## M.Sc. PHYSICS

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# Core Based Electives

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<td>Crystal Growth and Thin Films</td>
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<td>II</td>
<td>Computational Methods for Physics</td>
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<td>Nano science and Technology</td>
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<td>III</td>
<td>Special Electronics</td>
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<td>Electronic Instrumentation</td>
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* Not considered for Grand Total and CGPA
SEMMESTER I: CORE – I
CLASSICAL DYNAMICS

Course Code : 14PPH1C1
Max.Marks : 100
Hours / Week : 6
Internal Marks : 40
Credit : 5
External Marks : 60

Objectives:
➢ To understand Lagrangian and Hamiltonian principles and its applications
➢ To study the canonical transformations of Poisson’s Brackets & Hamilton – Jacobi Theory
➢ To study the general theory of small oscillations and Rigid body dynamics
➢ To study the energy concepts in relativistic mechanics.

UNIT – I Lagrangian Dynamics 18 hours
Constraints – generalized co-ordinates – principle of virtual work – D’Alembert’s principle
Lagrange’s equations from D’Alembert’s principle – Hamilton’s principle and Lagrange’s equations
Applications – simple pendulum – At wood’s machine – Bead sliding on rotating wire in a force –
#free space#.

UNIT - II Hamiltonian Dynamics 18 hours
Cyclic co-ordinates – Hamilton’s canonical equations of motion – deduction of Hamilton’s principle
from the D’Alembert’s principle – Deduction of Hamilton’s equation from the modified Hamilton’s
principle – principle of least action – Examples: Motion of a particle in a central force field, charged
particle moving in an electromagnetic field.

UNIT - III Poisson’s Brackets & Hamilton – Jacobi Theory 18 hours
Poisson’s bracket – canonical transformations – invariance of Poisson bracket with respect to canonical
transformations – Hamilton-Jacobi theory – Action and Angle variable – Kepler’s problem – solution
of Harmonic oscillator problem by Hamilton-Jacobi equation – Hamilton’s characteristic function
conservative system.

UNIT – IV Small oscillations and Rigid-body dynamics 18 hours
General theory of small oscillation – Equation of motion for small oscillation – solution of eigen value
equation – normal co-ordinates and normal frequencies of vibration – vibration of a linear triatomic
molecule.
Euler’s angle – equation of motion of Rigid body – Euler’s equations – the motion of a symmetric top
under action of gravity.
UNIT – V  Relativistic Mechanics  18 hours
Relativistic energy – relation between momentum and energy and conservation law – transformation of momentum and energy – Force in relativistic mechanics – Minkowski space and Lorentz transformations – World point and world line – Four vectors.

Self study portion

Text book

UNIT I  Chapter 2  Sections 2.3-2.11
UNIT II  Chapter 3 & 5  Sections 3.2 - 3.5 & 5.3 -5.11
UNIT III  Chapter 7 & 8  Sections 7.2 - 7.6 & 8.2 -8.8
UNIT IV  Chapter 9 & 10  Sections 9.4 - 9.6 & 10.3 -10.14
UNIT V  Chapter 13 & 14  Sections 13.3 -13.8 & 14.2 -14.5

Books for reference:
MATHEMATICAL METHODS FOR PHYSICS

Course Code : 14PPH1C2
Max.Marks : 100
Hours / Week : 6
Internal Marks : 40
Credit : 5
External Marks : 60

Objective:

➢ To practice mathematical methods for physics through vector analysis, matrices, Tensors, complex variable, Fourier transform

UNIT – I Vector Analysis 18 hours
Differentiation of Vector Functions: The Derivative of a Vector- Gradient, Divergence, Curl and Laplacian Operators
Integration of Vector Functions: Line integral- Gauss Divergence Theorem – Green’s theorem – Stoke’s theorem – Statements and proofs only.

General Curvilinear Coordinates: Orthogonal Curvilinear Cylindrical Coordinates-Gradient, Divergence, Curl and Laplacian in Orthogonal Curvilinear Coordinates - Spherical Polar coordinates.

UNIT - II Linear Vector Spaces and Matrices 18 hours
Linear Vector Spaces: Definition – Linear independence, basis and dimension – Scalar Product-Orthonormal basis- Schwartz Inequality-Gram-Schmidt’s Orthogonalization process – Linear operators

Special Types of Matrices: The Eigen Value Problem-Cayley Hamilton theorem –Coordinate Transformations: Rotation in two and Three Dimensions.

