M.Sc. Physics (2017-2019)

SEMESTER I

PHYS-611 Mathematical Methods in Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials: 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Coordinate Systems:

Curvilinear coordinates, differential vector operations, special coordinate systems- rectangular Cartesian, spherical polar and circular cylindrical coordinates, and expressions of gradient, divergence, curl and Laplacian **(4 Lecturers)**

Tensors:

Coordinate transformations, scalars, contra-variant and covariant vectors, definition of contra-variant, mixed and covariant tensor of second rank, Addition, subtraction and contraction of tensors, quotient rule.

(4 Lecturers)

UNIT – II

Matrices:

Orthogonal matrices, Orthogonality conditions- two and three dimensional cases, Hermitian and unitary matrices, Pauli matrices, Dirac matrices, Diagonalization of matrices- Eigen value and Eigen vectors.

(4 Lecturers)

Elementary Group Theory:

Definition of group, Isomorphism and Homomorphism, Matrix representation- reducible and irreducible groups, subgroup-invariant subgroup, Discrete groups-two objects two-fold symmetry axis, three objects-three-fold symmetry axis, Continuous Groups- orthogonal group O_3^+, special unitary group SU(2)

(4 Lecturers)

UNIT – III

Second Order Differential Equations:

Separation of variables-ordinary differential equations, singular points, series solutions – Frobenius method and its limitations, Wronskian-linear independence and linear dependence. **(4 Lecturers)**

Special Functions:

Bessel functions of the first kind, integral representation, Legendre functions-generating function, recurrence relations and orthogonality, Associative Legendre functions, spherical harmonics, Hermite functions. Laguerre functions. **(4 Lecturers)**

UNIT – IV

Complex Variables:

Functions of complex variable, Cauchy- Riemann conditions, Cauchy Integral theorem, Cauchy integral formula, Laurent expansion, Calculus of residues –poles, Essential singularities and branch points, Residue theorem, Jordan's lemma, Singularities on contours of integration, Evaluation of definite integrals.

(8 Lecturers)

UNIT – V

Fourier series and Fourier Transforms:

Fourier series- General properties and uses, Differentiation and integration of Fourier series, Fourier transforms, Fourier integral-exponential form, Fourier transform-inversion theorem. **(4 Lecturers)**

Laplace Transform:

Elementary Laplace transforms, Laplace transform of derivatives**,** substitution properties of Laplace transform.

(4 Lecturers)

Tutorials:

Applications of topics covered in each unit in Physics (based on problems given in the reference books) as given in the detailed lecture schedule will be covered in the tutorial classes. **(10 Hours)**

Recommended Books:

Mathematical methods for Physicists – George B. Arfken & Hans J. Weber

Applied Mathematics for Physicists and Engineers – L. A. Pipes

PHYS-612 Classical Mechanics

External: 70 Marks Internal: 30 marks

Lectures: 40 Lecturers Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Many particle systems; conservation laws, Constraints; their classification; degrees of freedom, D'Alembert's principle, generalized coordinates, Lagrange's equations from D'Alembert's principle, velocity dependent potentials and dissipative forces. **(8 Lecturers)**

UNIT – II

Jacobi integral, Gauge invariance, generalized momenta, cyclic coordinates, integrals of motion, Symmetries

of space and time with conservation laws. **(2 Lecturers)**

Rotating frames:

Transformation equations, pseudo (fictitious) forces, Rigid body dynamics: Angular momentum and Kinetic energy of motion about a point, moment of inertia tensor. **(6 Lecturers)**

UNIT – III

Central force:

Definition and characteristics; properties, closure and stability of circular orbits, Two-body collisions, scattering in laboratory frame, scattering centre-of-mass frame. **(4 Lecturers)**

Variational principles:

Techniques of the calculus of variations, Example of use of the variational principle to find the shortest distance between two points, Hamilton's principle: derivation of Lagrange's equations from Hamilton's principle, equations of motion. **(4 Lecturers)**

UNIT – IV

Canonical transformation:

Generating functions, Hamilton-Jacobi equation; solution: Hamilton's principal function, Solution of harmonic oscillator problem by H-J method. **(4 Lecturers)**

Poisson brackets:

fundamental PB, some properties, Poisson theorems, Angular momentum PBs, Invariance of PB under canonical transformations, relation of PB to quantum mechanics. **(4 Lecturers)**

UNIT – V

Types of equilibria, Periodic motion, small oscillations and normal modes, Free vibrations of a symmetric linear tri-atomic ,Special theory of relativity, Lorentz transformations, Velocity transformations, mass energy equivalence, Four vectors : velocity and acceleration 4 vectors. **(8 Lecturers)**

Tutorials:

Principle of virtual work, problems related to conservation laws, Application of Lagrange equations : Simple pendulum, two connected mass with string over pulley, rolling mass inside or outside a circular ring, Foucault's pendulum, examples of Coriolis force on earth, Example of how energy can be conserved while H need not and vice versa.

Infinitesimal contact transformation, Example of application of canonical transformation for a harmonic oscillator

In addition to the above problems, students are expected to solve examples and problems given in the text as assignments. **(10 Hours)**

Recommended Books:

Herbert Goldstein: Classical Mechanics

Rana and Joag, Classical Mechanics

PHYS-613 Quantum Mechanics-I

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Inadequacy of Classical Mechanics:

Black body radiation, Planck' hypothesis, photoelectric effect, Compton effect, Frank-Hertz experiment, Hamilton's principle. Schrödinger equation, Normalization, probability interpretation of ψ, Admissible wave functions. **(3 Lecturers)**

Linear Vectors Space:

Vectors: Definition and properties, Examples of linear vector spaces, norm of a vector, orthonormality and linear independence, Basis and dimensions, Completeness (Closure property), Hilbert space, subspace, Inequalities and Ehrenfest theorem.

Operators: Equality, product, sum, power, function, inverse of operators, eigenvalues and eigenvectors of an operator, Positive definite, continuous and bounded operators, Linear operators, Hermitian operators, Unitary operators, Projection operators. **(5 Lecturers)**

UNIT – II

Dirac Space and Representation Theory:

Completeness of eigenfunctions, Bra and Ket notation for vectors, Dirac-Delta function, Matrix elements of change of basis, unitary transformation. Representation theory, Coordinate and momentum representations. **(3 Lecturers)**

Postulates of Quantum Mechanics & Uncertainty Relations:

Postulates of Quantum mechanics, Uncertainty relations**,** States with minimum uncertainty product, Commutators, Theorem of simultaneous eigenfunctions. **(5 Lecturers)**

UNIT – III

Quantum Dynamics:

The equations of motion, Schrodinger picture, Heisenberg picture, Interaction Picture, Linear Harmonic Oscillator: Solutions from Schrodinger and Heisenberg Pictures, the method of second quantization. **(5 Lecturers)**

The Hydrogen Atom:

Two body equation, Separation of variables for spherically symmetric potential, radial wave equation, radial wave functions and energy states. **(3 Lecturers)**

UNIT – IV

Quantization of Angular Momentum:

Definition, angular momentum of a system of particles, matrix representation, Pauli matrices, the spin eigenvectors. Orbital angular momentum: Solutions, Spherical harmonics and properties, addition theorem (no proof). **(5 Lecturers)**

Addition of angular momenta:

Clebsch-Gordan coefficients, the selection rules, properties of CG coefficients (without proof): symmetry, orthogonality and recursion relations. **(3 Lecturers)**

UNIT – V

Perturbation Theory (Non-degenerate case):

Basic formulation of the method and applications: Anharmonic oscillator (x^4), linear harmonic oscillator, infinite square well. **(5 Lecturers)**

Degenerate case:

Formulation and applications: Stark and Zeeman effects in H, Infinite cube well.

(3 Lecturers)

Tutorials:

Applications of topics covered in each unit in Physics (based on problems given in the reference books) as given in the detailed lecture schedule will be covered in the tutorial classes. **(10 Hours)**

Recommended Books:

Quantum Mechanics, V.K. Thankappan, Wiley Eastern Ltd. (1986).

Introduction to Quantum Mechanics, D.J. Griffiths, Pearson Education Inc. (2005)

Principles of Quantum Mechanics, R. Shankar, Plenum Press, New York (1994)

Modern Quantum Mechanics, J.J. Sakurai, Addison and Wesley (1994).

