working principle, Characteristics

Unit-III : **Rectifiers:** Half wave, Full wave, Bridge (calculation of ripple factor and rectification efficiency), Filters (L, C, LC, ´), Clipping and Clamping circuits.

Power Supplies: Regulated power supply, zener regulated power supply, transistorised series and shunt regulated power supply, Voltage Regulator ICôs Fix Voltage Regulators 78XX series and 79XX series, Adjustable Voltage Regulators ICs 317 and its applications. IC based power supply study.

Power Control Devices: Four Layer Diode (PNPN), Silicon Controlled Rectifier (SCR), Triac, Diac (Principle, Characteristics and Applications).

Unit-IV : **Bipolar Junction Transistor:** Basic working principle, Input and Output Characteristics, Basic configurations. Biasing, Operating point, Load line, Stabilization of Operating Point, Self-Bias Arrangement.

Amplifiers: Classification of amplifiers, Class-A, B, AB and C Amplifiers, Cascading of amplifiers, RC Coupled amplifiers. Properties of amplifiers (distortion, noise, thermal noise, shot noise, noise figure).

Feedback in Amplifiers: Feedback concept, transfer gain with feedback, Effect of Negative Feedback on amplifiers performance.

Unit-V : **Transducers:** Basic idea of Transducers, Resistive transducers (PTC-PT-100, NTC-thermisters, capacitive (microphone) transducers, Inductive (LVDT) Transducers, Pressure transducers-Strain Gauge, photo voltaic cell, LDR, Photodiode and phototransistors (qualitative only).

Basic Measuring Instruments: Analogue Multimeter, Digital Multimeter, Cathode Ray Oscilloscope, Function Generator (functional block diagram, basic working principle, measuring quantities).

Reference books.:

1. Basic Electronics and Linear Circuits by Bhargava & Kulshreshtha (TTTI)
2. Integrated Electronics by Millman and Helkian
3. Circuits and Networks by A. Sudhakar and Shyam Mohan
4. Instrumentation Repair and Maintenance by R.G. Gupta

OR

2PHY-4(ii) : LASERS AND LASER APPLICATIONS

UNIT-I : Spontaneous emission, Stimulated emission, Population inversion, Fabry Perot etalon, Stable two mirror optical resonators, Longitudinal and transverse modes of laser cavity, Mode selection, Gain in a regenerative laser cavity.

UNIT-II : Two level laser system, Threshold for three and four level laser systems, Mode locking, Pulse shortening- pico second and femto second operation, Spectral narrowing and stabilization, Gaussian beam and its properties

UNIT-III : Ammonia maser, Nitrogen laser, Carbon dioxide laser, Excimer laser, Dye laser, Ruby laser, Nd-YAG laser, Diode ï pumped solid state lasers, Semiconductor lasers, High power laser systems,.

UNIT IV : Laser induced fluorescence, Raman scattering and its applications, Non-linear interaction of light with matter, Laser induced multi-photon processes and their applications.

UNIT V : Ultra high resolution spectroscopy with lasers and its applications, Propagation of light in a medium with variable refractive index, Optical fibers, Light wave communication, Qualitative treatment of medical and engineering applications of lasers, Material processing.

TEXT AND REFERENCE BOOKS

1. Introduction to laser physics Koichi Shimoda
2. Introduction to laser physics B A Lengyl
3. Lasers Svelto
4. Optical electronics Yariv
5. Laser spectroscopy Demtroder
6. Nonlinear laser spectroscopy Letekhove
7. Laser physics Silfrast
8. An Introduction to Lasers : M.N.Avdahanulu
9. Theory and Applications (S.Chand & Co.)

2PHY-5: LABORATORY COURSE-1

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Determination of e/m by Magnetron.
2. Determination of Landeôs factor of DPPH using Electron Spin Resonance Spectrometer.
3. Determination of Magnetic Susceptibility of Material by Quinckeôs Method.
4. Characteristics of G.M.Tube.
5. Determination of dead time of G.M. counter
6. Determination of e/m by Helical Method.
7. Measurement of Hall coefficient of given semiconductor.
8. Determination of Rydberg constant.
9. Directional characteristics of Yagi Antenna.
10. Study of Transmission line.
11. Study of microphone / loud speaker characteristics.
12. Determination of œeôby Millikanôs oil drop method.
13. Determination of Current sensitivity of B.G.
14. Determination of e/m by Thomson Method.
15. Study of Magnetic Properties (Coercively, retentivity, saturation magnetisation and hysteresis loops) of ferromagnetic samples (soft iron, hard steel & nickel).

2PHY-6: LABORATORY COURSE-2

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Verification of Network theorems : Theveninôs, Nortonôs, Millimanôs and Maximum Power transfer theorem.

2. Practical use of:
   (a) Multimeter (measurement of voltage, current, resistance).
   (b) Power Supply (study the variation in line and load voltage)
   (c) Oscilloscope (voltage and frequency measurement).
3. Study of Electronic Components:
   (a) Resistor (study the types, colour coding, wattage rating, potential divider arrangement).
   (b) Capacitors (study the types, colour coding, working voltage).
   (c) Switches, Relays, Fuse (basic function, types, usage, testing).
4. P-N Junction Diode (study the types, testing, manual study, V-I Characteristics and parameters).
5. Study of PN diode as wave clipping element.
6. Study of Zener Diode (testing, V-I Characteristics, design & study of voltage regulating properties).
7. To study characteristics and application(s) of UJT.
8. Characterization and applications of SCR
9. To study characteristics and applications of SCR.
10. Study of Amplifiers (Design of CB/CE/CC, find R_{in}, R_o, A_v, frequency response).
11. Design and study of the Characteristics of JFET amplifier
12. Design and study of Characteristics of MOSFET amplifier
13. Study if Astable, monostable and bistable multivibrators by using BJT.
14. Design and testing of transistorised oscillators (any two):
    (a) RC-phase shift (b) Wein Bridge
    (c) Hartleyôs (d) Colpittôs

M.Sc. Semester - III

3PHY-1 ELECTRODYNAMICS-II

(RADIATIONS AND PLASMA PHYSICS)

Unit-I : Wave Equation for Electric and Magnetic Fields in free space, Wave Equations for Vector and Scalar Potential, Retarded and Lienard-Wiechert Potentials, Electric and Magnetic fields due to a Uniformly moving charge and an Accelerating Charge. Total power radiated and Angular Distribution of Power Radiated by moving charge with linear and circular acceleration, Cerenkov radiation, Radiation Reaction Force.

Unit-II : Motion of charged Particles in Electromagnetic Field: Uniform E and B Fields, Nonuniform Fields, Diffusion Across Magnetic Fields, Time Varying E and B Fields, Adiabatic Invariants: First, Second and Third Adiabatic Invariants.

