# Government Arts and Science College
## Ratlam (M. P.) 457001

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For the session 2021-22 the syllabus applied respectively in UG I is adopted from Central Board of Studies Bhopal designed according to NEP2020. For UG II and III and PG the syllabus of the previous session have been followed.

Principal

Govt. Arts and Science College

Ratlam (M.P.)

Principal
Govt. Arts & Science College
Ratlam (M.P.)

# VIKRAM UNIVERSITY, UJJAIN

## Faculty of Science

### M. Sc. (Physics) I Semester

Scheme of Examination and Courses of
Studies Including Recommended Books
for the Examination of year

## 2015-16 and onwards

**EXAMINATION IN THE FACULTY OF SCIENCE**

**MASTER OF SCIENCE**

**SCHEME AND COURSE**

# PHYSICS

## M. Sc. Examination

### M. Sc. I Semester Examination

**Theory:**

| | | |
|---|---|---|
| Paper I (101): | Mathematical Physics | 50 Marks (40+10 CCE) |
| Paper II (102): | Statistical Mechanics | 50 Marks (40+10 CCE) |
| Paper III (103): | Quantum Mechanics – I | 50 Marks (40+10 CCE) |
| Paper IV (104): | Electrodynamics and Plasma Physics | 50 Marks (40+10 CCE) |

**Practical:**

| | |
|---|---|
| Electrical Lab | 100 Marks |

## M. Sc. I Semester

## Paper I – 101 [Mathematical Physics]

**UNIT-I:**

**Vector Spaces and Matrices**: Vector Spaces; Base, Dimension, Inner product space, Linear transformations, Matrices; Inverse, Orthogonal and Unitary matrices, Independent elements of a matrix, Eigen values and eigenvectors, Diagonalisation of a matrix, Complete Orthogonal sets of functions.

**UNIT-II:**

**Differential Equations and Special Functions**: Second order linear Ordinary Differential Equations with variable coefficients; Solution by series expansion; Legendre, Bessel, Hermite and Lagurre equations; Generating functions; Recursion relations, Physical Applications: Solving one dimensional harmonic oscillator; Schrödinger equation and Hydrogen atom, Schrödinger equation with Lagurre equation.

**UNIT-III:**

**Integral Transforms**: Integral transform; Laplace transform; Inverse LT by partial fractions; Solution of initial value problems by LT.

**UNIT-IV:**

**Fourier Series and Fourier Transform**: Fourier series; FS of arbitrary period; Half-wave expansions; Partial sums; Fourier integral and transforms; FT of delta function; Solution of time dependent problems by FT.

**Text and Reference Books**


1. G. Arfken: Mathematical Methods for Physics (Academic Press, INC. (London) Ltd.)
2. A. W. Joshi: Matrices and Tensors in Physics (Wiley Eastern Ltd, New Delhi)
3. E. Kreyszig: Advanced Engineering Mathematics (Wiley Eastern Ltd, New Delhi)
4. E. D. Rainville: Special Functions (The Macmillan Company, NewYork)
5. W. W. Bell: Special Functions (Dover Publication Inc.)
6. K.F. Reily, M.P. Hobson and S.J. Bence: Mathematical Methods for Physicists and Engineers (Cambridge University Press)
7. Mary L Boas: Mathematics for Physicists (John Wiley & Sons)

## M. Sc. I Semester

## Paper II – 102 [Statistical Mechanics]

**UNIT-I:**

Foundations of Statistical Mechanics; Specification of states of a system, Statistical interpretation of the basic thermodynamic variables, Classical ideal gas, Entropy of mixing and Gibb's paradox.

**UNIT-II:**

Microcanonical ensembles, Phase space, Trajectories and density of states, Liouville's theorem, Canonical and Grand canonical ensembles, Partition function, Calculation of statistical quantities: Energy and Density fluctuations.

**UNIT-III:**

Density matrix, Statistics of ensembles, Statistics of indistinguishable particles; Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics, Properties of ideal Bose and Fermi gases, Bose-Einstein condensation.

**UNIT-IV:**

Correlation of space-time dependent fluctuations, Fluctuations and transport phenomena; Brownian motion; Langevin theory, Fluctuation dissipation theorem, The Fokker-Plank equation.