PHYS-614 Electronics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Amplification: Operational Amplifiers-I:

Differential amplifier: circuit configurations, dual input, balanced output differential amplifier, DC analysis

and AC analysis, inverting and non inverting inputs, block diagram of typical OP-Amplifier, constant current-bias level translator. Open loop configuration, inverting and non-inverting amplifiers, and Frequency- response

OP-Amp Parameters: input offset voltage, bias currents, input offset current, output offset voltage, CMRR, frequency response, Slew rate. OP-Amp with negative feedback, voltage series feedback, effect of feed-back on closed loop gain, input and output resistance, band width. **(8 Lecturers)**

UNIT – II

Operational Amplifiers based Instrumentations and their applications:

DC and AC amplifier, voltage follower, adder, subtractor, multiplier, phase changer, active filters, active integrator and active differentiator. **(3 Lecturers)**

Oscillators and wave shaping Circuits:

Oscillator Principle - Oscillator types, frequency stability response, the phase shift oscillator, Wien bridge oscillator, LC tunable oscillators, multivibrators: monostable and astable, comparators, square and triangle wave form generators. **(5 Lecturers)**

UNIT – III

Voltage regulators:

Block diagram of Power supply, fixed voltage regulators, adjustable voltage regulators, switching regulators. Clipping and clamping circuits. **(3 Lecturers)**

Boolean algebra and logic gates:

Canonical and standard forms, IC logic families, Simplification of Boolean functions: Karnaugh map of up to 4 variables, don't care conditions, NAND and NOR implementation. **(3 Lecturers)**

Combinational logic:

Adders, subtractors, binary parallel adder, magnitude comparator, decoders/de-multiplexers encoders/multiplexers. **(2 Lecturers)**

UNIT – IV

Sequential Logic:

Basic flip-flop, clocked RS flip-flop, T flip-flop, D flip-flop, J-K flip flop, triggering of flip-flops, JK master slave flip-flops; Synchronous and asynchronous counters: Binary counters, Decade counters, Registers. **(5 Lecturers)**

Microprocessors:

Organization of a Micro computer based system, Microprocessor architecture and its operations, Memory, memory map. The 8085 microprocessor unit; Functional block diagram. **(3 Lecturers)**

UNIT – V

Assembly Language Programming of 8085:

Instruction set of 8085: Data transfer operations, Arithmetic operations, Logic operations, Branch operations, Addressing modes of 8085 instructions, Assembly language programmes involving data transfer, arithmetic logic operations and looping, counting and indexing - counters and timing delays. **(8 Lecturers)**

Tutorials:

Review of basic electronics: Currents in a transistor, Design of CE and CC Amplifier, Design of two stage amplifier. In addition to the above, problems from the reference books can be given as assignments to the students. **(10 Hours)**

Recommended Books:

- Integrated Electronics by J. Millman and C.C. Halkias, TMH, New Delhi
- OP-AMP and Linear Integrated Circuits by Ramakanth, A. Gayakwad, PHI, New Delhi
- Electronic Devices and Circuit Theory by Robert Boylestead and Louis Nashelsky, PHI, New Delhi – 110001
- Digital Logic and Computer design by Electronics by Morris Mano
- Digital Principle and Applications by A.P. Malvino and Donald P. Leach, TMH, New Delhi.
- Microprocessors Architecture, Programming and Applications with 8085/8086, Ramesh S Gaonkar, Wiley - Eastern Ltd.

PHYS-615 General Physics Practical

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

- Students are required to complete at least five experiments allotted to them.
- Students are expected carry out the practical after understanding theoretical principle behind each experiment, design of experiments, working principle of the equipments/instruments, sources of errors in experiments etc.
- Experimental errors must be estimated in all experiments.

LIST OF EXPERIMENTS

1. Measurement of arc spectra by constant deviation spectrometer.
2. Determination of elastic constants of glass by method of Cornu's fringes.
3. Determination of coefficient of thermal conductivity of metal by Ångstrom's method.
4. To study variation in internal resistance of a material with temperature.

5. To study the Hall effect in a given semiconductor probe and to find the Hall Voltage and Hall Coefficient, Charge Carriers, Hall angle and Mobility.
6. To study the characteristic of given Solar Cell Panel.
7. Determination of λ, dλ, and thickness using Michelson's interferometer.
8. Determination of wavelength of light emitted by He-Ne laser and to verify the law governing Interference from a Young's double slit experiment.
9. Measurement of wavelength of He-Ne laser light using ruler.
10. Measurements of thickness of thin wire with laser.
11. Investigation of Faraday's effect and to determine Verdt's constant.
12. To plot the polar curve of a filament lamp and to determine its mean spherical intensity.
13. To study the dissociation limit of iodine.
14. Jamin's Interferometer's method for refractive index of air using He-Ne Laser.
15. Beam characteristics of a He-Ne laser beam.

Any other experiments designed and setup by the teacher on the availability of laboratory.

PHYS-616 Electronics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

- Students are required to complete at all experiments allotted to them from Section-A and section-B.
- Students are expected carry out the practical after understanding theoretical principle behind each experiment, design of experiments, working principle of the equipments/instruments, sources of errors in experiments etc.
- Experimental errors must be estimated in all experiments.

LIST OF EXPERIMENTS

SECTION-A: Analog Electronics

1. Measurement of operational amplifier parameters.
2. Study of Clipping and clamping circuits.
3. Study of active filter circuits
4. Study of active integrator and differentiator circuits
5. Study of Wien Bridge Oscillator
6. Study of wave form generators: (a) Square wave generator (astable multivibrator), (b) Pulse generator (monostable multivibrator) and triangular wave generator.

7. Study of Schmitt Trigger and comparators
8. Study of UJT parameters and Relaxation Oscillator
9. Design of a Regulated power supply: (a) Study of series voltage regulated power supply and (b) study of IC regulated power supply.

SECTION-B: Digital Electronics

1. Study of two bit and four bit adder
2. Study of subtractor
3. Study of decoder and 7- segment display
4. Study of multiplexer
5. Study of demultiplexer
6. Study of Flips Flops : RS, JK, JKMS, D &T flip-slops
7. Study of Shift Registers
8. Study of Counters : 4-bit Ripple counter, 4-bit Synchronous Counter, BCD Counter

Any other experiments designed and setup by the teacher on the availability of laboratory.

Reference Books:

- Integrated Electronics by Millman and Halkias, TMH, New Delhi
- OP-AMP and Linear Integrated Circuits by Ramakanth, A. Gayakwad, PHI, New Delhi
- Electronic Devices and Circuit Theory by Robert Boylestead and Louis Nashelsky, PHI, New Delhi - 110001, 1991.
- Digital Logic and Computer design by Electronics by Morris Mano
- Digital Principle and Applications by A.P. Malvino and Donald P. Leach, TMH, New Delhi.
- Lab manuals

SEMESTER II

PHYS-621 Computational Methods in Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials: 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

(Topics must be taught through Algorithmic approach. Detailed derivations of the equations are not required.)

UNIT – I

Computers and Numerical Analysis:

IEEE 64 bit Floating point number representation, arithmetic operations, consequences of floating Point representation, computing errors, Error propagation, Introduction to parallel and distributed computing, Measuring efficiencies of Numerical procedures **(3 Lecturers)**

System of Linear Equations:

Solving a system of Linear equations using Gauss Elimination, Gauss Jordan methods, Inverse of a matrix, Iterative methods to solve Equations: Gauss Seidel iterations, comparison of Iterative and Direct Methods.

(6 Lecturers)

UNIT – II

Non-linear equations:

Bisection and Newton Raphson method, Solution of Polynomial Equations, Newton methods for a system of nonlinear equation. **(4 Lecturers)**

Interpolation:

Lagrange Interpolation, Difference tables, Truncation error, Spline Interpolation **(3 Lecturers)**

Curve fitting:

Straight line fit, fitting using polynomial function of higher degree, Exponential Curve Fit cubic spline fitting

(3 Lecturers)

UNIT – III

Fourier Transform:

Fourier analysis and orthogonal functions, Discrte Fourier Transform, Power Spectrum of driven pendulum.
(3 Lecturers)

Numerical Integration:

Simpson and Gauss quadrature method. **(2 Lecturers)**

Numerical Differentiation:

Difference approximation of first derivative. **(1 Lecturers)**

UNIT – IV

Differential equations:

Euler and Taylor Series methods, Runge-Kutta Methods, Predictor-corrector Method, Comparison of different methods. **(5 Lecturers)**

Elementary ideas of solutions of partial differential equations. **(1 Lecturers)**

Montecarlo simulations:

Sampling and Integration, Metropolis Algorithm, Applications in Statistical physics. **(3 Lecturers)**

UNIT – V

Matrices and Eigen values:

Eigen values and Eigen vectors, Similarity transformation to and Diagonalization power method find eigen values, physical meaning of eigen values and eigen vectors. **(6 Lecturers)**

Recommended Books:

- V. Rajaraman, Computer Oriented Numerical methods, Third Edition, PHI, 2013
- Curtis F Gerald and Patrick Wheatley: Applied Numerical Analysis, Seventh Edition, Pearson Education Inc. 2004
- Won Young Yang, Wenwu Cao, Tae-Sang Chung and John Morris: Applied Numerical Methods Using MATLAB, Wiley 2005
- Tao Pang: An Introduction to Computational Physics, Cambridge Press