Unit-III : Definition of plasma, concept of temperature, Debye Shielding, Plasma Parameters, Applications of plasma Physics.

Relation of Plasma Physics to ordinary electromagnetics, Classical treatment of Magnetic Materials and Dielectric. Dielectric constant of Plasma.

Fluid equations of motion, Equation of continuity, equation of state, Fluid drifts parallel and perpendicular o magnetic field.

Unit-IV : Plasma Oscillations, Electron Plasma Wave, Ion waves, Plasma Approximation, Electrostatic electron oscillations perpendicular to B, Electrostatic Ion waves perpendicular to B, Electromagnetic wave without magnetic field, Electromagnetic waves perpendicular and parallel to static magnetic field B_0.

Unit-V : Cutoffs and resonances, Whistler mode and Faraday rotation.

Hydromagnetic Waves: Magnetosonic and Alfven Waves, CMA Diagram.

Reflection of radio waves from ionosphere, effect of collision on reflection, Appleton- Hartee Formula and Propagation through Ionosphere and Magnetosphere.

References:

1. Introduction to Electrodynamics by David J. Griffiths, Publisher: PHI Learning (2009).
2. Electrodynamics: J. D. Jackson.
3. Elecrodynamics: Gupta Kumar Singh, Pragati Prakashan.
4. Electricity and magnetism: Mahajan and Rangawala Tata Mc Graw ï Hill,New York.
5. Electrodynamics: Laud New Age Publication.
6. Introduction to Plasma Physics: Francis Chen, Plenum Press.
7. Fundamentals of Plasma Physics: BittenCourt, Pergamon Press.
8. Plasma Physics: Plasma State of Matter, S. N. Sen. Prgati Prakashan.

3PHY-2: STATISTICAL MECHANICS

Unit-I : Classical Statistics :- Specification of States, phase space, trajectory and density of states, Liouvilleôs theorem, ensemble, micro canonical, Canonical and grand canonical ensembles, comparison of ensembles, Partition function and its correlation with thermodynamic quantities, Properties of partition function. Gibbs Paradox.

Unit-II : Quantum Statistics :- Basic Concepts regarding statistics of indistinguishable particles, Concepts about Fermi-Dirac and Bose-Einstein distribution. Ideal Bose-Einstein gas, degeneracy, Bose-Einstein condensation. Thermal properties of B-E gas. Blackbody radiation and Planckôs distribution law.

Unit-III : Ideal Fermi-Dirac Gas : Thermodynamic function of degenerate F-D gas, Free electron model and electron emission. Di-atomic molecule, specific heats of solids, Einstein & Debye theory,

Unit-IV : Phase Transitions : Landauôs theory of phase transition, Fluctuation in Thermodynamic Quantities, Correlation of space - time dependent fluctuations, fluctuations and transport phenomena, Brownian motion and Random walk, The Fokker-Planck Equation and its solution.

Unit-V : Introduction to non-equilibrium processes; Diffusion equation. Super-fluidity, experimentally observed properties of super-fluid He II. Landauôs theory.

Reference Books:

(1) Statistical Mechanics, K.Huang, Wiley Eastern Limited.

(2) Statistical Physics, Landau and Lifshitz

(3) Statistical mechanics, Donald Allan McQuarrie, University Science Books

(4) Introduction to modern statistical mechanics, David Chandler, Oxford University Press.

(5) Statistical Mechanics, B. K. Agarwal, New Age International.

(6) Statistical mechanics, James Woods Halley, Cambridge University Press.

(7) Statistical mechanics, Shang-keng Ma, World Scientific.

Text books

(1) Statistical Mechanics, B.K.Agrawal and M.Eisner, Wiley Eastern Limited.

(2) Introduction to Statistical Mechanics, B.B.Laud.

(3) Statistical Mechanics, Gupta, Kumar, Pragati Prakashan, Meerut.

3PHY-3: ATOMIC & MOLECULAR PHYSICS

Unit-I : Vector atom model; Space quantization and spin of electron, significance of Principle quantum number (n), Orbital quantum number (l), Magnetic Orbital quantum number (m1), Spin quantum number (s), Magnetic spin quantum number (ms), Total Angular Momentum quantum number (j), Magnetic Total number (mj). l-s coupling for single valence electron atom. Stern Gerlac Experiment. Pauliôs exclusion principle. Spectra of alkali elements. Fine structure in alkali spectra.

Unit-II : Normal and Anomalous Zeeman effect. Experimental setup to study Zeeman effect. Debyeôs explanation of Normal Zeeman effect. Theory of Anomalous Zeeman effect. Expression of Landeôs spectroscopic splitting factor (g) and effective magnetic moment for single valance electron atom. Origin of Sodium D1 & D2 lines. Anomalous Zeeman effect in Sodium D1 & D2 lines.

Unit-III : Paschen Back effect; Stark effect. LS & JJ coupling in two valence electron atoms. Interaction energy in LS & JJ coupling. Hyperfine structure (Qualitative), Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation.

Unit-IV : Types of Molecules : Diatomic linear symmetric top, asymmetric top and spherical top molecules. Molecular (band) spectra. Classification of molecular spectra (purerotational spectra, Rotation-vibration spectra, Visible and UV spectra), Rotational spectra of diatomic molecules as a rigid rotator. Quantum mechanical theory of pure rotational spectra (rigid rotator). Energy levels and spectra of nonrigid rotator. Comparison between spectra of rigid and nonrigid rotators. Isotopic effect in pure rotational spectra.

Unit-V : Vibrational energy of Diatomic molecule. Diatomic molecule as a simple harmonic oscillator. Energy levels and spectrum. Morse potential energy curve. Molecules as a vibrating rotator. Vibration spectrum of diatomic molecule. PQR branches, Raman spectra of diatomic molecules; IR spectrometer (Qualitative).

Reference Books :

1. Physics of Atoms and Molecules: Bransden and Joachain.

2. Introduction to Atomic Spectra: HG Kuhn.
3. Spectroscopy Vol. -I,II & III - Walker & Straughen
4. Introduction to Molecular Spectroscopy - G.M.Barrow
5. Spectra of Diatomic Molecules - Herzberg8.Molecular Spectroscopy - Jeanne L McHale
6. Molecular Spectroscopy - J.M.Brown
7. Spectra of atoms and molecules - P.F.Bemath
8. Modern Spectroscopy - J.M.Holias
9. Elements of Spectroscopy - Gupta, Kumar, Sharma, Pragati Prakashan, Meerut.