**Text and Reference Books**


1. F. Reif: Fundamentals of Statistical and Thermal Physics (Mcgraw-Hill Series)
2. K. Huang: Statistical Mechanics (Wiley eastern Ltd.)
3. R. K. Patharia: Statistical Mechanics (Pergamon Press)
4. R. Kubo: Statistical Mechanics (North-Holland Publishing Company, Amsterdam Landon)
5. Landau and Lifshitz: Statistical Physics (Pergamon Press, Oxford)
6. B.B. Laud: Fundamentals of Statistical Mechanics (New Age International Publisher)

## M. Sc. I Semester

## Paper III – 103 [Quantum Mechanics-I]

**Unit-I:**

Inadequacy of classical mechanics, Schrödinger equation, Continuity equation, Ehrenfest theorem, Admissible wave function, Stationary states.

One-dimensional problems, Wells and barriers, Harmonic oscillator by Schrödinger and by operator method.

**Unit-II:**

Uncertainty relation of x and p, States with uncertainty product, General formalism of wave mechanics, Commutation relations, Representation of states and dynamical variables, Completeness of eigen functions, Dirac-delta function, Bra and Ket notation, Matrix representation of an operator, Unitary transformation.

**Unit-III:**

Angular momentum in QM, Central force problem, solution of Schrödinger equation for spherically symmetric potentials, Hydrogen atom.

**Unit-IV:**

Time independent or stationary perturbation theory; Non-degenerate case; Application such as Stark effect.

**Text and reference books**


1. L I Schiff: Quantum Mechanics (Mcgaw-Hill Book Company)
2. S Gasiorowicz: Quantum Physics (Wiley, New York)
3. J D Powell and B Craseman: Quantum Mechanics (Addison Wesley Publishing Company)
4. A P Messiah: Quantum Mechanics (North - Holland)
5. J J Sakurai: Modern Quantum Mechanics (Pearson Education, INC.)
6. Mathews and Venkatesan: A text book of Quantum Mechanics (Tata McGraw-Hill Publishing Company Ltd.)
7. A Ghatak & S Loknathan: Quantum Mechanics; Theory and Applications (Macmillan India Ltd.)

## M. Sc. I Semester

## Paper IV – 104 [Electrodynamics and Plasma Physics]

**Unit-I:**

(i) Review of four-vector and Lorentz transformations in four-dimensional space; Covariance form and transformation equations for Lorentz condition, electromagnetic potentials, Lorentz force law, Continuity equation, electric and magnetic field equations and Maxwell's field equations.

(ii) Wave equation for vector and scalar potential and solution, Retarded potential and Leinard-Wiechert Potential, Electric and magnetic fields due to a uniformly moving charge.

**Unit-II:**

(i) Reaction force of radiation; Abraham-Lorentz equation of motion.

(ii) Motion of charged particles in electromagnetic field: Uniform E and B fields, Time varying E and B fields.

**Unit-III:**

(i) Elementary concept: Plasma oscillations, Debye shielding, Plasma parameters.

(ii) Hydrodynamical description of plasma: Fundamental equations, Hydromagnetic waves: Magneto sonic and Alfven waves.

**Unit-IV:**

(i) Wave phenomena in magneto plasma: Polarization, Phase velocity, Group velocity, Cut-offs and Resonance for electromagnetic waves propagating parallel and perpendicular to the magnetic field.

(ii) Propagation through ionosphere and magnetosphere.

**Text and reference books**


1. Panofsky and Philips: Classical electricity and magnetism (Addison – Wesley Publishing Company)
2. J D Jackson: Classical electrodynamics ( Berkley, California, 1974)
3. J A Bittencourt: Fundamentals of Plasma Physics (Springer, III Edition)
4. F F Chen: Introduction to Plasma Physics (Plenum Press, III Print)

# VIKRAM UNIVERSITY, UJJAIN

## Faculty of Science

### M. Sc. (Physics) II Semester

Scheme of Examination and Courses of

Studies Including Recommended Books

for the Examination of year

## 2015-16 and onwards

## M. Sc. II Semester Examination

**Theory:**

| | | |
|---|---|---|
| Paper I (201): | Atomic and Molecular Physics | 50 Marks (40+10 CCE) |
| Paper II (202): | Classical Mechanics | 50 Marks (40+10 CCE) |
| Paper III (203): | Quantum Mechanics – II | 50 Marks (40+10 CCE) |
| Paper IV (204): | Electronic Devices | 50 Marks (40+10 CCE) |