UNIT - III Tensors 18 hours

UNIT – IV Complex Variables 18 hours
The Derivative of a Complex Function \( f(z) \) of its Analyticity – Cauchy – Riemann conditions – Harmonic Functions- Cauchy’s Integral theorem - Cauchy’s Integral formula – Taylor’s series – Laurent’s series – Zeros of a Complex Function-Evaluation of Residues-Cauchy Residue theorem – Cauchy Principal Value -Evaluation of definite integrals [ Integrals of the form \( \int_0^{2\pi} f(sin\theta, cos\theta) d\theta \) and \( \int_{-\infty}^{+\infty} f(x) dx \) ]
UNIT – V  Fourier Transforms  18 hours

Fourier Integral Theorem and its proof- Fourier transform of time dependent functions-Integral Representation of the Dirac Delta Function- Parseval’s Theorem- Linearity Theorem- Fourier transform of derivatives – Shifting of the origin- Convolution theorem – Sampling Theorem-

#Use of Fourier Transforms in Solving Differential Equations#

#.............#Self study portion

Text books

UNIT I  Chapter 1  Sections 1.3.1 - 1.6.8  T.B 1
UNIT II  Chapter 2 & 7  Sections 2.5 - 2.9 & 7.1 - 7.6  T.B 1
UNIT III  Chapter 15 - 19  Sections 15.2 - 19.7  T.B 2
UNIT IV  Chapter 3 & 4  Sections 3.3.1 – 4.6.2  T.B 1
UNIT V  Chapter 10  Sections 10.1 - 10.10  T.B 3

Book for reference:
B.D. Gupta, Mathematical Physics, Vikas Publications, 3rd edition, 2005
Objectives:

- To understand the properties and models of nucleus
- To study about nuclear radioactivity and reactions
- To study about the properties of elementary particles

UNIT – I  General properties of Atomic Nucleus  18 hours


UNIT - II  Radioactive Decays  18 hours


UNIT - III  Nuclear Fission and Fusion  18 hours


UNIT – IV  Nuclear reaction  18 hours


UNIT – V  Elementary particles  18 hours

Classification of elementary particle - #fundamental interactions# – conservation laws and their validity – the C-P-T theorem – Properties of elementary particles: the Massless Bosons – the Leptons –
the mesons – symmetry schemes of elementary particles – SU(3) multiplets of Hadrons – Gellmann – Okubo mass formula for SU(3) multiplets – Quarks. Flavours and colours.

#.............#Self study portion

Text book

UNIT I Chapter 1, 8 - 10 Sections 1.6 - 1.7 & 8.3 - 10.21
UNIT II Chapter 5 - 7 Sections 5.4 - 7.6
UNIT III Chapter 13 Sections 13.1 - 13.2
UNIT IV Chapter 10 Sections 10.3 - 10.24
UNIT V Chapter 18 Sections 18.1 - 18.3

Books for reference:
2. Satya Prakash, Nuclear & Particle Physics, Sultan Chand & Sons, New Delhi, 4th edition, 2010
Objectives:
- To realize the physics principles through advanced physics experiments
- To determine a physical coefficients through electromagnetic and optical experiments.

1. e/m Thomson method
2. e/m Helical method
3. Determination of the specific charge \([e/m]\) of an electron by magnetron method.
4. Determination of \(q, n, \sigma\) by elliptical fringes method.
5. Determination of Specific Rotatory Power of Liquids - Lauret’s Half-shade Polarimeter
6. Fourier Analysis of Periodic Waveforms
7. Determination of magnetic susceptibility by Quinke’s method.
8. Determination of \(\lambda\) and \(\mu\) using Fresnel Bi-prism.

Book for reference:
Objective:

- To develop the skills in measuring physical quantities and determining coefficients through optics and heat experiments.

1. Determination of wavelength and $\Delta \lambda$ using Michelson’s interferometer.
2. Determination of $q, n, \sigma$ by Hyperbolic fringes method.
4. Charge of an electron by spectrometer.
5. Determination of Stefan’s constant.
6. Lorentz number determination – Forbe’s method.
7. Ultrasonic Diffraction – Bulk modulus.

Book for reference:

UNIT – I Diagnostic Devices

UNIT - II Therapeutic Devices

UNIT - III Medical Applications of Lasers

UNIT – IV Ultrasonic Study of Liquid Mixtures and Solutions

UNIT – V Applications of Ultrasound
High Frequency – Low Intensity Applications: Level Meters – Thickness Measurements – Ultrasonic Microscopy – Acoustic Holography (Transmission Acoustic Holography)

#............# Self study portion
**Text books:**

**T.B 1** Dr. M. Arumugam, Biomedical Instrumentation, Anuradha publications, Chennai, 10th Reprint 2005.


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**Book for Reference:**


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**SEMESTER I: CORE BASED ELECTIVE – I**

**CRYSTAL GROWTH AND THIN FILMS**

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**Objectives:**

- To learn the crystal growth and characterization techniques
- To study the formation of thin film and its analysis
UNIT – I  Crystal growth Phenomena  18 hours


UNIT - II  Low Temperature Solution growth  18 hours


UNIT - III  Other Crystal growth techniques  18 hours


UNIT – IV  Methods of Thin film  18 hours


UNIT – V  Thin film Analysis  18 hours


#............# Self study portion

Text Books

T.B 1  Dr. P. SanthanaRaghavan and Dr. P. Ramasamy, Crystal Growth, KRU Publications, 1st edition.