PHYS-622 Quantum Mechanics II

External: 70 Marks Internal: 30 marks

Lectures: 40 Lecturers Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Approximation methods

The WKB approximation:

Introduction of the method, The Classical region, Tunneling, The WKB wave function and connection formulae, Criterion for validity of approximation, Applications to potential well with a vertical wall and no vertical walls, Energy of one dimensional bound system. **(5 Lecturers)**

The Variational method:

Basic formulation and principle of the method, bound state (Ritz method), Applications to linear harmonic oscillator, Ground state energy under delta potential, Helium atom. **(3 Lecturers)**

UNIT – II

Theory of scattering:

The scattering experiment, Classical and quantum mechanical scattering, Relationship of scattering cross-section to the wave function, Scattering amplitude, Method of partial waves, Expansion of a plane wave into partial waves. **(5 Lecturers)**

Scattering by a central potential V(r):

Dependence of phase shift on V(**r**), angular momentum and energy, Zero energy scattering, Scattering length, Scattering by a square well potential, effective range. **(3 Lecturers)**

UNIT – III

Born approximation and Integral equation of scattering:

Born approximation, Green Function, The integral equation for scattering, The Born series, Criterion for the validity of the Born approximation, Low energy soft-sphere scattering, Yukawa Scattering, Scattering of electrons by atoms, Rutherford scattering. **(5 Lecturers)**

Identical particles:

The identity of particles, the indistinguishability principle, symmetry of wave functions, spin and statistics, Pauli exclusion principle, Illustrative example: scattering of identical particles, case of spin half and spin zero particles. **(4 Lecturers)**

UNIT – IV

Time dependent perturbation theory:

Basic principle and formulation of time dependent perturbation theory, constant perturbation, Continuum, Transition to continuum, Fermi‟s golden rule, scattering cross section in the Born approximation, Harmonic perturbation. **(5 Lecturers)**

Radiative transitions in atoms:

Theory of radiative transitions in atoms, The dipole transitions, Selection rules involving m and ℓ. **(3 Lecturers)**

UNIT – V

Relativistic wave equations:

The Klein Gordan equation:

Introduction, The Klein-Gordan equation, Interpretation of probability and the equation of continuity.

(6 Lecturers)

Dirac equation:

The first order wave equations, Weyl equation, The Dirac equation, Properties of Dirac matrices, Covariant form of Dirac equation, Existence of intrinsic angular momentum of Dirac particle, Solutions of Dirac equation, The non-relativistic limit of Dirac equation, spin-orbit coupling, Hole theory.

(6 Lecturers)

Recommended Books:

- Quantum Mechanics, V.K. Thankappan, Wiley Eastern Ltd. (1986).
- Introduction to Quantum Mechanics, D.J. Griffiths, Pearson Education Inc. (2005).
- Principles of Quantum Mechanics, R. Shankar, Plenum Press, New York (1994).
- Modern Quantum Mechanics, J.J. Sakurai, Addison and Wesley (1994).

PHYS-623 Statistical Mechanics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Classical Statistical Mechanics:

The Postulate of Classical Statistical Mechanics, Microcanonical Ensemble, Derivation of Thermodynamics, Equipartition theorem, classical ideal gas, Gibbs Paradox. **(4 Lecturers)**

Canonical Ensemble and Grand canonical Ensemble:

Canonical Ensemble, Energy fluctuations, Grand Canonical ensemble, Density fluctuations in the Grand Canonical Ensemble, The Chemical potential, Equivalence of the canonical ensemble and grand canonical ensemble. **(4 Lecturers)**

UNIT – II

Quantum Statistical Mechanics:

The postulates of Quantum Statistical mechanics, Density Matrix, Ensembles, Third law of Thermodynamics, The Ideal Gases: Micro canonical and Grand Canonical Ensemble, Foundations of Statistical Mechanics.

(8 Lecturers)

UNIT – III

The General Properties of Partition function, Classical Limit of Partition functions, Singularities and Phase transitions.

Classical cluster expansion, quantum cluster expansion, Virial coefficient, variational Principles, imperfect gases at Low temperatures.

Identical particles and symmetry requirement, difficulties with Maxwell-Boltzmann statistics, quantum distribution functions, Bose Einstein and Fermi-Dirac statistics and Planck's formula. **(8 Lecturers)**

UNIT – IV

Bose Einstein condensation, liquid He4 as a Boson system, quantization of harmonic oscillator and creation and annihilation of phonon operators, quantization of fermion operators

The Ising Model:

Definition of Ising model, Spontaneous Magnetization, The Bragg-Williams Approximation, The One dimensional Ising Model. **(8 Lecturers)**

UNIT – V

Landau theory of free energy, mathematical digression, derivation in simple models, mean field theory, the Vander-Waal equation of state, Gaussian model, Ginzburg criterion. **(8 Lecturers)**

Tutorials: **(10 Lecturers)**

- Calculation of number of states and density of states 1D free particles in a Box
- Linear harmonic and harmonic oscillators
- Statistics of Occupation number calculation of thermodynamic quantities
- Black body radiation and photon statistics
- Evaluation of second virial coefficient
- Fluctuations in thermodynamic variables

Recommended Books:

- Huag : Statistical Mechanics
- Reif: Fundamentals of Statistical and Thermodynamical Physics.
- Rice: Statistical mechanics and Thermal Physics.
- Kubo: Statistical Mechanics
- Landau and Lifshitz: Statistical mechanics
- S. N. Biswas: Statistical mechanics

PHYS-624 Electrodynamics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Coordinate systems and transformation: **(2 Lecturers)**

Electrostatics: Field lines, flux and Gauss law and applications, Laplace and Poisson equations, electrostatic boundary conditions. **(4 Lecturers)**

Magnetostatics: Biot-Savart law, Ampere's theorem, electromagnetic induction. **(2 Lecturers)**

UNIT – II

Maxwell's equations in free space and linear isotropic media, boundary conditions on fields at interfaces. **(3 Lecturers)**

Scalar and vector potentials, Gauge invariance. **(2 Lecturers)**

Electromagnetic waves in free space, dielectrics and conductors, reflection and refraction. **(3 Lecturers)**

UNIT – III

Electromagnetic waves in dielectrics and conductors: polarization, Fresnel's law, coherence, interference and diffraction. **(2 Lecturers)**

Dispersion relations in plasma, Lorentz invariance of Maxwell's equations, classification of waves (TEM, TE, TM), Transmission lines: lossless line, terminated transmission line and general lossy line. **(4 Lecturers)**

Rectangular wave guide, Electromagnetic cavities: time average electric and magnetic energies. **(2 Lecturers)**

UNIT – IV

Electromagnetic cavities: damping constant, quality factor (no derivation), Dipole radiation: Retarded potential. **(2 Lecturers)**

Liénard-Wiechert potential, dynamics of charged particle in static and electromagnetic field, electric and magnetic fields due to a uniformly moving charge and an accelerated charge. **(4 Lecturers)**

Radiation from moving charges, Qualitative discussion of Bremsstrahlung, synchrotron radiation (no derivations), Radiation reaction: The Abraham-Lorentz formula, radiation damping. **(2 Lecturers)**

UNIT – V

Basic properties and occurrence: definition of plasma, natural occurence of plasma, Astrophysical plasmas. **(2 Lecturers)**

Criteria for plasma behaviour, plasma oscillation, quasineutrality and Debye shielding, plasma parameter and plasma production, thermal ionization, Saha equation (No derivation) **(4 Lecturers)**

Brief discussion of methods of laboratory plasma production, steady stage glow discharge, microwave breakdown and induction discharge. **(4 Lecturers)**

Tutorials:

10 hrs Additional Contact Hours : 10 (Problems based upon coordinate systems and transformation, electrostatic and magnetostatic boundary conditions, Maxwell's equations, rectangular waveguide and electromagnetic cavities).

Recommended Books:

- DJG – David J. Griffiths, Introduction to Electrodynamics, 2nd Edition
- Edition JDJ – J.D. Jackson, Classical Electrodynamics, 3rd Edition
- MS- M. Sadiku – Elements of Electromagnetics, 3rd Edition
- Chen: Plasma Physics, 2nd Edition
- P & C – Robert Plonsey and R.E Collins : Principles and applications of electromagnetic fields.

PHYS-625 Electronics Projects

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

- Students are required to submit a project report and working model of the project for evaluation in Section A.
- Students will write and execute one program based on microprocessor.
- External assessments will be on presentation and viva-voce.