**Practical:**

| | |
|---|---|
| Non-Electrical Lab | 100 Marks |

## M. Sc. II Semester

## Paper I - 201 [Atomic and Molecular Physics]

**Unit 1**

**Raman Spectroscopy:** Introduction: Characteristic properties of Raman Lines; Difference between Raman and Infrared Spectra; Mechanism of Raman Effect: Classical theory of Raman Effect, (a) Effect of vibrations, (b) Effect of Rotation; Quantum theory of Raman Effect, Pure Rotational Raman Spectra, Polarization of light and Raman Effect, Structure determination form Raman and Infrared Spectroscopy, Instrumentation of Raman Spectroscopy.

**Unit II**

**Electronic Spectroscopy:** Electronic Spectra of Diatomic Molecules, The Born-Oppenheimer Approximation, Vibrational Coarse Structure, Frank-Condon Principle, Dissociation energy and Dissociation Products, Rotational Fine Structure of Electronic-Vibration Transitions, Fortrat Diagram, Predissociation, Applications of Electronic Spectra to Transition Metal Complexes.

**Unit III**

**Nuclear Magnetic Spectroscopy:** Nuclear Magnetic Resonance, Quantum Description of Nuclear Magnetic Resonance, Instrumentation, Chemical Shift, Spin-Spin Coupling, Applications of NMR Spectroscopy, Limitations of NMR Spectroscopy.

**Unit IV**

**Electron Spin Resonance Spectroscopy:** Electron Spin Resonance, Types of Substances, Comparison between NMR and ESR, Instrumentation, Presentation of ESR spectrum, Hyperfine Splitting, Determination of g value, Line width, Applications of ESR Spectroscopy.

**Text and References books**


1. Gurdeep Chatwal and Sham Anand, *Spectroscopy* (Atomic and Molecular) (Himalaya Publishers)
2. C. N. Banwell, Fundamentals of Molecular Spectroscopy. (Tata Mcgraw-Hill Publishers Company Ltd.)
3. Gerhard Herzberg, Infrared and Raman Spectra (D. Vannostrand Company, New York)

## M. Sc. II Semester

## Paper II – 202 [Classical Mechanics]

**UNIT-I:**

Constraints and their classifications, D'Alembert's principle, Generalized coordinates; Lagrange's equations, Gauge invariance, Generalized coordinates and momenta; Integrals of motion; Symmetries of space and time with conservation laws.

**UNIT-II:**

Rotating frames; Inertial forces; Terrestrial and astronomical applications of Coriolis force, Central force; Definition and characteristics, Two-body problem; Kepler's laws and equations, Artificial satellites; Rutherford scattering.

**UNIT-III:**

Principle of least action; Derivation of equation of motion; Variation and end points; Hamilton's principle and characteristic functions; Hamilton-Jacobi equation.

**UNIT-IV:**

Canonical transformation; Generating functions; Poisson brackets and their Properties, Poisson theorems; Small oscillations; Normal modes and coordinates.

**Text and Reference Books**


1. N. C. Rana and P. S. Joag: Classical Mechanics (Mcgraw-Hill Education (India) (P) Ltd.)
2. H. Goldstein: Classical Mechanics (Narosa Publishing House, New Delhi)
3. A. Sommerfeld: Mechanics ( Lectures on theoretical Physics Vol.1, Acadmic Press)
4. I. Peroceival and D. Richards: Introduction to Dynamics (Cambridge University Press)
5. J. C. Upadhyaya: Classical Mechanics (Ramprasad and Sons)

## M. Sc. II Semester

## Paper III – 203 [Quantum Mechanics-II]

**Unit-I:**

Variation method, Ground state of helium, Vander wall's interaction, Polarizability of hydrogen, Exchange degeneracy.

**Unit-II:**

Time-dependent perturbation theory, WKB method, $\alpha$-decay of radioactive nucleus, Penetration of barrier, Adiabatic approximation, Sudden approximation.

**Unit-III:**

Identical particles; Symmetric and anti-symmetric wave functions, Collision of identical particles, Spin angular momentum, Spin functions for a many-electron system.

**Unit-IV:**

Semi classical theory of radiation; Transition probability for absorption and induced emission, Electric dipole and forbidden transitions; Selection rules.