Unit  I  Chapter  2  Sections  2.2 - 2.26  T.B 1
Unit  II  Chapter  4  Sections: 4.11 -4.21  T.B 1
Unit III  Chapter 5  Sections: 5.1 - 5.4.61  T.B 1
Unit IV  Chapter 9  Sections: 9.1 - 9.72  T.B 2
Unit V  Chapter 7 Sections: 7.17 - 7.25  T.B 2

Books for reference:


SEMESTER II: CORE – V
ADVANCED MATHEMATICAL PHYSICS

Course Code  : 14PPH2C5  Max.Marks  : 100
Hours / Week  : 6  Internal Marks  : 40
Credit  : 5  External Marks  : 60

Objectives:
➤ To learn the mathematical functions and problem practice
➤ To learn the concept of group theory
UNIT – I  Partial Differential Equations  18 hours

UNIT - II  The Beta, Gamma and special functions  18 hours

UNIT - III  Dirac-Delta function and Green’s Function  18 hours
Dirac-Delta function – Properties of Delta function – three dimensional delta function – Green’s function for one-dimensional case – Application to Boundary value problem – general proof of symmetry property of Green’s function – Green’s function for Poisson’s equation and solution of Poisson’s equation – Green’s function for quantum mechanical scattering problem.

UNIT – IV  Laplace’s Integral transform  18 hours

UNIT – V  Group theory  18 hours

#............#Self study portion

Text books

T.B 2  Satya Prakash, Mathematical Physics, Sulthan Chand and Sons, New Delhi, 3rd edition, 2001

UNIT I  Chapter 15  Sections 15.2 - 15.7  T.B 1
UNIT II Chapter 4 & 7  Sections 4.1 - 4.7 & 7.11 - 7.40  T.B 2
UNIT III Chapter 11  Sections 11.1 - 11.13  T.B 2
UNIT IV Chapter 9  Sections 9.9 - 9.24  T.B 2
UNIT V Chapter 13  Sections 13.1 - 13.21  T.B 2

Book for reference:

SEMESTER II: CORE – VI
ELECTRONICS DEVICES AND CIRCUITS

Course Code : 14PPH2C6  Max.Marks : 100
Hours / Week : 6  Internal Marks : 40
Credit : 5  External Marks : 60

Objectives:
➢ To study the fabrication of semiconductor devices
➢ To study the constructions, operations and characteristics of solid state devices
➢ To learn the circuit ideas of Op-amp and 555 timer applications.

UNIT – I  IC Fabrication and Transducers  18 hours
UNIT –II Solid State Devices 18 hours
Construction, operation and V-I characteristics of special devices: Tunnel diode – Gunn diode – MOSFET – Enhancement MOSFET – Biasing of Enhancement MOSFET.
SCR – SCR half wave rectifier – SCR Full wave rectifier – TRIAC – DIAC – UJT – UJT relaxation oscillator

UNIT - III Operational Amplifier 18 hours
Multiplier – Divider – Differentiator – Integrator – Electronic analog computation: Simulation of 2\textsuperscript{nd} order differential equation – simulation of transfer function

UNIT – IV Comparators, Waveform Generators and Filters 18 hours
RC phase shift oscillator – Wien’s bridge oscillator – Function generator – RC active filters: I order low pass, high pass and band pass filters.

UNIT – V 555 Timer and Phase – Locked Loops PLL 18 hours
PLL Basic principle – Analog phase detector – Digital phase detector – Voltage controlled oscillator – PLL applications – frequency multiplication/division – Frequency Translation

Text books
T.B 1 S Salivahanan, N Suersh Kumar & A Vallavaraj, Electronic Devices and Circuits, Tata
SEMESTER II: CORE – VII
ELECTROMAGNETIC THEORY

Course Code : 14PPH2C7
Hours / Week : 6
Credit : 5
Max. Marks : 100
Internal Marks : 40
External Marks : 60

Objectives:
➢ To understand the concepts of electro and magnetic statics
➢ To study the principles and properties of electromagnetic wave

UNIT – I Electrostatics 18 hours
**Coulomb’s Law**: Discrete and continuous charge distribution – electric potential – Gauss’s law (or \( \text{div} \vec{E} \)) – Possion’s equation and Laplace equation - Multipole expansion of charge distribution – Dielectric and its polarization – Electric displacement – Dielectric constant.