Text Books :

(1) Introduction to Atomic Spectra- H.E.White

(2) Fundamentals of Molecular Spectroscopy - C.B.Banwell

3PHY-4(i) : DIGITAL TECHNIQUES

Unit-I : Fundamental Digital Devices:

The transistor as a switch Basic logical operation like OR, AND and NOT , ExOR, NAND, NOR Electronic Circuit operations using Various Logic Families devices like TTL(Std, Schotky, LP, HP), C-MOS, Comparison on Fan in Fan out, Propagation delays, voltage levels, power consumption packing density etc. Merits and Demerits. NOR and NAND devices as basic building blocks, Classification of Logic Circuits

Unit-II : Combinational Logic Design :

Boolean algebra ï Simplification of logic circuits Boolean algebraic methods, rules, limitations Demorganôs theorems - Exclusive OR gate, Simplification of logic circuits using KôMap Method and complementary KôMap min terms/max terms. Half Adder, Full Adder, 7483 IC, Adder-2-Subtractor, Arithmetic circuits for Binary Multiplier, Binary Divider,

Unit-III : Devices and converters:

Multiplexer : 2:1, 4:1, 8:1 and 16:1, De-multiplexer : 1:2:,1: 4, 1:8 and 1:16, Decoder IC 7445, 7447, 74138, Encoder hex key, ASCII key ,SSD display Devices, CK/CA SSD codes , Data selector etc. 2-Bit ALU,, 4-Bit ALU-74181.

Unit-IV : Sequential Logic Design:

Bi-stable Multivibrator, Flip - Flops : the RS Flip- Flop, JK Flip - Flop - JK master slave Flip - Flops - T Flip - Flop - D flip - Flop - Shift registers - SIPO, PISO, SISO, PIPO, Universal Shift operations using various ICs, Data latches, Controlled buffers, Unidirectional & Bidirectional controlled buffers. Counters Synchronous and Asynchronous and combination counters.

Unit-V : Memory Devices:

Concept of a memory cell using DFF, Working of the memory cell for each type Static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, non-volatile - NMOS, magnetic, optical and ferroelectric memories, charge coupled devices (CCD). Read- only Memory (ROM) and applications. Random Access Memory (RAM) and applications. Memory Organization, Memory Map, Memory devices classification and features, , Programmable, OTP Memory, EPROM, EEPROM, Memory map, Designing memory organization, Serial Expansion, Parallel Expansion using 6264, 2764, etc

References :

R. P. Jain & Anand, Pittman, Malvino & Leach, Tokheim, D. C. Green, Floyed

OR

3 PHY-4(ii) : CONDENSED MATTER PHYSICS-I

UNIT-I : Band Structure - Electron levels in periodic potential Kronig Penny Model), Bloch theorem - statement and proof. Crystal momentum, number of orbitalôs in a band, band index and the concept of effective mass. Motion of electrons in bands, Reduced, periodic and extended zone schemes, Construction of Fermi surface. Nearly free electron model: qualitative proof for origin of gap in periodic potential and perturbation theory. Tight binding model: assumptions and applications to SC, FCC and BCC structures.

UNIT-II : Magnetism: Atomic Magnetic Moment, Larmor Precession, Diamagnetism: Classical and Quantum Theory, Paramagnetism: Origin of permanent magnetic moment, Ideal Magnetic Gas, Classical and Quantum Mechanical Treatments of Paramagnetism, Paramagnetism in rare earth ions, Paramagnetic cooling.

UNIT-III : Ferromagnetism: Weiss Theory, Heisenberg Model of Molecular Field Theory, Spin Waves And Magnons, Curie-Weiss Law, Theory of Ferri and Antiferro Magnetism, Domains And Domain Walls.

UNIT-IV : Dielectrics: Concept of dielectrics, Macroscopic and Local electric fields, Claussius. Mosotti relation, Types of Polarization mechanisms, complex dielectric constant, relaxation time, Concept of Ferroelectricity, Theories of ferroelectricity, Antiferrolectricity, Piezo electricity.

UNIT-V : Superconductivity: Introduction, Meissner effect, D.C. resistivity, the heat capacity, flux quantization, Type I and II superconductors. Superconducting energy gap, coherence length, London penetration depth, BCS theory, Ginzsberg- Landau theory, DC and AC Josephson effects, SQUID, Introduction to high Tc superconductors.

References:

1. Solid State Physics, N W Ashcroft and N D Mermin (Cenage Learning India Pvt Ltd, 2009).
2. Introduction to Solid State Physics, C. Kittel (John-Wiley, 8th Ed. 2005).
3. Introduction to Solids, L V Azaroff (Tata-McGraw Hill, 1984).
4. Introduction to Modern Solid State Physics, Yuri M Galperin.
5. Solid State Physics, R. L.Sighal, Ram Nath Kedar Nath & Co., Publishers Meerut.

3PHY-4 (iii) : ANALOGUE COMMUNICATION

UNIT-I : Amplitude Modulation- Generation of AM waves - Demodulation of AM Waves - DSBSC modulation. Generation of DSBSC waves, coherent detection of DSBSC waves SSB modulation, Generation and detection of SSB waves. Vestigial sideband modulation. Frequency Division multiplexing (FDM).

Unit-II : Radar block diagram, an operator radar frequency, pulse considerations. Radar range equation, derivation of radar range equation, minimum detectable signal, receiver noise, signal to noise ratio, integration of rader pulses. Radar cross section. Pulse repetition frequency. Antenna parameters. System Losses and Propagation losses. Radar transmitters, receivers. Antennas, Displays.

UNIT-III : Klystrons, Magnetrons and traveling Wave Tubes, Velocity modulation, Basic principles of two cavity Klystrons and Reflex Klystrons, principles of operation of magnetrons. Helix Travelling Wave Tubes, Wave Modes. Transferred electron devices, Gunn Effect, Principles of operation. Modes of operation , Read diode, IMPATT diode, TRAPATT Diode.

Unit-IV : Advantages and disadvantages of microwave transmission , loss in free space, propagation of microwaves atmospheric effects on propagation, Fresnel Zone problem, ground reflection, fading sources, detectors components, antennas used in MW communication systems.

Unit-V : Satellite communications : Orbital satellites, geostationary satellites , orbital patterns, look angles, orbital spacing, satellite systems. Link modules.

Text and Reference Books :

1. ñMicroelectronics ñ by Jacob Millman, Megraw-hill, International Book Co., New Delhi, 1990.
2. ñOptoelectronics : Theory and Practiceò Edited by Alien chappal MeGrawHill Book Co., New York.
3. ñMicrowaves ñ by K.L. Gupta , Wiley Eastern Ltd., New Delhi, 1983.
4. ñAdvanced Electronics Communications systems ñ by Wayne Tomasi, Phi.Edn.
5. ñElectronic Devices and circuit theoryò by Robert Boylested and Louis Nashdsky PHI., New Delhi-110001, 1991.