**Text and reference books**


1. L I Schiff: Quantum Mechanics, (Mcgraw-Hill Education (India) (P) Ltd.)
2. S Gasiorowicz: Quantum Physics
3. B Craseman and JD Powell: Quantum Mechanics, (Addison – Wesley Publishing Company)
4. A P Messiah: Quantum Mechanics, (North - Holland)
5. J J Sakurai: Modern Quantum Mechanics, (Pearson Education, Singapore)
6. Mathews and Venkatesan: Quantum Mechanics, (Tata Mcgraw-Hill Publishers Company Ltd.)

## M. Sc. II Semester

## Paper IV – 204 [Electronic Devices]

**Unit-I:**

**(i)Transistors:** JFET, BJT, MOSFET and MESFET: Structure, working, derivations of equations for I-V characteristics under different conditions, High frequency limits.

**(ii) Microwave devices:** Tunnel diode, Transfer electron devices (Gunn diode), Avalanche transit time devices, Impatt diodes and parametric devices.

**Unit-II:**

**(i) Memory devices:** Static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, NON-volatile-NMOS, Magnetic, Optical and Ferroelectrics memories, Charge coupled devices (CCD).

**(ii)** Transistor as a switch, OR, AND and NOT gates; NOR and NAND gates, Boolean algebra, Demorgan's theorem; Exclusive OR gates; Decoder/Demultiplexer data selector/multiplexer; Encoder.

**Unit-III:**

**Oscillators:** The phase shift oscillator, Wein bridge oscillator, LC-tunable oscillators, Multivibrator; Monostable and Astable, Comparators, Square wave and triangle wave generators.

**Unit-IV:**

**Voltage regulators;** Fixed voltage regulators, Adjustable voltage regulators, Switching regulators.

**Text and reference books**


1. S M Sze: Semiconductor devices, (John Wiley & Sons)
2. M S Tyagi: Introduction to semiconductor materials and devices, (John Wiley & Sons)
3. M Sayer and A Mansingh: Measurement, instrumentation and experimental design in physics and engineering, (Prentice Hall of India, New Delhi)
4. Ajoy Ghatak and K Thyagarajan: Optical electronics, (Cambridge University Press)
5. J Millmann and C C Halkias: Integrated electronic: Analog and digital circuits and systems, (Tata Mcgraw-Hill Education, New Delhi)
6. G K Mithal: Electronic devices and circuits, (Khanna Publishers)

# VIKRAM UNIVERSITY, UJJAIN

## Faculty of Science

### M. Sc. (Physics) III Semester

Scheme of Examination and Courses of Studies

Including Recommended Books

for the Examination of year

## 2016-17 and Onwards

# EXAMINATION IN THE FACULTY OF SCIENCE

# MASTER OF SCIENCE

# SCHEME AND COURSE

# PHYSICS

## M. Sc. Examination

## M. Sc. III Semester Examination

**Theory:**

| | | |
|---|---|---|
| Paper I (301): | Condensed Matter Physics-I | 50 Marks (40+10 CCE) |
| Paper II (302): | Nuclear and Particle Physics- I | 50 Marks (40+10 CCE) |
| Paper III (303): | Advanced Quantum Mechanics –I | 50 Marks (40+10 CCE) |
| Paper IV (304): | Advanced Electronics (Digital Electronics) | 50 Marks (40+10 CCE) |

**Practical:**

General 100 Marks

## M. Sc. III Semester

## Paper I – 301 [Condensed Matter Physics-I]

**Unit-I:**

(1) Crystal structure and reciprocal lattice; Crystal structure and Bravais lattice, Primitive unit cell, Wigner Seitz cell, Reciprocal lattice, Brillouin zone.

(2) X-ray diffraction: Bragg formulation, Van Laue formulation of X-ray diffraction, Ewald construction, Laue method, Debye-Scherrer method.

**Unit-II:**

Lattice vibration, Normal modes of a one-dimensional mono-atomic lattice, Normal modes of one-dimensional diatomic lattice, Two ions per cell, The acoustic and optical modes of vibrations, Connection with the theory of elasticity.

**Unit-III:**

Band theory-I: Periodic potential and Bloch's theorem, Proof of Bloch theorem, Born-Von-Karman boundary condition, Fermi surface, Density of levels, Schrödinger equation in a weak periodic potential (nearly free electron), Energy bands in one dimension, Construction of Fermi surface.