**Polarisibility(\( \alpha \))**: Electronic, Ionic, dipolar – polarization of non-polar molecules: Lorentz equation for molecular field, Clausius – Mosotti relation.

**UNIT - II Magneto statics** (18 hours)

- Definition for current density \( \vec{J} \) – Biot-Savart law (Laplace formula) – Applications: Long straight wire, circular coil – Ampere’s circuital law (Curl \( \vec{B} \)) – Applications: straight current carrying conductor – Magnetic scalar potential – magnetic vector potential – magnetic energy, derivation.

**UNIT - III Electromagnetic waves and propagation** (18 hours)

Maxwell equations – Propagation of electromagnetic wave in free space – propagation of electromagnetic wave in conducting media (Phase velocity, refractive index, spatial attenuation only) – equation of continuity – displacement current – Poynting’s theorem (derivation only)


**UNIT – IV Electromagnetic fields and radiating system** (18 hours)

Electromagnetic potential \( \vec{A} \) and \( \Phi \) – Maxwell equations in terms of electromagnetic potentials – Non-uniqueness of electromagnetic potentials and concept of gauge – Lorentz gauge – Coulomb Gauge.

Retarded potentials – Lienard-Wiechert potentials.

Oscillating electric dipole – radiation from an oscillating dipole: Vector potential, scalar potential, magnetic induction, Poynting vector and radiated power.

**UNIT – V Relativistic electrodynamics** (18 hours)

Purview of special theory of relativity - 4 vector and tensor – transformation equations for the electromagnetic potentials – transformation equation for the field vectors E and H – covariance of Maxwell equation in 4-tensor form – covariance and transformation law of Lorentz force

#.............#Self study portion

Text book
UNIT I  Chapter 1  Sections 1.1 - 1.9
UNIT II  Chapter 3  Sections 3.1 - 3.3
UNIT III  Chapter 4 - 6  Sections 4.1 - 6.8
UNIT IV  Chapter 4, 8 & 9  Sections 4.7 - 4.11, 8.1 - 9.2
UNIT V  Chapter 10  Sections 10.1 - 10.9

Books for reference:

SEMESTER II: CORE – VIII
SOLID STATE PHYSICS - PRACTICAL

Course Code : 14PPH2C8P1  Max.Marks : 50
Hours / Week : 3  Internal Marks : 20
Credit : 3  External Marks : 30

Objectives:
➢ To develop the skills in measuring physical quantities, determining coefficients for semiconducting materials.
➢ To realize the magnetic properties of materials.
1. Band gap energy – Four Probe method
2. Determination of carrier concentration and Hall coefficients in semiconductors.
3. Determination of Planck’s constant.
4. Di-electric Constant : Determination of the Curie Temperature for a Dielectric Specimen
5. Determination of magnetic susceptibility of powered sample – Guoy’s method.
6. Hysteresis loop tracer
7. B-H Curve – Determination of the energy loss of a magnetic specimen due to hysteresis using Anchor Ring and Spot Galvanometer
8. g” factor determination – ESR spectrometer

Books for reference:


SEMESTER II: CORE – VIII
ANALOG ELECTRONICS - PRACTICAL

Course Code : 14PPH2C8P2
Hours / Week : 3
Credit : 2

Max.Marks : 50
Internal Marks : 20
External Marks : 30

Objective:

➤ To develop the skills analog electronic experiments and to practice the circuit ideas.

1. Characteristics of LDR.
2. Relaxation oscillator using UJT
3. D/A converter – Binary Weighted Method
4. D/A converter – R-2R ladder Network method
5. Filters – low pass, high pass & band pass filters
6. Wien’s Bridge Oscillator
7. Verification of Richardson-Dushmann Law: Thermionic Work Function
8. Dielectric Constant using Radio Frequency Hartley Oscillator

Books for reference:

SEMESTER II: CORE BASED ELECTIVE – II
COMPUTATIONAL METHODS FOR PHYSICS

Course Code : 14PPH2CE2
Max.Marks : 100
Hours / Week : 6
Internal Marks : 40
Credit : 5
External Marks : 60

Objectives:
➢ To understand the numerical computations for algebraic, transcendental and linear simultaneous equations.
➢ To understand the concept of linear interpolation and curve fitting.
➢ To understand the numerical differentiation and integration.