SECTION-A: Design and fabrication of one Experimental Kit

1. Design the operational amplifier parameters circuit.
2. Design Clipping and clamping circuits.
3. Design the active filter circuits.
4. Design the active integrator and differentiator circuits
5. Design the wave form generators like square wave generator, pulse generator or triangular wave generator.
6. Design the Schmitt Trigger circuit.
7. Design the series voltage regulated power supply.
8. Design the metal oxide field effect transistor (MOSFET) circuit or field effect transistor (FET) circuit.

9. Design the push-pull amplifier circuit.
10. Design and study a two stage RC coupled amplifier.
11. Design the two bit and four bit adder or a subtractor.
12. Design the decoder and encoder.
13. Design the multiplexer or de-multiplexer.
14. Design RS, JK, JKMS, D &T flip-flops.
15. Design of Shift Registers.

SECTION-B: Microprocessor 8085

1. One's compliment and two's complements of a number.
2. Mask off most significant and least significant 4-bits of an 8-bit data.
3. Addition of 8-bit hexadecimal data.
4. Subtraction of two 8-bit data.
5. Addition of 16-bit data.
6. Multiplication of two numbers.
7. Division of two 8-bit data and the quotient and the remainder are stored in two successive memory locations.

Note: Any other experiment suggested by teacher

Recommended Books:

- Morris Mano, Digital Logic and Computer design by Electronics
- Malvino and Leach, Digital Principle and Applications
- Ramakanth and Gayakwad, OP-AMP and Linear Integrated Circuits
- Boylestead and Nashelsky, Electronic Devices and Circuit Theory
- Millman and Halkias, Integrated Electronics
- Ramesh S Gaonkar, Microprocessor Architecture, Programming and Applications with 8085/8086.

PHYS-626 Computational Physics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 30 marks + 20 marks

Viva-Voce: 20 marks

NOTE:

SECTION-A: Fortran Language

In this section students are required to carry out practical by implementing algorithm taught in the theory paper computational methods in physics.

SECTION-B: Matlab Programming

In this section programming should be done by the students using matlab for numerical analysis.

PHYS-627 Information and Communication Technology skill (ICT)

External: 70 Marks Internal: 30 marks

Practical training on following topics and to acquire the skill mentioned must be provided to the participants of the course

Use of video and online recourses: 10 Hrs.

Assignment/Self study/Practical: 60 Hrs.

Skill test and presentations: 10 Hrs.

Identification of various components of a computer system: Identify mother board, CPU, Memory, various ports and connectors, drives, keyboards, mouse, types of monitors and its connection to computer, hardware specifications.

Skill: Identification of various components of a PC and writing specification of a computer.

Operating a computer system: Desktop, using help, My computer, folders and files, word pad, copy, save and print.

Skill: Operation of a PC

Word Processing: Creating new documents, entering text, saving, closing and opening files, editing & formatting, cut, copy and paste, search and replace, insert page number, date, picture, page layout, spell and grammer check, headers and footer, footnoting, table of contents, table, mail merge, mailing labels using Menu items etc.

Skill: Preparation of a given document.

Spreadsheet: Creating and editing a workbook, using charts, managing workbook. Candidate should be trained to create, enter and edit data, save and close workbook, change column width, moving, entering and merging cells, using formulae, using functions, formatting worksheet, creating chart, printing.

Skill: Preparation of invoice, balance sheet, plotting selected columns of a table etc.

Database Management System: Creating a database, modifying table, creating forms, queries and reports. Candidates should be trained in creating data entry, close and open table and database, customizing and inserting fields, sorting, form wizard, adding records, using queries, creating and printing reports.

Skill: Prepare telephone directory, catalogue and making queries and required reports.

Presentation Graphics: Creating modifying and refining presentation, using advanced presentation features.

Skill: Prepare a good presentation on given topic.

Insert and Personal Information Management: Internet and intranet, browsers and finding information, URL's, search services, e-mail, checking internet connection.

Using calendar for appointment, creating and managing task, address book and its management.

Skill: Creating of mailing list, preparing appointment and tasks.

Web Authoring and IT work: Creating a web page using HTML editor, modifying and refining web page, inserting hyperlink, changing theme and layout, inserting images, publishing web page.

Skill: Creating and Publishing a web page.

Installation of Software including antivirus software, printer and other devices. Installing and using PDF files, using ftp, using google drive.

Skill: Preparing a PC for office by installing necessary software.

SEMESTER III

PHYS-631 Atomic and Molecular Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials: 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

General introduction:

Atomic orbital, Electromagnetic spectrum, Hydrogen Atom spectrum-I Hydrogen Atom spectrum-II, Pauli's Principle, Spectra of alkali atoms- I, Spectra of alkali atoms- II, Spin orbit interaction, Fine structure in alkali Spectra, Equivalent and non equivalent electrons **(8 Lecturers)**

UNIT – II

Normal Zeeman Effect, Anomalous Zeeman Effect, Paschen back effect, Stark Effect, Two electron systems, LS and JJ coupling, determination of nuclear spin and nuclear g factors, transition probabilities and line width, Doppler, natural collision and stark broadening

(8 Lecturers)

UNIT – III

Rotation spectra of diatomic molecules, Rotation spectra of Polyatomic molecules, Techniques and instrumentation, Chemical analysis by Microwave spectroscopy, Diatomic vibrating rotator, The interaction of rotation and vibration, Vibration of poly atomic Molecules, I-R- Spectrometer **(8 Lecturers)**

UNIT – IV

Pure rotational Raman Spectra, Vibrational Raman Spectra, Polarization of light and Raman Effect, Structure determination from Raman effect, Structure determination from IR, spectroscopy, Raman Spectrometer, Near I R Raman Spectroscopy, F T Raman Spectroscopy **(8 Lecturers)**

UNIT – V

Electronic Spectra of Diatomic molecules, Electronic Spectra of poly atomic molecules, Molecular Photoelectron Spectroscopy, General Introduction – Resonance Spectroscopy, NMR Spectroscopy- I, NMR Spectroscopy- II, ESR Spectroscopy- I, ESR spectroscopy- II **(8 Lecturers)**

Tutorials: Examples and problems from reference books will be listed in the Lecture schedule as tutorial and assignments

Recommended Books:

- Elementray Atomic Structure by Woodgate.
- Fundamentals of Molecular Spectroscopy by Colin N. Banwell & Elaine M McCash.
- Atomic and Molecular Physics by Littlefield.
- Quantum Physics of Atoms, Molecules Solids and Nuclear Particles by Eistaberg & Rasmic
- Quantum Mechanics : A Modem Approach by Das & Melfessions.
- Atomic Spectra by White.
- Molecular spectra by Herzberg.
- Spectroscopy by Kittle
- Spectroscopy by Gupta & Kumar

PHYS-632 Solid State Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Crystallinity and Forms of Solids:

Crystal classes and systems, periodic array of atoms, fundamental types of lattices, 2d and 3d lattices, index system for crystal planes, simple crystal structures, non ideal crystal structures, elementary ideas of point defects: line defects, planar faults, surface and volume defects, lattice vacancies, interstitials, colour centers, F-centers.

Reciprocal lattice, diffraction of waves by crystals, scattered wave amplitude, structure factor, Brillouin zones. **(8 Lecturers)**

UNIT – II

Lattice Dynamics:

Lattice vibrations, phonons, vibrations of crystals with mono-atomic basis, two atoms per primitive basis, quantization of elastic waves, phonon momentum, inelastic scattering by phonons. Specific heat of solids, phonon heat capacity, an-harmonic crystal interactions, thermal conductivity. **(8 Lecturers)**

UNIT – III

Electrons in Solids:

Free electron theory- Fermi statistics, effect of temperature on the Fermi- Dirac distribution, free electron gas in three dimensions, heat capacity of the electron gas, electron motion in magnetic fields.

Number of orbitals in a band, energy bands in metals, insulators and semiconductors, tight binding approximations. **(8 Lecturers)**

UNIT – IV

Idea of reduced and periodic zones, construction of Fermi surfaces, electron orbits, hole orbits, open orbits, de Haas van Alfen effect for Fermi surface (no derivation). **(4 Lecturers)**

Superconductivity, Meissner effect, type-I and type-II superconductors, BCS theory of superconductors, Josephson junctions. **(4 Lecturers)**

UNIT – V

Magnetic Phenomena in Solids:

Langevin diamagnetism equation, quantum theory of diamagnetism of mononuclear systems, paramagnetism, quantum theory of paramagnetism, Hund's rules.