TUTORIAL : ELECTRONICS :

1. Radiowave propagation in free space.
2. Tropospheric & ionospheric propagation.
3. Applications of counters & shift registers.
4. Dedicated systems using microprocessor.
5. Sampling Theorem - smaple and hold circuits,
6. Second and higher order filter design concepts.
7. A/D & D/A interfacing.
8. Photo electric effect.
9. Photo emissive cells.
10. Microwave amplification.
11. Klystron and Gunn Oscillator characteristics.
12. Concepts of wave guides.

13. Microwave propagation.
14. Design considerations of microwave links.

Different types of Radar systems.

i) Weather Radars

(ii) Cyclone detection radars

(iii) Moving target indicators.

Frequency considerations in satellite communications.

In addition to above, the tutorial will also consist of solving problems given in the Text and Reference books.

OR

3PHY-4 (iv) Photonics-1: Fundamentals of Photonics

Unit-I : Maxwellôs equations, Maxwellôs wave equations for a vacuum, solution of the general wave equation, Group and Phase velocity, generalized solution of the wave equation,, transverse electromagnetic wave, flow of electromagnetic energy, electric dipole radiation, Fundamentals of geometrical optics, Ray tracing, paraxial approximation, Aberrations, Designing Optical set-ups, Thin lens theory

Unit-II : Fundamentals of Modern Optics: Wave propagation, wave particle duality, Kramers - Kronig relations, Electromagnetic fields in homo and inhomogeneous dispersive media, diffraction theory, Polarization of light.

Unit-III : Fourier Optics: Plane waves, spatial frequency, Optical Fourier Transform, Diffraction of light, special function in Photonics and their Fourier transform, convex lens and its function, Image formation, spatial filters, Holography, Applications of Holography.

Unit-IV : Near Field optics: The evanescent waves, Goos-Hänchen Shift, generation of evanescent waves, Photon tunneling microscope, scanning near field optical microscope, probes to detect the evanescent field.

Unit-V : Radiation pressure of laser light, Optical Tweezers and its applications, Raman-optical tweezers, Laser cooling of atoms, Bose Einstein Condensate, Atom laser.

References

1) Keigo Iizuka, ñElements of PHOTONICS Vol. 1 (In free space and special media) and 2 (for fiber and integrated optics),ò Wiley Series in Pure and Applied Optics.

2) Eugene Hecht, ñOptics (International Edition),ò Addison Wesley, (2003).

3) F G Smith, T A King and D Wilkins, ñOptics and Photonics: An Introduction,ò John Wiley & Sons, Ltd, San Francisco, USA, (2007).

4) David J. Griffiths, ñIntroduction to Electrodynamics (3rd edition),ò Pearson Publishers.

5) Born and Wolf, ñPrinciples of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light,ò Cambridge University Press.

6) Joseph W Goodman, ñIntroduction to Fourier Optics,ò McGraw-Hill.

7) Hand Book/Optics, Vol. 1-IV, Optical Society of India, McGraw Hill

3PHY-5(i) : LAB COURSE ON DIGITAL TECHNIQUES

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Digital I: Basic Logic Gates, TTL, NAND, and NOR.
2. Digital II: Combinational Logic.7483, BCD Adder, A-2-S
3. Designing various binary counters using JKMSFF.
4. Designing various Shift resisters using JKMSFF
5. Study of Multiplexer : 2:1, 4:1, 8:1 and 16:1, De-multiplexer : 1:2:,1: 4, 1:8 and 1:16, Multiplexers and De-multiplexers.
6. Designing Memory using ICs of required organization Solving problems using KôMap
7. Design consideration of Combinational logic design circuits for HA/ FA/ Subtractor,
8. Design consideration of Multiplier, Divider etc using ICs.
9. Design consideration of Synchronous/asynchronous Modulo N Counters and Decade Counter,
10. Design consideration of SIPO, PISO, SISO, PIPO, Universal Shift operations,
11. Design consideration of, Memory expansion problems

3PHY-5(ii): LAB COURSE ON CONDENSED MATTER PHYSICS

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Determination of Magnetic Susceptibility of Material by Quinckeôs Method.
2. Study of Magnetic Properties (Coercivity, retentivity, saturation magnetization and hysteresis loops) of ferromagnetic samples (soft iron, hard steel & nickel).
3. To study variation of Dielectric constant of a given solid / liquid with temperature.
4. Determinations of specific heat of graphite sample.
5. Determination of magnetic susceptibility of a solid by Guoy balance method.
6. Determination of Curie temperature of a given sample.
7. Determination of Landeôs g-factor of DPPH using Electron Spin Resonance Spectrometer.
8. Determination of band gap of semiconductor by variation of conductivity with temperature.
9. Determination of band gap by absorption coefficient measurement.
10. Demonstration of Meissner effect.
11. Determination of adiabatic compressibility of a given liquid.
12. Determination of Thermoelectric Power of a substance.

3PHY-5(iii) : LAB COURSE ON ANALOGUE TECHNIQUES

The experiments from serial no. 1 to 5 are compulsory & perform any two experiments from others. It is expected that the teacher may perform open ended experiments.

1. Pulse amplitude modulation and demodulation.
2. Pulse position modulation and demodulation.
3. Pulse width modulation and demodulation.
4. Study of delta modulation and demodulation.
5. Characteristics of antenna.
6. Study of amplitude modulator.
7. Study of frequency modulator.
8. Study of FSK modulator and demodulator
9. Study of super-heterodyne receiver.
10. Study of fibre optics voice transmission and reception.

3PHY-5 (iv) Lab on Photonics-1

A student should perform at least seven experiments from the following list. In the examination he will be asked to perform one experiment only

1) Handling, cleaning, maintenance of optical components and laser systems. Laser safety demonstration.

2) Characterization of laser beam.
3) Setting up of two and multi-beam Interferometer.
4) Measurement of UV-Visible Absorption spectra of standard samples.
5) Measurement of refractive index of the transparent material using Mach-Zahnder Interferometer.
6) Conversion of continuous wave laser into pulsed laser.
7) To study relaxation oscillation of diode laser.
8) Temporal pulse shaping of laser beam.
9) To study various polarized states of light.
10) To record and study Laser Induced Breakdown spectroscopy signal of known and unknown samples.**(Demo)**

Setting up of high power interferometer demonstrative experiment.

M.Sc. Semester - IV

4PHY-1: NUCLEAR AND PARTICLE PHYSICS

Unit-I : General Properties of Atomic Nucleus:

Nuclear charge, Nuclear Mass,(Atomic Number and Mass Number), Meaning of isotopes, Isobars, Isotones, Isomers, Isodiapheres with examples, Nuclear Radius, Classification of Nuclear radius, (Electrical and Potential Radius)Determination of Nuclear Radius by electron scattering(Hofstadterôs Experiment),Mirror Nuclei method, Mass Defect, Binding energy, Variation of Binding energy per nucleon with mass number, Semi empirical Mass Formula, Mass Parabola.