UNIT –I Roots of Algebraic and Transcendental Equations 18 hours
programs for finding the roots of a simple quadratic equation and for polynomial equations by using False Position and Newton – Raphson methods

UNIT - II Numerical Solution of Linear Simultaneous Equations 18 hours
Need and scope of Simultaneous Linear Equations- Existence of Solutions- Solution by Elimination - Basic Gauss Elimination Method - Gauss Elimination with Pivoting- Applications to Electrical Networks- C Programs for implementing Basic Gauss Elimination Method and Gauss Elimination Method with pivoting

UNIT - III Curve Fitting: Interpolation and Regression 18 hours
Interpolation-Polynomial Forms -Linear interpolation – Lagrange’s interpolation Formula-Newton Interpolation Polynomial-Divided Difference Table - C programs for implementing Lagrange’s interpolation formula and Newton’s interpolation formula
Curve Fitting of Linear Equations-Linear Least Squares Regression Method- Fitting of Transcendental Equations-C-Programs for implementing these.

Unit – IV Numerical differentiation and integration 18 hours
Numerical Differentiation: Newton’s forward, central and backward difference Coeffecients- Higher Order Derivatives – Differentiating Tabulated Functions- Difference Tables
Numerical integration: the trapezoidal rule, Simpson’s 1/3 rule –C program to evaluate integrals using trapezoidal and Simpson’s 1/3 rules.

UNIT –V Numerical Solution of ODE’s: Initial and Boundary Value Problems 18 hours
Boundary value problems- Shooting Method-Conversion of Boundary Value Problems to Eigen Value Problems-Polynomial Method

#............#Self study portion

Text books
UNIT I  Chapter 4      Sections 4.1 - 4.9      T.B 1
UNIT II  Chapter 7      Sections 7.1 - 7.5      T.B 2
UNIT III  Chapter 9 & 10  Sections 9.1 - 10.3  T.B 2
UNIT IV  Chapter 11 & 12  Sections 11.1 - 12.4  T.B 2
UNIT V  Chapter 13 & 14  Sections 13.1 - 14.5  T.B 2

Book for reference:

SEMESTER II: CORE BASED ELECTIVE – II
NANOSCIENCE AND TECHNOLOGY

Course Code : 14PPH2CE2               Max.Marks : 100
Hours / Week : 6                    Internal Marks : 40
Credit : 5                         External Marks : 60

Objectives:
➢ To learn the nano technology and nano materials
➢ To study the application of nano materials in medicine
➢ To understand Evaluation techniques and Green technology

UNIT-I      Nano Technology and Nano materials      18 hours
Nanotechnology – Basics and Basis – Four generations of Nano-technology development – Thermal, optical, electrical and magnetic properties of nanomaterials- Classification of Nano materials –
Techniques of preparation – Bottom up methodology (Sol-Gel technique) – Top down methodology – Fullerenes – #Properties of fullerenes#.

UNIT - II  
**Carbon Nanotube**  
18 hours


UNIT - III  
**Nanophysics**  
18 hours


UNIT – IV  
**Nanomedicine and Nanobiology**  
18 hours


UNIT – V  
**Evaluation techniques and Green technology**  
18 hours


#.............#Self study portion

Text book

SEMESTER III: CORE – IX
ATOMIC AND MOLECULAR SPECTROSCOPY

Course Code : 14PPH3C9       Max. Marks : 100
Hours / Week : 6       Internal Marks : 40
Credit : 5       External Marks : 60

Objectives:
➢ To understand the principles of Vibrational, Rotational, Electronic, mass and Resonance Spectroscopies.
➢ To study the component of the spectrometer and to determination molecular structure.

UNIT – I   Vibrational and Rotational Spectroscopy – I       18 hours
UNIT - II  
**Vibrational and Rotational Spectroscopy – II**  
18 hours


UNIT - III  
**Electronic Spectroscopy**  
18 hours

Electronic spectroscopy of atom: Electronic wave functions - shapes and energies of atomic orbitals-orbital angular momentum-fine structure of hydrogen atom.


UNIT – IV  
**Mass Spectroscopy**  
18 hours


UNIT – V  
**Resonance Spectroscopy**  
18 hours


ESR: Basic Principles – Nuclear interaction and hyperfine structure –‘g’ characteristics - ESR Spectrometer – Applications

#............#Self study portion

**Text books**

SEMESTER III: CORE – X
QUANTUM MECHANICS

Course Code : 14PPH3C10     Max.Marks : 100
Hours / Week : 6       Internal Marks : 40
Credit : 5          External Marks : 60

Objectives:
➢ To understand the concepts and Formalism of Quantum Mechanics
➢ To practice Eigen value problems and matrix formulation
➢ To learn approximation methods to study perturbation theory
➢ To study the concepts of Angular Momentum and Spin States and Relativistic Wave Equations.