**Unit-IV:**

Band theory-II: Tight binding method, Cellular method, Muffin-Tin potential, Augmented Plane wave (APW) method, Orthogonalised plane wave (OPW) method, de Haas-Van-Alphen effect.

***Text and References Books***:


1. Solid State Physics: N. W. Ashcroft and N. D. Mermin (Harcourt Asia PTE Ltd.)
2. Introduction to Solid State Physics: C. Kittel (John Wiley and Sons, II and III Ed.)
3. Intermediate Quantum theory of Crystalline Solids: A. E. Animalu (Prentice Hall of India Pvt. Ltd.)
4. Principles of Condensed Matter Physics: Chaikin and Lubensky (Cambridge University Press)

## M. Sc. III Semester

## Paper II – 302 [Nuclear and Particle -I]

**Unit-I: Nuclear Decay**

(1) Beta decay: Introduction, shape of beta ray spectrum, the neutrino hypothesis, Fermi theory of beta decay, Kurie plot, Comparative half-life, Selection rule, Violation of parity, Conservation in beta decay.

(2) Gamma ray emission: Electric and magnetic multiple radiation, Selection rules.

**Unit II: Nuclear reactions**

Kinds of nuclear reactions, nuclear reaction kinematics, Compound nucleus and direct reactions, Cross section of nuclear reaction, Thermonuclear reactions, Controlled thermonuclear reactions on the earth.

**Unit III: Nuclear models**

Shell model, Square well potential, Harmonic oscillator potential well, Spin orbit potential, unified (collective) model, Nuclear rotational motion for even-even nuclei, collective oscillations.

**Unit IV: Two-Nucleon Problem**

Two-nucleon problem: Introduction, ground state of deuteron, excited state of deuteron, neutron-proton scattering at low energies, scattering length.

***Text and Reference books:***


1. Introductory Nuclear Physics- Y. R. Waghmare (Oxford and IBH Oub)
2. Nuclear Physics- R. R. Roy and B. P. Nigam (New Age Int. (P) Ltd. Publishers)
3. Nuclear Physics- Rajkumar (Campus Book International)
4. Elementary Nuclear Physics: D. C. Tayal ( Himalaya Publishing House )
5. Concepts in Nuclear Physics: B. L. Cohen (McGraw-Hill Book Company)

## M. Sc. III Semester

## Paper III – 303 [Advanced Quantum Mechanics -I]

**Unit-I: Angular Momentum**

Angular Momentum: Time displacement symmetry and conservation of energy, Angular momentum and rotation, Rotational Symmetry and conservation of angular momentum, Degeneracy, Reflection invariance and parity, Eigen values of angular momentum operators, Angular momentum matrices, Pauli's spin matrices.

Addition of angular momentum, The possible values of J-Clebsh-Gordan coefficients for $j_1 = j_2 = 1/2$ *and* $j_1 = 1,\ j_2 = 1/2$.

**Unit-II: Bose, Fermi and Particle and Parastatistics**

Identical particles in quantum mechanics and permutation symmetry, Symmetrization postulate, Algebraic approach to Bose and Fermi statistics, Parastatistics, Quantization and spin statistics connection.

**Unit-III: Radiation Theory**

The quantum theory of radiation, The Hamiltonian quantization of the radiation field (second quantization), Creation and Annihilation operator.

**Unit-IV: Relativistic Theory**

The Klein-Gordon equation, The Dirac equation, Probability and Current densities, Covariance of Dirac equation, Plane wave solutions. The electron in electric and magnetic field. Dirac equation in central potential, Energy levels of hydrogen atom, The hole theory and positrons, Prediction of the spin angular momentum.

***Text and Reference Books:***


1. A.K. Ghatak and S. Loknathan: Quantum Mechanics; Theory and Applications (Macmillan India Ltd.)
2. S. N. Biswas: Quantum Mechanics (Books & Allied (P) Ltd.)
3. Messiah: Quantum Mechanics (Dover Publications)

## M. Sc. III Semester

## Paper IV – 304 [Advanced Electronics (Digital Electronics)]

**Unit-I: Operational Amplifiers and Gates**

OP-Amp: Operational amplifier, Inverting and non-inverting amplifier, Difference amplifier, Analog Integration and differentiation.

Gates: Binary, Decimal, Hexadecimal numbers, BCD, ASCII codes, Inverter, Diode OR and AND gates, Boolean algebra, De-Morgen's Theorems, NOR, NAND, ex-OR and ex-NOR gates, Controlled inverter.