Quantum Numbers for individual nucleons(Principal, Orbital, Radial, Spin, Total, Iso-spin, Quantum Numbers) Parity, Quantum Statistics; Nuclear Angular Momentum, Nuclear Magnetic Momentum, Nuclear Magnetic Dipole Moment, Measurements of nuclear magnetic moment by Rabiôs method and Blockôs method, Problems.

Unit-II : Nuclear Forces:

Deuteron, Ground state properties of Deuteron,(Properties of Nuclear Forces, number, Range and depth of potential, excited States of Deuteron),Neutron-Proton scattering at low energies(Scattering length, phase shift, spin dependence, Coherent scattering ,shape independent effective range theory; Proton-Proton scattering at low energies, similarity between n-n and p-p forces ,Meson Theory of Nuclear forces ,spin dependence of Nuclear forces.

Beta Decay and Nuclear Models: Three forms of ß decay, continuous nature of ß-ray energy spectrum, difficulties encountered in explaining ß-ray energy spectrum,. Pauliûs Neutrino hypothesis(properties of neutrino and explanation of ß-decay using Pauliûs Neutrino hypothesis), Assumption of Fermiûs theory of ß-decay, Fermi-Kurie Plots, Seargents Plots. Detection of Neutrino (Cowan Experiment),non conservation of Parity in ß-decay (Wuûs experiment).

Liquid drop model of Nucleus, Magic numbers, Evidences in support of Magic Numbers, Shell Model.

Unit-III : Neutron Physics, Properties of neutrons, classification of neutrons according to their energy, neutrons sources, neutrons detectors, slowing down of fast neutrons, absorption of neutrons. Reactor Physics : neutrons multiplication, types of reactors, General considerations for reactor design, four factor formula, moderators.

Unit-IV : Nuclear Detectors - Gas filled, solid state and high energy detectors. Wilson cloud chamber, Spark Counter. Particle Accelerators - Need for particle accelerators, classification, wave guide type linear accelerator, focusing in linear accelerators, Betatron, Synchrotron, Synchrotron as a radiation source.

Unit-V : Particle Physics : Classification of elementary particles, types of interactions between elementary particles, symmetry and conservation laws, Basic ideas of CP and

CPT invariance, the quark model, Lie algebra, SU(2) and SU(3) multiplets (Meson and Baryon states), the General model.

Reference Books :

(1) Nuclear Physics, Second Edition - Irving Kaplan, Addison-Wesley Publishing - Massachusetts.

(2) Concepts of Nuclear Physics - Bernard L.Cohen, Tata McGraw-Hill Publishing Co. - New Delhi.

(3) Elements of Nuclear Physics - Pandya M.L.

(4) Nuclear Physics : An Introduction - S.B.Patel, Wiley Eastern Limited-New Delhi.

(5) Nuclear Physics : Theory and Experiment : R.R.Roy and B.P.Nigem,New Age International (P) Ltd.-New Delhi.

(6) Nuclear Physics - D.C.Tayal, Himalaya Publishing House, Bombay.

(7) Nuclear Physics - S.N.Ghoshal, S.Chand & Company, New Delhi.

(8) Elementary - Particle Physics - Committee on Elementary Particle Physics Universities Press (India) Ltd., Hyderabad.

(9) The Elements of Nuclear Reactor - Glasstone Samuel, D.Van Nestrand Company- New Jersey.

4PHY-2 : OPAMP THEORY AND ITS APPLICATIONS

Unit-I : Differential amplifier - circuit configurations, Four types, DC analysis- AC analysis ï Detail study of dual input balanced output differential amplifier -, inverting and non-inverting inputs CMRR- constant current bias level translator.

Unit-II : Block diagram of a typical Op-Amp -Analysis Open loop configuration inverting and non-inverting amplifiers. Op-amp with negative feedback - voltage series feed back - effect of feed back on closed loop gain input persistence output resistance bandwidth and output offset voltage - voltage follower.

Unit-III : Practical op-amp Op-Amp parameter definition and illustration, input offset voltage - input bias current - input offset current offset voltage, CMRR, frequency response. DC and AC amplifier; summing, scaling and averaging amplifiers, instrumentation amplifier, integrator and differentiator

Unit-IV : Oscillators principles - Oscillator types - frequency stability - response - The phase shift oscillator. Wein bridge oscillator, LC - tunable oscillators - Multivibrators - Monostable and Astable ï comparators. PLL circuit and its applications. OPAMP as butter worth filter (low pass, high pass and band pass only).

Unit-V : Analogue computation, active filters, comparators, logarithmic and anti-logarithmic amplifiers, sample and hold amplifiers, waveform generators, Square and triangular wave generators, pulse generator. Applications of Linear ICs OPAMP as instrumentation amplifier, Digital to Analogue converter : ladder and weighted register type. Analogue to Digital converter : Counter type and successive approximation type

Reference Books :

1. OPAmps and Linear Integrated Circuits- Gaikwad R. A. : Prentice ï Hall of India Pvt. Ltd.
2. Electronic Devices and Circuits , Vol. II ï Godse A. P. and Bakshi U. A., Technical Publications, Pune .

List of Experiments:

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Application of OPAMP as inverting, non-inverting and summing amplifier.
2. Applications of OPAMP as differentiator and integrator.
3. OPAMP as square and triangular waveform generator.
4. OPAMP as instrumentation amplifier for measurement of temperature.
5. Study of ADC and DAC.
6. Study of PLL and its applications.
7. OPAMP as Butterworth filter low pass, high pass and band pass circuit.
8. ADC using ICsDAC using opamp and WRM, R-2-R Ladder
9. Design consideration of ADC/DAC Using Opamp and other ICs
10. Digital Clock using Counters, Frequency meters.

4PHY-3(i) : MICROPROCESSOR PROGRAMMINGAND INTERFACING

Unit-I : 8085 Microprocessor: Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor clock signals, address, data and control buses, instruction cycles, machine cycles, and timing states, Basic instruction set, instruction timing diagrams.

Unit-II : Programming of 8085 microprocessor: HLL, LLL and ALP Writing assembly language programs, looping, counting and indexing operations, stacks and subroutines, conditional call and return instructions, debugging programs.

Unit-III : 8085 Interfacing: Bus interfacing concepts, timing for the execution of input and output(I/O) instructions, I/O address decoding, memory and I/O interfacing memory mapped I/O interfacing of matrix input keyboard and output display, Serial I/O lines of 8085 and the implementation asynchronous serial data communication using SOD and SID lines,

Unit-IV : Programmable Interface and peripheral devices: PPI IC 8255A programmable peripheral interface Block Diagram, Control words, Modes of Operations and applications, 8251 SIO, USART block diagram functions. 8279 programmable keyboard/display interface controller.