UNIT – I Concepts and Formalism of Quantum Mechanics 18 hours

Time dependent Schrödinger equation- Physical Interpretation of Wave function $\psi$:
Normalization and Probability Interpretation - Conservation of Probability: 

Equation of Continuity - Expectation Values: Ehrenfest's Theorem - Admissibility conditions on wave functions - Stationary states: Time independent Schrödinger wave equation.

UNIT - II Exactly Soluble Eigen Value Problems and Matrix Formulation 18 hours


UNIT - III Approximation Methods 18 hours

Stationary State Perturbation theory: non-degenerate and degenerate cases - Applications:

Stark Effect in the ground state and first excited state of Hydrogen atom

Variation Method: The Variational Principle – Rayleigh-Ritz Method – Ground State of Helium Atom

Time Dependent Perturbation Theory: First Order Perturbation – Harmonic Perturbations - Transition to Continuum States - Fermi’s Golden Rule

UNIT – IV Angular Momentum and Spin States 18 hours

Raising & lowering operators – Eigen values of \(J^2\) and \(J_z\) – Angular Momentum Matrices – Addition of Angular Momenta: Clebsch–Gordan coefficients – Recursion relation for C.G. coefficients – Computation of C.G. matrix for simple cases \([j_1 = \frac{1}{2}, j_2 = 1/2], (j_1 = \frac{1}{2}, j_2 = 1)\]

Spin angular momentum - spin \(\frac{1}{2}\) states - Pauli’s spin matrices and their properties - Particle Exchange Operation - symmetric and antisymmetric wave functions - Construction of symmetric and antisymmetric wave functions from unsymmetrized wave functions - Pauli’s Exclusion Principle – Wave function for a particle including spin

UNIT – V Relativistic Wave Equations 18 hours

Klein-Gordon Equation for free particle - Merits and its Demerits - Dirac’s Relativistic Equation for a free particle - Dirac’s Matrices - Covariant form of Dirac’s Equation - Probability Densities for
charge and current-Plane wave solutions of the Dirac’s Equation- Negative Energy States -Dirac’s Equation for a particle in a Central Potential– Spin of a Dirac Particle

#.............#Self study portion

Text books

UNIT I  Chapter 2   Sections 2.1 - 2.9   T.B 1
UNIT II  Chapter 2 ,4& 6  Sections 2.10, 2.11, 4.1 - 4.17 & 6.17  T.B 1
UNIT III  Chapter 5  Sections 5.1 - 5.4  T.B 1
UNIT IV  Chapter 8 & 13  Sections 8.4 - 8.9 & 13.1 - 13.3  T.B 2
UNIT V  Chapter 15  Sections 15.1 - 15.10  T.B 2

Book for reference:

SEMESTER III: CORE – XI
STATISTICAL MECHANICS

Course Code  : 14PPH3C11  Max.Marks : 100
Hours / Week  : 6  Internal Marks : 40
Credit  : 5  External Marks : 60

Objectives:
➢ To understand the classical and quantum statistics for energy distributions
➢ To study the kinetic theory of gases and principles of entropy.

UNIT – I  Classical Statistics   18 hours

UNIT - II   Kinetic theory  


UNIT - III   Entropy and Thermodynamics  


UNIT – IV   Quantum statistics  


UNIT – V   Advanced Statistical Mechanics  


#............#Self study portion

Text books


SEMESTER III: CORE – XII
DIGITAL ELECTRONICS - PRACTICAL

Course Code : 14PPH3C12P1
Max.Marks : 50

Hours / Week : 3
Internal Marks : 20
Credit : 3
External Marks : 30

Objectives:
➢ To realize the digital circuits
➢ To practice the circuit constructions

1. IC Regulated Dual Power Supply
2. Verification of De Morgan’s theorem and simplification of Boolean expressions using K-Map.
3. Adders and Subtractors using Logic Gates.
   [0 – 9 counter using IC 7490, 7 segment display using decoder driver 7447 ]
6. Shift register
7. Comparators (1-bit and 2-bit)
8. Multiplexer and Demultiplexer.

Books for reference:

2. C.C. Ouseph, U.J. Rao & V. Vijayendran, Practical physics and electronics,

SEMESTER III: CORE – XII
NUMERICAL PROGRAMMING IN PHYSICS - PRACTICAL

Course Code : 14PPH3C12P2
Hours / Week : 3
Credit : 2
Max. Marks : 50
Internal Marks : 20
External Marks : 30

Objective:

➢ To practice the numerical computation for solving scientific application problems using ‘C’ programs.