Ferromagnetic order, magnons, neutron magnetic scattering, Antiferromagnetic order, Ferromagnetic domains, single domain particle. **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be covered during Tutorials and assignments. **(10 Hours)**

Recommended Books:

- Introduction to Solid State Physics by Kittel (Seventh and higher edition
- Solid State Physics by Dekker

PHYS-633A Radiation Physics

External: 70 Marks Internal: 30 marks

Lectures: 40 Lecturers Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Sources of Radiation:

Cosmic rays, radioactive sources, accelerators (Brief study of principle of operation & characteristics of radiations of Cockroft Walton, Van-de Graff, cyclotron, electron linac, electron synchrotron) Synchrotron radiation: Polarization, coherence and emittance. Neutron Source: Reactors, Neutrons from charged particle and photon induced reactions. **(6 Lecturers)**

Radiation Protection:

Units and special parameters, background levels, radiation carcinogesis. **(2 Lecturers)**

UNIT – II

Interaction of Charged Particle with Matter:

Definition of range, types of charged particle interaction, energy transfer in elastic collisions, Bethe formula, scattering of heavy and light charged particles. **(3 Lecturers)**

Interaction of Photons:

Attenuation coefficients, classical scattering from single electrons, coherent scattering, Klein –Nishina cross section for Compton scattering (No derivation), Compton scattering from atomic electrons: Effect of electron binding, electron recoil energy, electron momentum distributions from Compton profiles. Photoelectric absorption, characteristic X-rays, Auger electrons, pair production. **(5 Lecturers)**

UNIT – III

Interaction with Neutrons:

Neutron interactions, Neutron fields in non-multiplying media: Definition of flux, current density, collision dynamics, distribution of energy and angle of scatter, Mean scatter angle and energy loss in single collision, extension to multiple collision, slowing down in hydrogen, neutron diffusion, moderation and diffusion. **(8 Lecturers)**

UNIT – IV

Nuclear Detectors:

Gas detectors, Scintillation detector, Semiconductor detectors. **(4 Lecturers)**

Microdosimetry and Radiation Effects:

Experimental determinations of microdosimetric spectra, practical considerations, primary radiation effects, track structure, radiation effects in condensed systems, radiolysis of water, dosimeter. **(4 Lecturers)**

UNIT – V

Dosimetry:

Charged particle equilibrium, photon interaction coefficients, relation between exposure, kerma and absorbed spectra, measurement of exposure, practical aspects of ionization, chamber dosimetry, calorimetry, tandardization for low and medium energy X-rays, high energy photons, electrons, chemical dosimeters, TLD, solid state and film dosimeters. **(4 Lecturers)**

Brief discussion of radiotherapy using photons, electrons and heavy particles. **(2 Lecturers)**

Brief introduction to radiation imaging techniques (Diagnostic radiology, tomography, MRI, Nuclear Medicine) **(2 Lecturers)**

Tutorials:

assignments will be given by the teacher concerned. **(10 Hours)**

Recommended Books:

- A Primer in Applied Radiation Physics by Smith.
- Nuclear Radiation Physics by Lapp and Andrews.

PHYS-633B Industrial Electronics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Introduction:

Concept and application of power electronics, advantage and disadvantage of power electronic converter, power electronic system.

Power Semiconductor devices:

Characteristic and types of power diodes, Power transistor – Power MOSFET, IGBT, MCT. **(8 Lecturers)**

UNIT – II

Diode circuit and Rectifier:

Diode circuit with dc source, freewheeling diodes, diode and L-circuit, recovery of trapped energy, single phase diode rectifier, zener diode.

Thyristors:

Terminal characteristic, turn on method, switching characteristic, gate characteristic, rating, thyristor protection, GTO thyristor, load and line commutation. **(8 Lecturers)**

UNIT – III

Phase Controlled Rectifier:

Single phase half wave circuit with RL load, RL load and freewheeling diode, RLE load, full wave controlled converter, single phase full wave mid-point and bridge converter, effect of source impedance on the performance of converters, introduction to three phase converter (no derivation). **(8 Lecturers)**

UNIT – IV

Choppers:

Principle and control strategies of chopper, step up chopper, Chopper classification, Class A, B, C, D and E choppers, voltage, current and load commutated chopper circuits. **(8 Lecturers)**

UNIT – V

AC voltage controllers:

Types of AC voltage controllers, integral cycle control, single phase voltage controller with R load and RL load, Sequence control of AC voltage controllers, introduction to three phase controller (no derivation).

(8 Lecturers)

Tutorials and industrial visit:

Assignments will be given by the teacher concerned and also one industrial visit will be done. **(10 Hours)**

Recommended Books:

- Industrial Electronics by G.K. Mittal, Khanna Publishers 2000.
- Power electronics circuits, Devices and Applications, by Rashid, PHI.
- Electronics in Industry by Chute and Chute, McGraw Hill, Tokyo.
- Industrial electronics by Petruzulla, McGraw Hill, Singapore.
- Power electronics by Bimbhra, Khanna Publishers, 1999.

PHYS-634 Plasma Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Charged particle motion and drifts, Guiding centre motion of a charges particle. Motion in (i) uniform electric and magnetic field (i) gravitational and magnetic fields. Motion in non-uniform magnetic field (i) grad B perpendicular to B, grad B drift and curvature drift (ii) grade B parallel to B and principle of magnetic mirror. Motion in non-uniform electric field for small Larmour radius. **(8 Lecturers)**

UNIT – II

Time varying electric field and polarization drift. Time varying magnetic field adiabatic invariance of magnetic moment. **(2 Lecturers)**

Plasma fluid equations fluid equations, conventive, two fluid and single fluid equations, fluid drifts perpendicular to B diamagnetic drift. Diffusion and Resistivity : Collision and diffusion parameters, decay of a plasma by diffusion, ambipolar diffusion **(6 Lecturers)**

UNIT – III

Diffusion across magnetic field. Collision in fully ionized plasma. Plasma resistivity Diffusion in fully ionized plasmas. Solution of Diffusion equation. **(3 Lecturers)**

Hydromagnetic equilibrium. Concept of magnetic pressure. Equilibrium of a cylindrical pinch. The Benner pinch. Diffusion of magnetic field into a plasma **(5 Lecturers)**

UNIT – IV

Classification instabilities. Two stream instability. The gravitational instability Resistive drift waves. **(3 Lecturers)**

Understanding the Sun: Solar plasma magneto hydrodynamics, solar magnetism, Chromospheres and corona, Solar wind and heliosphere, solar eruptions. Solar vibrations (GONG) sunspots and sunspots cycle. **(5 Lecturers)**

UNIT – V

Solar plasma electrodynamics for solar luminosity, opacity, temperature, pressure, mass, radius and gases. The Sun's continuous and absorption line spectrum, solar energy transport, photosphere, chromospheres corona and solar winds. Solar interior, nucleus transformation and fusion reactions, solar neutrino experiments. **(6 Lecturers)**

Basic of nebular models and the formation of the planets, Asteroid, Comets, Meteors. **(2 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and

assignments. **(10 Hours)**

Recommended Books:

- An introduction to Plasma physics by Chen, Plenum press, 1977.
- Methods in non-linear plasma theory by Davidson, Academic press, 1972.
- Plasma physics in theory and application by Kunkel, McGraw Hill, 1966.
- Fundamentals of Plasma physics by J.A. Bittencoms, Pergamons press, 1986.

PHYS-635 Theoretical Methods in Condensed Matter Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials: 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Electronics Structure:

Single electron Model: Basic Hamlitonian, Densities of States, Statistical mechanics of non interacting electrons, sommerfield expansion: specific heat of non interacting electrons at low temperatures.

Schrodinger equation and Symmetry:

Translation Symmetry-Bloch's theorem, vanhove singularities, Fourier analysis of Bloch's theorem, Kronig penney model **(8 Lecturers)**

UNIT – II

Rotational Symmetry: classes and characters, consequences of point group symmetries for Schrodinger's equation.

Nearly free and tight bound electrons: Nearly free electrons- Degenerate perturbation theory, Brilloine zones-nearly free electron Fermi surfaces. **(8 Lecturers)**

UNIT – III

Tight bound electrons: Wannier functions and tight binding model.

Electron Electron Interaction: Hartree and Hartree-Fock equations : Hartree –fock equations, numerical implementation. **(8 Lecturers)**

UNIT – IV

Density fuctional theory: Thomas Fermi theory and Kohn-shyam equations.

Calculations of Band Structure: Numerical methods: Psuedopotentials and orthogonal Plane wave

(8 Lecturers)

UNIT – V

LCAO, Plane waves, LAPW, LMTO, Brief survey of Periodic table **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Hours)**

Recommended Books:

- Condensed Matter Physics by Michael P Marder.
- Solid State Physics by Ashcroft & Mermin.

PHYS-636 Data and Computer Communications

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Protocol Architecture:

Overview: Communication model, Communication Tasks, Data Communication Networking: WAN, LAN, Wireless Networks. Basics of Network Software: Protocol and protocol architecture, Protocol functions, Design Issues for the layers, interfaces &Services, Connection oriented and connectionless services, service primitives, relationship of services to protocols , ISO REF Models, TCP/IP Model.

