GOVT. NAGARJUNA PG COLLEGE OF SCIENCE
RAIPUR

DEPARTMENT OF PHYSICS

SYLLABUS

M. Sc.
(1st and 2nd Semester System)

3/12/15 3/12/15

2013-2014

M. Sc. PHYSICS

Scheme of Semester Examination (2013-2014)

Semester	Paper	Title of Theory/ Practical Paper	Theory	Internal	Total
I	1	Mathematical Methods I	80	20	100
	2	Classical Mechanics	80	20	100
	3	Numerical Methods and Programming	80	20	100
	4	Electronics I	80	20	100
	Lab. Course A	General			100
	Lab. Course B	Electronics			100
		TOTAL MARKS			**600**
II	1	Mathematical Methods II	80	20	100
	2	Quantum Mechanics I	80	20	100
	3	Electrodynamics	80	20	100
	4	Electronics II	80	20	100
	Lab. Course A	Computer Programming			100
	Lab. Course B	Electronics			100
		TOTAL MARKS			**600**

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Scheme of M. Sc. (PHYSICS)

Semester - I (JULY - 2013)

Semester I	Paper	Title of Theory/ Practical Paper	Theory	Internal	Total
	1	Mathematical Methods I	80	20	100
	2	Classical Mechanics	80	20	100
	3	Numerical Methods and Programming	80	20	100
	4	Electronics I	80	20	100
	Lab. Course A	General			100
	Lab. Course B	Electronics			100
		TOTAL MARKS			**600**

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M. Sc. (PHYSICS)
SEMESTER - I (July - 2013)
PAPER – I
(Mathematical Methods I)

UNIT –I

Vector Spaces and Matrices linear independence Bases; Dimensionality; Inner product; linear transformations; Matrices; Inverse; Orthogonal and unitary matrices; Independent elements of a matrix; Eigen values and eigenvectors; Diagonalization; Complete orthonormal set of functions.

UNIT – II

Special Functions; Solution by series expansion; Legendre Polynomial Generating function, recursion relations; Rodrique formula, orthogonal properties, Associated Legendre polynomials; Recurrence formulae and orthogonal properties,

Laguerre Polynomial Generating function, recursion relations; Rodrique formula, orthogonal properties, Associated Lagueree differential equation and polynomial.

UNIT – III

Bessel's Differential equations, First and Second kind, Recurrence formulae and generating function for $J_n(x)$, Jacobi series Bessel's Integrals, orthonormality of Bessel's functions, spherical Bessel's function : Recurrence relation and orthogonality.

Hermite Differential equation and polynomials, generating function, Recurrence relation, Rodrigue formula, orthogonality.

UNIT-IV

Integral Transforms, Laplace transform; First and second shifting theorems; Inverse LT by partial fractions; LT of derivative and integral of a function.

Fourier series; FS or arbitrary period; Half-wave expansions; Partial sums; Fourier integral and transforms; Dirac delta function, three dimension delta function.

Text and Reference Books:

1. Mathematical Methods or Physics, by g Arfken
2. Matrices and Tensors for Physicists, by AW Joshi
3. Advanced Engineering Mathematics, by E Kreyszig
4. Special Functions, by ED Rainville
5. Special Functions, by W W Bell
6. Mathematical Method for Physicists and Engineers. By KF Reilly, M P Hobson and S J Bence
7. Mathematics for Physicists, by Mary L Boas

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M. Sc. (PHYSICS)
SEMESTER - I (July - 2013)
PAPER – II
(Classical Mechanics)

Unit-I

Conservation Principles, Mechanics of a particle conservation Principles for system of particles. Constrained motion constraints and degrees of freedom generalised coordinates, Generalised Notations (i) Generalised Displacement , velocity , Acceleration, momentum force and potential , limitations of Newton's laws.

D'Alemberts Principle, Lagranges equations form D'Alemberts principle . Application of Lagrange's equation of motion (i) Linear Harmonic oscillator (ii) Simple pendulum (iii) spherical pendulum (iv) Isotropic oscillator (v) Atwood's Machine, conservation of linear momentum angular momentum and energy in Lagrangian formulation Lagrange's equation for nonholonamic system procedure to eliminate consideration of Ignorable coordinates the Routhian function.

Unit – II

Variational Principle, calculus of variation, some techniques of calculus of variables , Euler Lagrange differential equation. Hamilton variational principle Deduction of Hamilton's Principle from D'Alemberts principle. Deduction of Newton's second law of motion from Hamilton's Principle. Deduction of Lagrange's equations of motion from Hamilton's Principle for conservation and for non conservative systems Non conservative forces. Dissipative system, Rayleigh's Dissipation function , Lagrangian for a charged particle in an electromagnetic field.