Unit-V : 8253/8254 programmable interval timer, Interrupt structure of 8085: RST(restart) instructions, vectored interrupt, interrupt process and timing diagram of interrupt instruction execution, 8259 A interrupt controller, principles block transfer(direct memory access) techniques 8257 direct memory access controller.

Text Books:

1. Microprocessor, Architecture, Programming and Application with 8085-Gaonkar, John Wiley Eastern , Ltd, Publication
2. Microprocessors and interfacing-Douglas V Hall, Tata Mc-Graw Hill publication

Reference Books:

1. Microcomputer Systems: The 8086/8088 family-Yu-Chen Lin, Glen A Gibson, Prentice Hall of India Publication
2. The 8086 Microprocessor : programming and interfacing the PC-Kenneth J Ayala, Penram publication
3. The 8086 family: John Uffenbeck, Prentice Hall of India publication.

OR

4PHY-3(ii) : CONDENSED MATTER PHYSICS-II

Unit-I : Imperfections in Crystal: Mechanisms of plastic deformation in solid, Dislocations, stress & strain field of screw dislocation, elastic energy of dislocations, Slip, Cross slip, climb, Dislocation Multiplications, stress needed to operate Frank Read Source.

Unit-II : Dislocation reaction, Partial Dislocations and stacking faults in close packed structures, Thompson Tetrahedron.

Experimental methods of observing dislocation and stacking fault.

Unit-III : Interacting electron gas, Hartee & Hartee-Fock approximation, Correlation energy, Screening, dielectric function, Thomas-Fermi and Lindhard Theory, Frequency dependent Lindhard screening, Screening of Hartee-Fock approximation. Introduction of Fermi Liquid Theory.

Unit-IV : Point Defects: Types of point defects, concentration of point defects, description of point defect within the frame work of band model, diffusion and ionic conduction, recombination process of imperfection, optical transitions at imperfections.

Unit-V : Lattice disorders: Types of lattice disorders, localized states, Anderson model, and density of states: Impurity band semiconductor, amorphous semiconductors, transport in disordered lattice, hopping probability, fixed and variable range hopping, conductivity in impurity bands and in amorphous semiconductors.

References:

1. Introduction to Dislocations, Derek Hull and D J Bacon, Butterworth-Heinemann.
2. Introduction to Solid-State Theory, Otfried Madelung, Springer.
3. Solid State Physics, N W Ashcroft and N D Mermin (Cenage Learning India Pvt Ltd, 2009).
4. Introduction to Solid State Physics, C. Kittel (John-Wiley, 8th Ed. 2005).

OR

4PHY-3 (iii) : DIGITAL COMMUNICATION

UNIT-I : Digital Communications:

Pulse-Modulation Systems : Sampling theorem-Low-Pass and Band-pass signals, PAM, Channel BW for a PAM signal. Natural sampling. Flat-top sampling. Signal recovery through Holding, Quantization of signals, Differential PCM, Delta Modulation, Adaptive Delta modulation, CVSD,

UNIT-II : Digital Modulation Techniques : BPSK, DPSK, QPSK, FSK.

Introduction to PSK, QASK, BFSK, and MSK. Mathematical Representation of Noise : Sources of noise. Frequency domain representation of noise, Effect of filtering on the probability Density of Gaussian noise, spectral component of noise , Effect of a filter on the power spectral density of noise. Superposition of noises. Mixing involving noise. Linear filtering, Noise Bandwidth, Quadrature Components of noise. Power spectral density of nc(t), ns(t) and their time derivatives.

UNIT-III : Data Transmission : Baseband signal receiver, probability of error. Optimum filter. White noise. Matched filter and probability of error. Coherent reception, Correlation, PSK, FSK, Non-coherent detection of FSK, Differential PSK, QPSK, Calculation of error probability for BPSK, BFSK, and QPSK.

Unit-IV : Noise in pulse-code and Delta-modulation systems : PCM transmission, Calculation of Quantization noise, output-signal power. Effect of thermal noise, output signal-to-noise ratio in PCM, DM, Quantization noise in DM, output signal power, DM output - signal - to quantization - noise ratio, Effect of thermal noise in Delta modulation, output signal-to-noise ratio in DM.

UNIT-V : Mobile Radio and Satellites : Time Division multiple Access (TDMA), Frequency Division Multiple Access (FDMA), ALOHA, Slotted ALOHA, Carrier Sense Multiple access (CSMA), Poisson distribution protocols.

TEXT AND REFERENCE BOOKS :

1. Barry B.Brey, ñThe Intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, pentium and pentium pro-processor architecture, programming, and interfacingò, 4th Edition, PHI, 1999.
2. Dougles V.Hall, ñMicroprocessors and interfacing, programming and Hardwareò, 2nd Edition, McGraw Hill, international edition, 1992.
3. Muhammad Ali Maxidi and Janice Gillispie Mazidi, ñThe 80x86 IBM PC and Compatible computers (Volume I & II), 2nd Edition, Prentice Hall international, 1998.
4. Taub and Schilling, principles of communication system, 2nd edition, TMH, 1994, Simon Hykin communication system, Third Edition, John Wiley and Sons, INC,1994.

4PHY-4(i): ADVANCED MICROPROCESSOR AND MICROCONTROLLER

Unit-I : 8086 Microprocessors: Architecture and organization of 8086microprocessors family, bus interface unit, 8086hardware pin signals, timing diagram of 8086 family microprocessors, simplified read/ write bus cycles, 8086 minimum and maximum modes of operation, 8086memory addressing, address decoding, memory system design of 8086 family, timing considerations for memory interfacing, input/output port addressing and decoding, introduction to 8087 floating point coprocessor and its connection to host 8086.

Unit-II : 8086 assemble language programming:Addressing modes, 8086 instruction formats and instruction set, data transfer, arithmetic, bit manipulation, string, program execution transfer and program control instructions, machine codes of 8086 instructions, assemble language syntax, assembler directives, initialization instructions, simple sequential and looping programs in assemble language, debugging assembly language programs.

Unit-III : The 8051 Architecture : 8051 microcontroller, Hardware ï oscillator, clock, program counter, data pointer, A and B CPU registers, Flags and the program status word (PSW) , Internal memory, Internal RAM , the stack and stack pointer, special function register (SFR), internal ROM. I/O pins, ports and circuits External memory, counters and Timers serial data input/output, Interrupts.

Unit-IV : 8051 Assembly Language Programming Introduction , structure of assembly language, assembling and running on 8051 program, Data transfer types , addressing modes, PUSH and POP operations, Arithmatic, Logic , JUMP, LOOP, CALL instructions, time delay, I/O programming, serial port programming.

Unit-V : Applications : Interfacing of LCD, Keyboard, ADC, DAC and Sensor interfacing. Microcontroller Application Development Tools : Use of Kell software 8051 development tool.