1. False position method: Roots of a Quadratic equation
4. Linear Least Squares Fitting: Determination of the charge of an electron.
5. Eigen Values and Eigen vectors of a matrix
6. Determinant of a matrix
7. Evaluation of statistical parameters: Mean deviation, Standard deviation
8. Random number generation – Determination of the value of pi

Books for reference:


SEMESTER III: CORE BASED ELECTIVE– III
SPECIAL ELECTRONICS

Course Code : 14PPH3CE3
Max.Marks : 100
Hours / Week : 6
Internal Marks : 40
Credit : 5
External Marks : 60

Objectives:

➢ To understand the hardware components and software programming instructions of INTEL 8085, 8086 microprocessors and 8051 microcontroller.
➢ To understand the concept of interfacing and peripheral devices.

UNIT – I Intel 8085 Microprocessor: Architecture, Instructions and Programming   18 hours

Intel 8085 - Architecture – Pin diagram – #Instruction word size# – Instruction Cycle – Fetch and Execute operations - Timing diagram – Op-code Fetch – Memory read and write – I/O read and write.Instruction set – Addressing modes – Intel 8085 instructions – Assembly language program for
addition, subtraction, Multiplication and division–sum of a series of 8-bit numbers – Arrange an array of data in ascending and descending order – block transfer.

**UNIT - II Interfacing and Peripheral Devices 18 hours**

Address space partitioning – Memory and I/O Interfacing – Data Transfer schemes – DMA Data Transfer schemes – Synchronous data transfer - Asynchronous data transfer – #Interrupt driven data transfer# – Interrupts of Intel 8085. Programmable Peripheral Interface (8255A) – Programmable Interrupt Controller(8259) – Programmable DMA controller(8257) – Functional block diagram and modes of operation.

**UNIT - III Intel 8086 Microprocessor 18 hours**


**Programs:** Addition, Subtraction & Factorial.

**UNIT – IV 8051 Microcontroller 18 hours**


**UNIT – V Assembly Language Instruction and Programming 18 hours**


#.............#Self study portion

**Text books**


SEMMESTER III: CORE BASED ELECTIVE– III
ELECTRONIC INSTRUMENTATION

Course Code : 14PPH3CE3
Hours / Week : 6
Credit : 5
Max.Marks : 100
Internal Marks : 40
External Marks : 60

Objectives:

➢ To understand the principles and operations of analog and digital instruments
➢ To study Signal Generators and Waveform analysis
➢ To learn the principle of transducers and their classifications

UNIT – I Analog Instruments 18 hours

AC Instruments: AC Voltmeter using half-wave rectifier – Multirange AC voltmeter – Transistor voltmeter (TVM) – Electronic voltmeter (Solid State m/V)

UNIT - II Digital Instruments 18 hours


Digital measurements: Digital frequency meter – Digital measurement of time – Universal counter (Timer).

UNIT - III Signal Generators 18 hours

Basic Signal generators: Standard signal generator – Modern laboratory signal generator – AF sine and square wave generators.

Special signal generators: Function generator – Pulse and square generator – sweep generators – pattern generator.

UNIT – IV Waveform analysis 18 hours


UNIT – V Transducers 18 hours

Classification of transducers – Potentiometer – unbounded strain gage – Bonded strain gage foil type strain gage – Linear variable differential transducer (LVDT) – Rotational variable differential transducer (RVDT)

Self study portion

Text book:

UNIT I Chapter 2 Sections 2.4 – 2.41
UNIT II Chapter 3 Sections 3.3 – 3.27
UNIT III Chapter 5 Sections 5.3 – 5.22
UNIT IV Chapter 6 Sections 6.3 – 6.18
UNIT V Chapter 8 Sections 8.42 – 8.51
SEMESTER III: EXTRA CREDIT – 1
NONLINEAR ELECTRONICS

Course Code : 14PPH3EC1       Max.Marks : 100
Hours / Week:  --               Internal Marks:   --
Credit       : 5                 External Marks: 100

Objectives:

➢ To understand the concept of nonlinearity its mathematical implications in oscillators.
➢ To study the characterisation of nonlinear oscillations
➢ To understand the concepts of Chaos in nonlinear electronics circuits

UNIT- I: Linear and Nonlinear Oscillators

Nonlinearity - Mathematical Implications of Nonlinearity-Linear Superposition Principle-
Effects of Nonlinearity-Linear Oscillators and Predictability: Free Oscillations, Damped Oscillations,
Damped and Forced Oscillations-Nonlinear Oscillators and Bifurcations: Free Oscillations, Damped Oscillations, Forced Oscillations: Primary Resonance and Jump Phenomenon (Hysteresis), Secondary Resonances (Subharmonic and Superharmonic), Bifurcations.

UNIT- II: Qualitative Features of Dynamical Systems


UNIT- III: Bifurcations and Onset of Chaos in Dissipative Systems


UNIT- IV: Chaos in Dissipative Nonlinear Oscillators and Criteria for Chaos


UNIT- V: Chaos in Nonlinear Electronic Circuits

Realization, Stability Analysis, Explicit Analytical Solutions, Experimental and Numerical Studies - Analog Circuit Simulation of a Duffing Oscillator- Nonlinear Circuits as Dynamical Systems.