Data Communications:

Data Transmission: Concepts of frequency, spectrum, bandwidth, electromagnetic spectrum and frequencies for data communication, Fourier analysis, data and signal, transmission impairments, channel capacity, Nyquist bandwidth, Shannon capacity formula ,decibels and signal strength, Transmission media:Coaxial, twisted pair, Comparative study of Categories of cables, Coaxial, Optical Fibers, Wireless transmission: TerrestialMicrowave, satellite, Broadcast Radio,Infrared. **(8 Lecturers)**

UNIT – II

Data Encoding:

BCA (NRZ, Bipolar AMI, B8ZS, HDB3,ASK,FSK,PSK,PCM,AM,FM,PM), Spread Spectrum. Asynchrous and Synchronous transmission, Full and Half duplex, Interfacing, Functional and Procedural aspects of V.24.

Data Link Control:

Flow control: Stop and Wait, Sliding window, Error detection: Parity Check,CRC. Error control: Stop and Wait ARQ, Go back-N ARQ, Selective-Reject ARQ, Brief idea of HDLC and other Data Link control protocols. **(8 Lecturers)**

UNIT – III

Circuit Switching:

Simple switching network, circuit switching networks, circuit switching concepts: space division switching, time division multiplexing, routing in circuit switching networks, control signaling, inchannel & common channel signaling, Brief idea of SS7. Packet Switching: Packet switching principles, Routing, X.25.

(8 Lecturers)

UNIT – IV

LAN technology:

LAN architecture, IEEE 802 standards, Ethernet (CSMA/CD): Medium Access Control, 10, 100, Gigabit Ethernet. Brief survey of other LAN systems (Token ring,FDDI,ATM, Fiber channel). Wireless LANS, Bridges, Latest trends in LAN technologies.

LAN Devices:

Study of specifications of L2 and L3 switches, Structured cabling, Passive components. **(8 Lecturers)**

UNIT – V

Principles of internetworking, connection less Internetworking, IP, IPv6, IP multicasting. Routing protocols, TCP, UDP, SNMP, SMTP and MIME, HTTP. **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Hours)**

Recommended Books:

- Data & Communications by William Stallings.
- Computer Networks by A. S. Tanenbaum.

PHYS-637 Programming using JAVA

External: 70 Marks Internal: 30 marks

Lectures: 40 Lecturers Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Introduction to Java: Bytecode, features of Java, data types, variables and arrays, operators, control statements.

Objects & Classes: Object Oriented Programming, defining classes, static fields and methods, object construction **(8 Lecturers)**

UNIT – II

Inheritance: Basics, using super, method overriding, using abstract classes, using final with inheritance.

Packages and Interfaces: Defining a package, importing package, defining an interface, implementing and applying interfaces. **(8 Lecturers)**

UNIT – III

Exception Handling: Fundamentals, exception types, using try and cache.

Multithreaded Programming: Creating a single and multiple threads, thread priorities, synchronization.

(8 Lecturers)

UNIT – IV

Applets: Applets basics, applets architecture, applets skeleton, the html applet tag, passing parameters in applets.

Event Handling: Event classes and event listener interfaces. **(8 Lecturers)**

UNIT – V

Graphic Programming Introduction to swings. **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Hours)**

Recommended Books:

- The complete reference to Java by Naughton and Schildt.
- How to program in Java by Deitel and Dietel.

PHYS-638 Data Analysis Techniques

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks; Viva-Voce: 20 marks

Computer based data analysis Techniques will be offered.

PHYS-639A Radiation Physics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

Practical based on Radiation physics will be designed and perform in the laboratory

PHYS-639B Industrial Electronics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

Practical based on Industrial electronics will be designed and perform in the laboratory

PHYS-639C Plasma Physics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

Practical based on Plasma physics will be designed and perform in the laboratory

PHYS-639D Condensed Matter Physics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

Practical based on condensed matter physics will be designed and perform in the laboratory

SEMESTER IV

PHYS-641 Nuclear and Particle Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials: 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Properties of stable nuclei:

Nuclear size: Different type of radii and brief discussion of methods to determine radii, spin and magnetic moment of nuclei, Quadrupole moment of nuclei. **(4 Lecturers)**

Nuclear Force and Two body problem:

Ground state of deuteron: Ground state wave function, Nucleon-Nucleon scattering: Qualitative discussion of n-p and p-p scattering cross section. **(4 Lecturers)**

UNIT – II

Nature of the nuclear force, form of nucleon-nucleon potential; Charge-independence and charge-symmetry of nuclear forces, isospin, exchange nature of nuclear force. **(3 Lecturers)**

Nuclear model:

Liquid Drop Model, Evidence of shell structure, single- particle shell model, its validity and limitations; Brief discussion of Nuclear Collective model. **(5 Lecturers)**

UNIT – III

Nuclear reactions:

Energy considerations, cross section for nuclear reactions : statistical considerations, compound nucleus and direct reactions, nuclear fission and fusion (brief discussion), Neutron scattering cross section (brief discussion). **(5 Lecturers)**

Alpha decay:

Range and disintegration energy, Geiger Nuttal law, Fine structure of alpha spectrum. **(3 Lecturers)**

UNIT – IV

Beta decay:

Beta particles: experimental information, neutrino hypothesis, Fermi theory of beta decay, Fermi Kurie plot, Brief survey of *ft* values: allowed and forbidden transitions, Non-conservation of parity in beta decay, Helicity of Neutrino. **(4 Lecturers)**

Gamma decay:

Electromagnetic transitions in nuclei, Gamma ray transition probability: (qualitative study only), Internal conversion of gamma rays (qualitative study only), Brief discussion of Angular correlation of gamma rays. **(4 Lecturers)**

UNIT – V

Introduction to particle physics:

Classification of elementary particles, particle interactions. brief survey of different types of elementary particles (i.e., electrons, protons, neutrons, mesons, hyperons and their anti-particles), conservation laws, spin and parity assignments, isospin, strangeness, C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interactions. **(8 Lecturers)**

Tutorials:

Examples and problems from reference books will be listed in the lecture schedule as tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Fundamental of nuclear physics – Verma, Bhandari and Somayajulu.
- Nuclear physics – Tayal

PHYS-642 Experimental techniques in Physics

External: 70 Marks Internal: 30 marks

Lectures: 40 Lecturers Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Sensors & transducers:

Mechanical and electromechanical sensors: Strain Gauge, inductive and capacitive sensors. Thermal Sensors and measurement of temperature: Resistance change, thermo-e.m.f, junction semiconductor, thermal radiation. Magnetic Sensors: Magnetic resistive, Hall effect, inductive and eddy current based sensors, Opto-electronic devices: Solar cells, LED, Photo detectors. Radiation detectors: GM detector, Scintillation, Semiconductor pin detector. **(8 Lecturers)**

UNIT – II

Analog Signal Processing:

Signal classifications, functions in analog signal processing, errors in signal processing, signal conditioning, recovery & conversion, sample and hold circuits, impedance matching, filtering and noise reduction, shielding and grounding, analog to digital conversion, digital to analog conversion, box-car integrator, modulation techniques, phased locked Loop, lock-in detector, Lock in Amplifier. **(8 Lecturers)**

UNIT – III

Vacuum Techniques and Thin Films:

Introductory vacuum concepts: System volume, leak rates, pumping speed, conductance and measurement of system pressure. Vacuum Pumps: Rotary, diffusion pumps, UHV pumps and materials for UHV, measurement of vacuum, surface preparation and cleaning procedure. Thin film preparation techniques: Thermal evaporation, sputtering, ion-beam, molecular epitaxial and chemical vapor methods. **(8 Lecturers)**

UNIT – IV

Digital Imaging and Basics of imaging techniques:

Field effect Transistors, homo and hetro-junction devices: device structure, characteristics, frequency dependence and applications, charge coupled devices and its applications, microscopic techniques in physics (field ion microscopy, scanning tunneling microscopy, electron microscopy: principle, typical experimental setup and measurement). **(8 Lecturers)**

UNIT – V

Mass spectroscopy:

Principle, spectrometer, and its operation, resolution, mass spectrum, applications. **(2 Lecturers)**

Physical properties Measurements of Solids:

Experimental techniques for measurement of heat capacity, electrical resistance of metals, thermal conductivity and magnetic susceptibility (Principle, typical experimental setup and measurement).
(6 Lecturers)

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Sensors and transducers– D. Patranabis
- Analog Signal Processing– Ramón Pallás-Areny
- Vacuum Science and Technology– Rao, Ghosh and Chopra
- Advanced Experimental techniques in Modern Physics– Varier, Jodrph and Pradyumnan.
- Microscopy Techniques for Material Science– Ashley Clarke and Colin Nigel Eberhardt
- Experimental techniques in low-temperature physics– White and Meeson

PHYS-643A Fundamental of Nano-science

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Introduction:

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering, classifications of nano-structured materials, nano particles, quantum dots, Nanowires – ultra – thinfilms, multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

(8 Lecturers)

UNIT – II

Preparation Methods:

Bottom-up Synthesis, top-down approach: Precipitation, mechanical milling, colloidal routes, self-assembly, vapour phase deposition, MOCVD, sputtering, evaporation, molecular beam epitaxy, atomic layer epitaxy, MOMBE. **(8 Lecturers)**

UNIT – III

Patterning and Lithography for nanoscale devices

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography **(8 Lecturers)**

UNIT – IV

Preparation Environments:

Clean rooms: specifications and design, air and water purity, requirements for particular processes, vibration free environments: Services and facilities required. Working practices, sample cleaning, chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

(8 Lecturers)

UNIT – V

Characterization Techniques

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques - AFM, SPM, STM, SNOM, ESCA, SIMS - Nanoindentation. **(8 Lecturers)**

Recommended Books:

- Nanomaterials: Synthesis, Properties and Applications– Edelstein and Cammearata
- Nanoscale charecterisation of surfaces & Interfaces– N John Dinardo

- Nanotechnology– G Timp
- The Hand Book of Nano Technology, "Nanometer Structure", Theory, Modeling and Simulations– Akhlesh Lakhtakia

PHYS-643B Atmospheric Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Radiative transfer in the atmosphere

Temperature of the sun and spectral distribution of solar radiation, blackbody radiation budget of radiation energy, Passage of solar radiation through the atmosphere, atmospheric windows, emissivity, absorption spectra of atmospheric gases, optically thick and thin approximation, aerosol, scattering, calculation of radiative heating and coling, terrestrial radiation and its passage through the atmosphere. **(8Lecturers)**

UNIT – II

Atmospheric thermodynamics:

Laws of thermodynamics, Lapse rate, thermodynamic equations entropy change water-air mixture, moisture variables, potential temperature, virtual temperature, thermodynamic diagram, dry and moist static energy, static stability, convective instability. **(8 Lecturers)**

UNIT – III

Basic equation of atmospheric thermodynamics:

Equations of motion in spherical coordinates, rotating frame, coriolis force, quasistatic approximation, scale analysis, Rossby number, balanced flow, natural coordinate system, equations of continuity in spherical and Cartesian coordinates. Thermodynamic energy equations, pressure as vertical coordinate. **(8 Lecturers)**

UNIT – IV

Cloud Microphysics:

Cloud forms and characteristics, formation and growth of precipitation particles, terminal velocity, thunderstorms, artificial rain making. **(8 Lecturers)**

UNIT – V

Atmospheric circulation:

Circulation, Vorticity, divergence and deformation Circulation theorems and applications, Barotropic and baroclinic fluids, dynamic instabilities. **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Physical meteorology – H.G. Houghton
- Atmospheric Sciences : an introductory survey– Vallace and Hobbs
- A short course on cloud Physics – R.R. Rogers
- An introduction to dynamic meteology – J.R. Holton
- Introduction to Theoretical Meteorology – S.L. Hess
- Atmospheric Waves – T. Beer
- Atmospheric Tides, Chapman and Lindzen– Riedel

PHYS-644A Microwave Electronics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Introduction:

Introduction to microwaves and its frequencies spectrum, Necessity of microwaves and their applications. **(1 Lecturers)**

Wave guides:

(a) Rectangular wave guides: Wave equation & its solutions, TE and TM modes. Dominant mode and choice of wave guide dimensions, Methods of excitation of wave guide, Power transmission and power losses. **(3 Lectures)**

(b) Circular wave guide: Wave equation and its solutions, TE, TM and TEM modes, power transmission and power losses. **(4 Lectures)**

UNIT – II

Resonators:

Resonant modes of rectangular and cylindrical cavity resonators, Q of the cavity resonators, Frequency meter, Dielectric resonators. **(3 Lecturers)**

Striplines:

Introduction to mircostrip lines, characteristic impedance of microstrip lines, losses in microstrip lines, quality factor of microstrip lines, basics of parallel and coplanar strip lines. **(3 Lecturers)**

Transferred electron devices:

Gunn effect, differential negative resistance, two-valley model theory (No derivation), microwave generation using gunn diode. **(2 Lecturers)**

UNIT – III

Microwave linear beam tubes:

Space charge spreading of an electron beam, beam focusing, velocity modulation, two cavity klystron, reflex klystron and efficiency of klystrons, slow wave structure of helix TWT, amplification process and working principle of TWT. **(8 Lecturers)**

UNIT – IV

Microwave crossed field tube:

Types and description, theoretical relations between electric and magnetic field of oscillations for magnetrons, modes of oscillations and operating characteristics of magnetrons, construction and working principle of gyrotron. **(4 Lecturers)**

Ferrites:

Microwave propagation in ferrites, Faraday rotation, Devices employing Faraday rotation (isolator, gyrator, circulator). Introduction to single crystal ferromagnetic resonators. **(4 Lecturers)**

UNIT – V

Microwave test equipment:

Measurement of power, frequency, attenuation, impedance and VSWR, reflectometer, antenna measurements and radiation pattern. **(5 Lecturers)**

Complex permittivity of materials and its measurement:

Definition of complex permittivity of solids, Dielectric properties of materials using shift of minima method.

(3 Lecturers)

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Microwave devices and circuits– Samuel Y. Liao.
- Microwaves– Sisodia and Gupta.
- Microwave Devices and Applications– Dube.
- Foundations of Microwave Engineering– Collin.
- Electromagnetic Waves & Radiating System– Jorden and Balmain.
- Theory and Applications of Microwaves– Brownwell and Beam.
- Introduction to Microwave Theory– Atwater.

- Principles of Microwave circuits– Montogmetry.

PHYS-644B Ionospheric Physics

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Ionosphere propagation and measurement techniques:

Effect of Ionosphere on radiowave propagation, Refraction, Dispersion and polarization, Magnetoionic theory, critical frequency and virtual height, Oblique propagation and maximum usable frequency, Ground based techniques: ionosondes, radars, scintillation and TEC, ionospheric absorption, rocket and satellite borne techniques: Langmuir probe, electric field probe mass spectrometer. **(8 Lecturers)**

UNIT – II

Ionospheric plasma dynamics:

Basic Fluid equations, steady state ionospheric Plasma motions due to applied forces, generation of Electric field mapping, collision frequencies, Electrical conductivities, Plasma diffusion, Ionospheric dynamo, Sq current system, Equatorial Electrojet & EIA. **(8 Lecturers)**

UNIT – III

Airglow and its measurement:

Night glow, dayglow, twilight glow, aurora, photometers, spectrometers and imagers for airglow measurement, applications of airglow measurement for ionospheric dynamics and composition. **(8 Lecturers)**

UNIT – IV

Ionospheric plasma irregularities:

E-region irregularities associated with electrojet, Sporadic-E, Auroral electrojet and associated irregularities, F-region irregularities, Equatorial Spread F and its various manifestations. Airglow depletions and plasma bubbles, Ground based, rocket borne and satellite based measurement techniques for these irregularities. Theories of ESF. **(8 Lecturers)**

UNIT – V

Ionospheric modeling and models:

IRI, SUPIM, TIGCM, PIM. Brief introduction to ionospheres of Mars, Venus and Jupiter. **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Aeronomy of the Middle Atmosphere – Guy Brasseur and Susan Solomon.
- Electromagnetic waves and Radiating System – Jordan
- Antennas and Radio Wave Propagation – R.E. Collin.
- Electronics Communication Systems – B. P. Lathi
- Electronics Communication – Kennedy.
- Introduction of Ionospheric Physics– Risbeth and Garriot

PHYS-645A Material Science

External: 70 Marks | Internal: 30 marks

Lectures: 40 Lecturers | Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Phase diagram:

Definitions and basic concepts, solubility limit, phases, microstructure. phase equilibria, equilibrium phase diagram, binary isomorphous systems, interpretations of phase diagrams, binary eutectic systems, development of microstructures in eutectic alloys. The Fe-Fe; C phase diagram, development of microstructures in iron-carbon alloys.

Phase transformations: Kinetics of phase transformation, metastable vs equilibrium states. **(8 Lecturers)**

UNIT – II

Ceramics:

Ceramic structure, ceramics density calculations, Silicate Ceramics, imperfections in ceramics, ceramic phase diagram, Brittle fracture of ceramics, stress, strain behaviours.

Glasses:

Properties of glasses, glass forming. Heat treating glasses glass ceramic. Clay products. Characteristics of clay. Composition of clay products. Refractories. Abrasives, Cement. **(8 Lecturers)**

UNIT – III

Polymers:

Hydrocarbon molecules. Polymer molecules. The chemistry of polymer molecules. Molecular weight and shape. Molecular structure. Molecular configuration. Stress-strain behaviour. Thermoplastic and thermosetting

polymers, viscoelasticity. Deformation of elastomers. Impact strength, fatigue, strength and hardness.