Reference Books :

1. The 8051 Microcontroller and embedded system using assembly and C - Mazidi, Mazidi Mckinlay
2. The 8051 Microcontroller ï Ayala - third edition.
3. Microcontroller ï Architecture, Programing, Interfacing and system design ï Rajkamal 4 8051 Microcontroller ï Mckenzie.
4. Microprocessors & Interfacing ï Programming & hardware By D. V. Hall (TMH)
5. The 8088 AND 8086 microprocessors By Walter A. Trebel & Avtar Singh (PHI)
6. 8086 Microprocessor By Uffenbeck (PHI)
7. The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processor Architecture, programming and interfacing. By Barry B. Brey (PHI)

8. The 8051 Microcontroller: Architecture, programming and applications By Kenneth J. Ayala (Penram International)
9. The 8051 Microcontroller and Embedded Systems By Mazidi & Mazidi (PHI)

4PHY-4(ii) NANO SCIENCE AND NANOTECHNOLOGY

Unit-I : Free electron theory and its features, Idea of band structures, Insulators, semiconductors and conductors, Reciprocal space, Energy bands and gaps of semiconductors, Effective masses, Fermi surfaces, Localized particles, The Bloch theorem, band structure in three dimensions. Electron transport in semiconductors in 3D (bulk), 2D (thin film) and low dimensional systems.

Unit-II : Different methods for preparation of Nanostructured materials, Bottom up and top down process, sol-gel, electrodeposition, chemical bath deposition, thermal evaporation methods, ball milling, pulsed laser deposition, chill block melting and gas quantizationmethod.

Unit-III : Different methods for measuring the properties of Nano-materials, Structure determination: Atomic structures, crystallography and powder diffraction method, determination of particle size from XRD peaks. Microscopy: Transmission electron microscopy, Field ion microscopy, scanning microscopy.

Unit-IV : Size dependent properties, quantum size effect, quantum dot, quantum wire and quantum well. Mechanical and electrical properties of nano-structured materials, single electron tunneling, infrared detectors, quantum dot lasers. Super Conductivity at Nano Scale.

Hopping conduction, Polaron conduction.

Unit-V : Carbon nanostructures, nature of carbon bond, carbon clusters: C_{60}, Structure of C_{60} carbon anotubes, Applications of carbon nanotubes: computers, fuel cells, chemical sensors, catalysis, Single electron transistor (no derivation), Molecular machine, applications of nanomaterials in energy, medicine and environment.

Reference Books:

1. Introduction to Nanotechnology ï C. P. Poole, John Wiley and Sons
2. Nanotechnology Appin. Lab BPB publication New Delhi
3. Nanomaterials ï A. K. Bandyopodhyay , New Age Publication

4. Physics of semiconductor nanostructures K. P. Jain Narosa Publication
5. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
6. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N.Banerjee, Publisher: PHI Learning and Private Limited.

4PHY-4 (iv) Photonics-2: Optical fibre and applications

Unit-I : Optical fibers: Classification, total internal reflections, Goos Hanchen shifts, Analysis of optical wave guides-ray and wave optics, characteristic equation of step index fiber, modes and their cut-off frequencies, single and multimode fibers, linearly polarized modes, power distribution

Unit-II : Graded index fiber, propagation constant, leaky modes, power profiles, dispersions, impulse response, types of couplings, Birefringent effects, polarization maintaining fibers, Fabrication techniques, Photonic crystal fiber.

Unit-III : Optical Communications: Optical transmitters, Optical receivers, system design and performance, coherent and multi channel light wave systems, optical amplifiers, dispersion compensation, Optical signal processing.

Unit-IV : Optical devices: Optical modulators, Optical Transducers, Optical switches, All optical logic gates, Photonic circuits, Optically integrated devices, Optical sensors.

Unit-V : Optoelectronic devices: Wide bandgap semiconductors, light emitting diodes (LEDôs), Diode lasers, fiber lasers, Wave division multiplexing network optical devices, Advances in waveguides and waveguide devices, Plasmonic waveguides.

Reference:

1) Ajoy Ghatak and K Thyagarajan, ñIntroduction to fiber optics,ò Cambridge University Press (1999).
2) G P Agarwal, ñFiber-Optic Communication systems (second edition),ò
3) Pallab Bhattacharya, ñSemiconductor Optoelectronic devices,ò Prentice Hall (1996).
4) Shun Lien Chuang, ñPhysics of Optoelectronic Devices,ò Wiley Series in Pure and Applied Optics, John Wiley & Sons Ltd. (1995).
5) S. O Kasap, ñOptoelectronics and Photonics: Principles and Practices,ò Pearson Education (2001).

6) Various Research Journal Papers on Optical and optoelectronic devices.

4PHY-5:

(A) Compulsary lab experiments:

OPAMP-List of Experiments:

11. Application of OPAMP as inverting, non-inverting and summing amplifier.
12. Applications of OPAMP as differentiator and integrator.
13. OPAMP as square and triangular waveform generator.
14. OPAMP as instrumentation amplifier for measurement of temperature.
15. Study of ADC and DAC.
16. Study of PLL and its applications.
17. OPAMP as Butterworth filter low pass, high pass and band pass circuit.
18. ADC using ICsDAC using opamp and WRM, R-2-R Ladder
19. Design consideration of ADC/DAC Using Opamp and other ICs
20. Digital Clock using Counters, Frequency meters.

Respective laboratory specialization:

(B) Microprocessors Lab

List of Experiments : (Any Five)

Experiment :Problem 1

(A) 4 single byte numbers are stored at consecutive memory location starting at ñXò write and implement a program which will transfer first two numbers in BC pair and the other two in DE pair respectively.

ò[a] Using LDA instruction.

ò[b] Using LHLD instruction.

ò[c] Using register-indirect instruction.

ò[d] Compare these programs in the context of memory requirements.

(B) 4 single byte numbers are stored in registers B,C,D & E respectively. Write and implement the programme which will transfer the contents of the registers B,C,D,E to the memory block starts at X successively, respectively.

ò[a] Using STA instruction.

ò[b] Using SHLD instruction.

ò[c] Using register indirect instruction.

ò[d] Compare these programs in the context of memory requirements.

(C) Two double byte nos. are stored at two memory location starts at X & Y resply. Write and implement the program which exchanges the information between X & Y resp.[i.e. Xð Y & X+1ð Y+1]

ò[a] Using direct instructions {LDA}

ò[b] Using register indirect instruction.

ò[c] Using LHLD & XCHG instruction.

ò[d] Compare these programs in the context of memory requirements.

(D) 4 single byte nos. are stored consecutively in memory starting at ñXò. Write and implement a programs

ò[a] Using register indirect instruction, without loop.