Text book:

UNIT I Chapter 1 & 2 Sections 1.1 – 2.3
UNIT II & III Chapter 3 & 4 Sections 3.1 – 4.4.4
UNIT IV Chapter 5 Sections 5.1 – 5.4.1
UNIT V Chapter 6 Sections 6.1 – 6.5

Book for reference:

SEMESTER IV: CORE – XIII
SOLID STATE PHYSICS

Course Code : 14PPH4C13 Max. Marks : 100
Hours / Week : 6 Internal Marks : 40
Credit : 5 External Marks : 60

Objectives:
➢ To study the structure of crystalline solids
➢ To study the carrier movement, lattice vibration and thermal property in solids
➢ To understand the concepts of Free Electron and Band Theory of Solids
➢ To study the dielectric and super conductivity materials

UNIT-I Crystal Physics 18 hours
Crystals-Crystal lattice and translation vectors - Types of lattices (2D & 3D)- Point group - Space

**UNIT-II  Semiconductors, Lattice Vibrations and Thermal Property  18 hours**
Intrinsic and Extrinsic semiconductors-General study of carrier movement- Fermi level and conductivity –Lattice vibrations-One dimensional Monotomic lattice-One dimensional diatomic lattice- Phonons- Phonon momentum- Lattice heat capacity- Classical theory (Dulong and Petit Law) - Einstein theory- Debye’s model-Density modes.

**UNIT-III   Free Electron Theory and Band Theory of Solids  18 hours**

**UNIT-IV   Dielectrics and Magnetism in Solids  18 hours**
Polarization and Susceptibility – Local field-Dielectric constant and Polarizability (Clausius-Mosotti Equation) - Sources of Polarizability - Ferro electricity - Piezo electricity.

**UNIT-V   Superconductivity  18 hours**

#............#Self study portion

Text book:

UNIT I    Chapter 4
UNIT II    Chapter 5,7 &10
UNIT III   Chapter 6
UNIT IV    Chapter 9
Books for reference:

SEMESTER IV: CORE – XIV
MICROPROCESSOR AND MICROCONTROLLER - PRACTICAL

Course Code : 14PPH4C14P1
Hours / Week : 3
Credit : 3
Max. Marks : 50
Internal Marks : 20
External Marks : 30

Objective:
➢ To practice Intel 8085 and Intel 8051 assembly language programs with interfacing circuits

Microprocessor Experiments using Intel 8085
1. Conversion from Decimal to Hexadecimal and vice versa.
2. Interfacing ADC
3. Wave form generation using DAC 0800
4. Interfacing Hex key board

Microcontroller Experiments using Intel 8051
1. Basic Arithmetic Operations
2. Interfacing seven segment display
3. Stepper Motor control
4. Traffic light control

**Book for reference:**


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**SEMESTER IV: CORE – XIV**  
**NUMERICAL SIMULATIONS IN PHYSICS - PRACTICAL**

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**Objective:**

- To practice numerical simulations of Physics principles by scientific programming using C language.

1. Plotting of Linear Harmonic Oscillator wave functions.
3. Lagrange’s Interpolation: Determination of nuclear energies.
4. Simulation of Brownian motion
5. Simulation of Radioactive decay.
7. Simpson’s Rule: Motion of a body in a central potential.
Books for reference:


SEMESTER IV: EXTRA CREDIT – II
NON – CONVENTIONAL ENERGY SOURCES

Course Code : 14PPH4EC2
Max.Marks : 100
Hours / Week : --
Internal Marks: --
Credit : 5
External Marks: 100

Objective:

➢ To understand the concepts of nonconventional energies resources and their applications

UNIT - I Solar Energy

UNIT - II Wind Energy & Biomass
Fuel properties of Bio-gas – Advantages and disadvantages.

UNIT - III  Geothermal & Ocean Energies
Introduction – Geothermal sources – Hydrothermal resources – Hot dry Rock resources – Magma resources – Applications of geothermal energy.
OTEC – Open cycle OTEC system – Heat exchangers – Basic principle of Tidal power – merits and demerits of wave energy.

UNIT – IV  Chemical Energy Sources

UNIT – V  Hydrogen and Nuclear energy source
Nuclear fission, fusion – Basic Nuclear fusion reaction – Thermo nuclear function reactors.

Text book:

UNIT I   Chapter 3, 5, 6, 7, 16
UNIT II & III  Chapter 18
UNIT IV     Chapter 9
UNIT V     Chapter 16

Books for reference :