(8 Lecturers)

UNIT – IV

Composites:

Particles Reinforced composites, large particles composites, dispersion strengthened composites, Fiber Reinforced Composites: Influence of fiber length, orientation and concentration. The Fiber phase, matrix phase, Polymer-matrix, Metal-Matrix, Ceramic-Matrix Composites, Carbon-Carbon composites, laminar composites, sandwich panels. **(8 Lecturers)**

UNIT – V

Magnetic Material:

Soft magnetic materials, hard magnetic materials, qualitative discussion of magnetic thin films, multilayers - DMS, GMR, CMR (no derivations). Magnetic nanoparticles, Measurement of Particle size density- porosity-lattice constant using X-ray. Working principles of magnetic characterization using Mössbauer spectroscopy, and VSM (Low and high field magnetic field and temperature) (qualitative discussion only).

(8 Lecturers)

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Material Science and Engineering : An Introduction– William D. Callister Jr.
- Introduction to magnetic materials – Cullity and Graham
- Fundamentals of nuclear physics– Varma, Bhandari and Somayajulu

PHYS-645B Astronomy and Astrophysics

External: 70 Marks Internal: 30 marks

Lectures: 40 Lecturers Tutorials : 10 Lecturers

Additional Contact Hours: 10 (seminars, quiz, assignments, group discussion etc.)

UNIT – I

Introductory Concepts:

Basic parameters in astronomical observations (magnitude scales, coordinate system), Stellar classification-H.R. Diagram, Saha's equation, Jean's criteria for stellar formation, Galaxy classification.

Cosmology:

Cosmological models, observations, cosmic violence (in nucleus of the Galaxy), cosmic back-ground radiation, elementary particles and cosmos, big-bang model of inflationary universe (flatness and horizontal problem), Relativistic and Cosmic geometry of space – time and universe. **(8 Lecturers)**

UNIT – II

Optical and near IR studies of Stars and Galaxies:

Optical Telescopes with CCD's–High angular resolution techniques (speckle, lunar occultation adaptive optics), interferometry with telescopes.

Spectral energy distribution (in optical bands) in stars, rotation of stars, study of binary stars. Gaseous nebulae

Extinction curve of interstellar matter, dust-rotation, curve of galaxies, spectral energy distribution, colour studies (Imaging of galaxies in different bands). **(8 Lecturers)**

UNIT – III

High Energy astronomy:

Atmospheric transmission, Detection Techniques for X-rays and Gamma-rays, X-ray-Telescopes with imaging and Spectroscopy -Radiation Processes in Accretion Disks around Black Holes and X-rays Binaries -Active Galactic Nuclei. **(8 Lecturers)**

UNIT – IV

Dark matter:

Evidences of dark matter – Dark matter components in our galaxy, in Halos of the spiral galaxy, in clusters of candidates in dark matter. Baryonic and non-Baryonic candidates in dark matter. **(5 Lecturers)**

Radio Telescopes– Radio interferometry, very long base interferometry (VLBI) of radio pulsars, radio galaxies– Distribution of HI gas in galaxies – Radiation mechanism. **(8 Lecturers)**

UNIT – V

Black hole Observation, Gravitational lens, Schwarzschild radius, Singularity, X-rays and Gamma rays bursts through cosmic flux detection using photo-multiplier tubes.

Hubble's law and Hubble's constant (Red shift, distance, age of the Universe Measurements) – Galactic Structure – Rotation and spiral (Optical, radio, X-rays, Gamma radiation observation). **(8 Lecturers)**

Tutorials:

Examples and problems from Reference books will be listed in the Lecture schedule as Tutorials and assignments. **(10 Lectures)**

Recommended Books:

- Solar Astrophysics– Foukal.
- Galaxy Formation (second edition) – Malcolm S. Longair.

- Fundamentals of solar Astronomy– Bhattnagar and Livingston.
- The Fundamentals of Stellar Astrophysics– George W. Collins.
- Stellar Astrophysics– Haung and Yu.
- Advanced Stellar Astrophysics– Rose
- Introduction to Stellar Astrophysics– Erika Bohm
- Quasars and Active Galactic Nuclei– Kembhavi and Narlikar
- Astrophysics Stars and Galaxies– Abhyankar
- The Sun– Michael Stix
- Spectropolarimetry– Jean Stein Flow

PHYS-646 Modern Physics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

LIST OF EXPERIMENTS

1. Study of Magneto-restriction in a ferromagnetic material.
2. Study of Millikan's oil drop experiment and determine the electronic charge.
3. Study of ultrasonic diffraction apparatus.
4. Find the Lande's g-factor using electron spin resonance spectrometer.
5. Calculate the velocity of ultrasonic sound through different liquid media.
6. Calculate the adiabatic compressibility of the given liquid.
7. Study of the characteristic of strain gauge.
8. Plot a graph between load applied versus output voltage of the bridge displayed on LED.
9. To study random events for a Co^{60} source using a G.M. counter
10. To determine end point energy of beta-particles of the given radioactive source
11. To study absorption coefficient of lead for cobalt 60 gamma rays using G.M. counter

Any other experiments designed and setup by the teacher on the availability of laboratory.

PHYS-647A Microwave Electronics Lab

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

List of Experiment:

1. Study the mode characteristics of reflex Klystron and to determine the mode number, transit time, ETR and ETS.
2. Determine the wavelength and frequency of microwaves produced by Klystron source.
3. Determine the wavelength and frequency of microwaves produced by Gunn diode source.
4. Study of the V-I characteristic of a Gunn diode and to measure its power.
5. Determine the dielectric constant of given dielectric material using reflex Klystron.
6. To study the radiation pattern of given antenna by plotting polar graph and find out 3 dB parameters.
7. To determine the low, medium and high voltage standing wave ratio using Klystron tube.
8. Bragg's diffraction based experiments using microwaves.
9. To study substitution method for the measurement of attenuation and to study variation in attenuation with the frequency.
10. To study square law behavior of a microwave crystal detector and hence to determine operating range and detection efficiency.

Reference books:

- Basic Microwave Technique and Laboratory Manual by Sisodia and Raghuvanshi.
- Microwave Engineering by Pozar.
- Microwave Engineering by Das and Das.

Any other experiment based set by the teacher and availability of laboratory.

PHYS-647B Material Science Lab

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

Practical based on material science laboratory will be performed by the students.

PHYS-647C Ionospheric Physics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

Practical based on ionospheric physics laboratory will be performed by the students.

PHYS-647D Astronomy and Astrophysics Laboratory

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

Practical based on computational methods and simulation based will be performed by the students.

PHYS-648 Computer Hardware Maintenance Skill Course

External: 70 Marks Internal: 30 marks

External Assessment:

Experiments: 50 marks

Viva-Voce: 20 marks

NOTE:

UNIT – I

CPU Cabinet and Laptop:

Basic understanding of working of different kinds of semiconducting components used in Mother Board, H.D.D. and memories, significance and difference in RAM and ROM

Prime Power Devices:

Usage and circuits of SMPS and adapter, ports application and uses –LN card, USB port, HDMI port and VGA cable.

Cooling devices:

Fan, aluminum plate, vent etc., and their maintenance

UNIT – II

Display System of computer:

Types of analog and digital display system-CRT, TFT, LCD, their construction and working principle, pixcel density and picture resolution of monitor screen. Settings of screen-contrast, brightness, colour quality wallpaper, advantage of timeout and screen saver. Screen camera-pixcel size and resolution, picture quality control and role in video conferencing.

UNIT – III

Input and Output devices:

Printer:

Brief introduction of printer's working, setting of printing papers, loading and refilling of cartridge, expected troubles and their remedies. Types of printer- Dot matrix, Laser jet, Scan jet and Colour printer.

Keyboard:

Maintenance and functions of all keys and buttons for fast processing.

Scanner:

Uses and setting for better scanning, solution to troubles in different scanners.

UNIT – IV

Assembling and Installation of computers:

Identification of quality and compatibility of mother board, RAM, ROM, H.D.D., cables for assembling of computer system. Types of connectors- pin-male-female, care in pushing and detaching connectors. Layout of components in CPU and LAPTOP.

Installation of operating system and application software-Win Vista, Win XP, Win-8 and 10, Linux etc., comparing merit and demerit of OSs.

UNIT – V

Handling of PC and Laptop:

Rules and instructions to be followed in operating and handling the PC's and Laptop.

Health issues related to sitting posture of user, environment at working place, illumination, dust, cleaning etc.

Proper maintenance and holding of PC and Laptop during their use.

UPS-essential electrical supply, appropriate location and maintenance of batteries.

Over heating of PC, Laptop, UPS.

How to do trouble shooting and their remedies.