ò[b] Using forming loop i.e. branch control group instruction.

ò[c] Compare the program in the context of memory requirements

Experiment Problem 2:

ò(A) The 4 numbers are N1=F7, N2=6A, N3=32, N4=1C. Write a programme which will perform following arithmatic. store the result in some memory location

[N1-N2] + [N3-N4].

ò[a] Using immediate instruction.

ò[b] Using register indirect instruction [assume in this case nos. are stored consecutively in memory starting at ñXò)

ò[c] Optimise the programme.ò

(B) Two 5-byte nos. are stored at ñXò & ñYò memory blocks. Write a programme to substract the lower number from the higher number and stores a result in memory block starts at ñZò

ò[a] Using register indirect instruction without loop.

ò[b] Using loop [i.e. branch control group instruction]

ò[c] Optimise the programme.

(C) Two double byte decimal nos. are stored at memory locations X & Y resply. Write a programme which will obtain product of these two nos. in decimal equivalent and stores a result at Z.

Experiment Problem 3

(A) Write a programme which will display ñHELPò in freely running fashion.

(B) Write a programme for Hexadecimal counter which will count the nos. from 00 to 40 and stops after. Implement a delay of 1 sec. and display the counts in data field.

(C) Write a programme which will produce blinking display alternately of following words.ò

òHallowò & ñWelcomeò

Experiment Problem-4

(A) Write programme for Hexadecimal counter which will count nos. from 0 to 21 and stops after. Implement a delay of 1.5 sec. and display the counts in data field of display.

(B) Write a programme which will display your name, fatherôs name & surname. ñCome in Lab.ò alternatly. Implement a delay of 2 sec.

Experiment Problem-5

(A) Write a programme which will add 3 double-byte numbers and stores the result in HL pair (the possible final carry).

(1) Using ADC instructions.

(2) Using DAD instructions.

(3) Compare the programmes in the context memory requirements.

(B) Write a programme to count number of logical ó1ôin following hexa decimal numbers. And to count the numbers which involve less than 5 logical 1ôs

C7, B8, A3, 74, 32, 17, D2, E8, 7E, 29, 3C.

ò(C) Two double byte decimal nos. are stored consecutively in memory which starts at ñXò. Write a programme to add these nos. and stores the result in decimal form at the next memory locations.

òò [1] Using register indirect without loop.

òò [2] Using loop i.e. branch control group instruction.

òò [3] Optimise the programme.

Experiment Problem-6

(A) Write a programme for the following type of dis-play. WORD :- ANURADHA

ò [1] Charactor will come from one side slowly in the display field.

òò [2] Stay for longer time and

òò [3] Go away from other side slowly,

(B) Five single byte nos. are stored at memory starts at X. Write programme

(i) which will find the largest of these nos. & store it at (X+5) location

(ii) Which will find the smallest of these nos. & stores it at (X+6) location.

Experiment Problem-7

(A) 4 single byte numbers are stored at ñXò consecutively & 4 other single byte numbers are stored at Y. Write a program to exchange these information between memory blocks X & Y.

[1] Using register indirect instruction.

[2] Using LHLD, SHLD & XTHL instruction.

[3] Compare the programs in the context of memory

(B) Two single byte nos. 0A & 25 are stored at memory location X and X=1. Write a programme which will obtain the product of these nos. Find total time required for the execution of this program.

(C) Write a programme which will arrange the following numbers in (i) ascending order (ii) descending order. A3, B6, F9 (The numbers are stored at memory starting at óXô). Finally the arranged numbers must occupy the same memory locations.

Experiment Problem-8 Application of 8085 microprocessor.

(A) Study of DAC Card. Generation of waveforms of definite frequency.

(1) Generate the square wave

(2) Generate the triangular wave

(3) Generate the ramp wave

(4) Measure the freq. of each wave by using CRO

(B) Study of 8255 in mode 0 operation.

(1) Construct the display panel for three characters.

(2) Write and execute the programme for three digit decimal counter.

(C) Study of 8255 in mode 0 operation

(1) Construct the display panel for 3 characters.

(2) Write and execute the programme for free running display of your name.

Experiment Problem-9: Application of 8085 microprocessor.

(A) Study of 8253 timer at mode 0, mode 1 & mode 2 operation.

(B) STUDY of 8253 timer at mode 3, mode 4 & mode 5 operation.

(C) 8085 microprocessor based on experiments viz. ADDITION, SUBSTRACTION, MULTIPLICATION, DIVISION, etc. may be performed.

(B) CONDENSED MATTER PHYSICS-II

Laboratory Experiments:

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Determination of Lattice parameters using powder photograph / graph.
2. To study lattice dynamics of monoatomic and diatomic molecules.
3. Measurement of Hall coefficient of given semiconductor.
4. Study of Crystal structure by Laueôs Pattern.
5. To study variation of ionic conductivity of a given sample with temperature.
6. Determination of Electrical Conductivity of a given material by Four Probe Method.
7. Measurement of photoconductivity of a sample.
8. Study of dislocation motion.
9. Measurement of dislocation density by etch-pit method.
10. Deposition of nanometer size thin films and determination of its thickness.
11. Determination of Poissonôs ratio of glass by Cornuôs method.

(B) Digital Communication

Laboratory Course:

The experiments from serial no. 1 to 5 are compulsory & perform any two experiments from others. It is expected that the teacher may perform open ended experiments.

1. Pulse Amplitude Modulation / Demodulation
2. Pulse position / Pulse width Modulation / Demodulation.
3. FSK Modulation Demodulation using Timer / PLL

4. Microwave characterization and Measurement
5. PLL circuits and applications.
6. Fibre Optics communication.
7. Study of Transmission line.
8. Characteristics of Yagi Antenna
9. Design of digital filters using MATLAB.

Setting up of new experiments on the following :

10. Mobile communication via satellites.
11. Cellular communications
12. Bandwith consideration in INTERNET.
13. IS DN
14. Wide Area Net work

4PHY-5 (iv) Lab on Photonics-1

A student should perform at least seven experiments from the following list. In the examination he will be asked to perform one experiment only.

1) To set up fiber optic voice communication system.
2) To determine numerical aperture of given optical fiber.
3) Determination of bending loss in multi mode fibers.
4) Magneto optic effect: To determine the angle of rotation as a function of mean flux density using different wavelengths of light and to calculate the corresponding Verdetôs constant in each case.
5) Acousto optic effects: Study of density and elasticity in various liquids.
6) To study Pockelôs effect.
7) To study Sculpting of plastic optical fiber tip.
8) To fabricate all optical fiber beam splitter.
9) Study of Second Harmonic Generation in crystals.
10) Pulsed laser deposition of thin films. (Demo)
11) Microlithography using High power Nd:YAG laser. **(Demo)**

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