**Unit-II: TTL circuits and Karnaugh Maps**

TTL circuits: 7400 devices, TTL characteristics, TTL overview, Encoders and Decoders, AND-OR-INVERT gates, Multiplexer, Karnaugh maps and Karnaugh simplification.

**Unit-III: Digital Electronics and system**

Arithmetic logic unit: Half adder, Binary adder, 2's compliment, 2's compliment adder and substructer.

Flip-Flops: RS-latches, Level clocking, D-latches and flip-flops, JK master slave flip-flops.

**Unit-IV: Registers and Memories**

Registers and counters: Buffer registers, Shift register, Ripple counters, Synchronous counters, Ring counters, other counters and Bus-organized computer.

Memories: ROMS, PROMS, EPROMS, RAMS, A small TTL memory, Hexadecimal addresses.

***Text and Reference Books:***


1. Digital Principles and Application: A. P. Melvino & D. P. Leech (Tata McGraw-Hill Eduction (P) Ltd.)
2. Op-Amps & Linear Integrated circuits: R. A. Gayakwad (Prentice Hall, 2000)
3. Electronics: D. S. Mathur (S. Chand Publishing)
4. Digital Communications: W. Tomasi (Prentice Hall)
5. Digital Computer Electronics: A. P. Malvino and Brown (Tata McGraw-Hill Eduction (P) Ltd.)

# VIKRAM UNIVERSITY, UJJAIN

## Faculty of Science

### M. Sc. (Physics) IV Semester

Scheme of Examination and Courses of
Studies Including Recommended Books
for the Examination of year

## 2016-17 and onwards

## M. Sc. IV Semester Examination

**Theory:**

| | | |
|---|---|---|
| Paper I (401): | Condensed Matter Physics-II | 50 Marks (40+10 CCE) |
| Paper II (402): | Nuclear and Particle Physics- II | 50 Marks (40+10 CCE) |
| Paper III (403): | Advanced Quantum Mechanics – II | 50 Marks (40+10 CCE) |
| Paper IV (404): | Microprocessor | 50 Marks (40+10 CCE) |
| | Internal Project | 50 Marks |

**Practical:**

| | |
|---|---|
| Electronics | 100 Marks |

## M. Sc. IV Semester

## Paper I – 401 [Condensed Matter Physics-II]

**Unit-I:**

**(1) Electron dynamics:** The semi-classical model; Motion in a DC electric field, the holes, Motion in a uniform magnetic field, Motion in perpendicular uniform electric and magnetic fields, Hall effect and magneto-resistance

**(2) The semi-classical theory of conduction in metals:** The relaxation time approximation, DC electric conductivity, AC electric conductivity, Thermal conductivity.

**Unit-II:**

**Defects in Solid:** Number of vacancies and interstitial as a function of temperature, Diffusion: Self-diffusion and chemical diffusion, Fick's law, Edge and screw dislocation, Slip, Burger vector, Dislocation mobility and density, Interaction between dislocations, Color center, Excitons, Elementary idea about luminescence.

**Unit-III:**

**Semiconductors:** Typical semiconductor band structures, effective mass in semiconductors, Cyclotron resonance, Number of carriers in thermal equilibrium: Intrinsic and extrinsic cases, Population of impurity levels in thermal equilibrium; Thermal equilibrium carrier density of impure semiconductors, p-n junction in equilibrium.

**Unit-IV:**

**Superconductivity:** Experimental surveys, Meissner effect, Heat capacity, Energy gap, Microwaves and infrared properties. Thermodynamics of superconducting transition, London equation, Qualitative idea of BCS theory, Type-I and Type-II superconductors, Super conducting devices, isotope effect, Flux quantization, Single particle tunneling, Josephson tunneling, High $T_c$ superconductors.

***Text and References Books:***


1. Solid State Physics: Neil W. Ashcroft and N. David Mermin (Harcourt ollege Publishers)
2. Solid State Physics: C. Kittel (John Wiley and Sons, VII Ed.)
3. Intermediate Solid State Physics: AE Animalu (Prentice Hall of India Pvt. Ltd.)
4. Principle of Condensed matter Physics: Chaikin and Lubensky

## M. Sc. IV Semester

## Paper II – 402 [Nuclear and Particle Physics -II]

**Unit I:**

Mechanism of scintillations in inorganic and organic scintillators, Photo multiplier tubes, semiconductor detectors, p-n junction detector, Lithium drifted Ge-detector, high purity Ge-detectors, Gamma ray interactions, NaI (Tl) scintillation spectrometer.

**Unit II:**

**Detector electronics and pulse processing:** pulse counting systems, pulse height analysis, pulse timing, pulse shape, pulse shape discrimination.

**Unit III:**

**Elementary Particles:** Classifications, gravitational, electromagnetic, strong and weak interactions, conservation laws, charge, iso-spin, baryon number, strangeness, parity, charge conjugation, CPT theorem, CP violation and neutral K-decay.

**Unit IV:**

**Elementary Particles symmetry:** SU (2) and SU (3) and their application to multiple mesons and baryon states, elementary idea of Quark theory.

***Text and Reference Books:***


1. Introductory Nuclear Physics- Y. R. Wagmare (Oxford and IBH Oub)
2. Nuclear Physics- R. R. Roy and B. P. Nigam (New Age Int. (P) Ltd. Publishers)
3. Nuclear Physics- Rajkumar (Campus Book International)
4. Elementary Nuclear Physics- D. C. Tayal ( Himalaya Publishing House )
5. Nuclear Radiation Detectors- S. S. Kapoor and V. S. Ramamurthy

## M. Sc. IV Semester

## Paper III – 403 [Advanced Quantum Mechanics -II]

**Unit-I: Scattering Theory**

Differential scattering cross section, Total scattering cross section, Relationship between the scattering cross section to the wave function, The scattering amplitude, Method of partial waves, Expansion of plane wave in terms of partial waves, Scattering by a central potential, The scattering length, Scattering by a square well potential, Resonance scattering.

**Unit-II:**

The Born approximation, Criterion for the validity of the Born approximation, Scattering of electrons to atoms.

**Unit-III: Elements of Field Quantization**

Quantization of the field, Non-relativistic fields, System of Bosons, System of Fermions, Commutators and anti-commutators, unequal times

**Unit-IV**:

Relativistic field, The Klein Gorden field, Invariant delta functions, The Dirac field, Spins and statistics, Covariant anti-commutation relations, Feynman diagrams.

***Text and Reference Books:***


1. V. K. Thankappan: Quantum Mechanics
2. Katiyar: Relativistic Quantum Mechanics and Field
3. A. J. Ghatak and S. Loknathan: Quantum Mechanics; Theory and Applications (Macmillan India Ltd.)

## M. Sc. IV Semester

## Paper IV – 404 [Microprocessor]

**Unit-I Microprocessor-I**

**(a) Introduction to microprocessors**

**(b) Programming and languages:** Relationship between electronics and programming. Flow-charts, Programming languages, Assembly languages.

**(c) System overview:** Computer architecture, Microprocessor architecture, specific microprocessor -8085 only

**Unit-II:**

**(a) Data transfer instructions:** CPU control instructions, Data transfer instructions, Microprocessor 8085 family only.

**(b) Addressing modes I:** Concept of addressing mode, Paging concept, Basic addressing modes. Microprocessor-8085 family only

**(c) Arithmetic and flags:** Microprocessors and numbers, Arithmetic instructions, Flag instructions, Microprocessor 8085 family only.

**(d) Logic instructions:** The AND instruction, The OR instruction, X-OR, X-NOR and NOT instructions.

**Unit-III: SAP**

**(a) Bistable multivibrators:** Stable state of a binary, Fixed bias transistor binary, Self biased transistor binary.

**(b) Simple-as-possible computer (SAP-1):** Architecture, Instruction set, Programming, Fetch cycle, Execution cycle, Microprogramme, Schematic diagram, Micro Programming.

**Unit-IV:**

**(a) Simple-as-possible computer-II (SAP-2):** Bidirectional resistors, Architectures, Memory reference instructions, Registers instruction, Jump and call instructions, Logic instructions.

**(b) Simple-as-possible computers (SAP-3):** Programming model, Arithmetic instructions, Increments, decrements and multiples Logic instructions.

***Text and Reference Books:***


1. Microprocessor Architecture Programming and Applications: R. S. Gaonkar
2. Digital Computer Electronics: A. P. Malvino and Brown (Tata McGraw-Hill Eduction (P) Ltd.)