Unit – III

Hamiltonian formulation of mechanics: Phase space and the motion of the system, Hamiltonian function , Hamilton's canonical equation of motion. Physical significance of H Deduction of Canonical equation from variational principle. Hamilton's canonical equations of motion in different coordinate systems. Application of Hamilton equation of motion (i) Simple pendulum (ii) compound pendulum (iii) Two dimensional Isotropic Harmonic oscillator (iv) Linear Harmonic oscillator (v) Particle in central field of force. Hamiltonian for a charged particle in an electromagnetic field . Principle of least action statement and its proof.

Unit – IV

Canonical or constant transformation, its advantage example of canonical transformation , necessary and sufficient condition for a trans formation to be canonical , Infinitesional contact transformations. Hamilton-Jacobi partial differential equation for Hamilton's Principle function. Solution of Harmonic oscillator problem by Hamilton-Jacobi method . Hamilton- Jacoby theory . Poisson Bracket: Definition and properties. Invariance of Poisson-Brackets with respect to canonical transformation , Equations of motion in Poisson bracket form Jacoby identity. Infinitesimal contact transformations interpretation in terms of Poisson Brackets. The angular momentum and Poisson Bracket Lagrange's Brackets: definition & Properties , Relation with Poisson Brackets .

Text and Reference Books:

1. Classical mechanics . H. Goldstein
2. Principle of mechanics – Synge and Griffith
3. Classical mechanics – Gupta Kumar , Sharma
4. Classical mechanics of particles and Rigid body- Kiran C. Gupta

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M. Sc. (PHYSICS)
SEMESTER - I (July - 2013)
PAPER – III
(Numerical Method and Programming)

UNIT- I

Problem analysis and solving scheme. Computational procedure, programming outline, flow chart. Branching and looping writing.

Character set, constants, (numeric string) variables(numeric string) rules for arithmetic expressions and hierarchy of operators, rational expressions, logical expressions, and operators, library functions. Identifiers, qualifiers, define statements, value Initialized variables, operators, and expressions. Operator precedence and associativity.

Scanf with specifier, search set arrangements and suppression Character, format specifier for scanf.

UNIT-2

Control structure, If statement, if else statement, multiway decision, compound statement.

Loops: for loop, while loop, do while loop, break statement , compound statement continue statement , goto statement

Function: function main , function accepting more than one parameter, user defined and library function concept associatively with functions, function parameter, return value, recursion comparison.

Arrays , strings, multidimensional array, array of strings function in string

UNIT-3
(Without Programming)

Method for determination of zeroes of linear, non linear, algebraic equations. And transcendental equations and their convergence.

Solution of simultaneous linear equations Gaussian elimination pivoting, iterative method matrix inversion.

Eigen values and Eigen vectors of matrices. Power and Jacobi method , curve fitting polynomial least squares

UNIT-4
(Without Programming)

Finite deference interpolation with equally spaced and unequally spaced points, Numerical differentiation and Integration , Newton cote's formula , Monte Carlos evaluation of Integral

Numerical solution of ordinary differential equation . Euler and Runga Kutta methods. Predictor corrector method

Text and Reference Books:

1. Sastry: Introductory methods of numerical analysis
2. Vetterming, Teukolsky press and Flannery : Numerical Recipes
3. Let Us C : Yashwant Kanitkar
4. Programming in C : E. Balaguruswami.
5. Numerical Methods : P.Kandasamy

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M. Sc. (PHYSICS)
SEMESTER - I (July - 2013)
PAPER – FOURTH
ELECTRONICS – I

UNIT- I

Transistors : Bipolar Junction transistor (BJT) – basics working principle of NPN and PNP transistor, characteristic curve and different modes of transistor, current gain in different modes and relation between them.

Junction Field Effect Transistor (FET) – N channel and P channel FET, Working principle, static and dynamic characteristic curves, pinched off voltage, Coefficient of FET, and relation between different coefficient.

Metal Oxide Field Effect Transistor (MOSFET) – DE MOSFET and E-MOSFET-construction and working principle, static and dynamic characteristics.

Uni-junction transistor (UJT) – basics structure, working principle, Voltage – Current characteristics and important parameters .

UNIT –II

MIS Diode : Introduction , Energy band diagram, accumulation, depletion and inversion condition concept of surface space charge, surface potential, surface capacitance, Ideal MIS curves .

MOS diode: structure , Ideal MOS, surface depletion region , Ideal MOS curves, Si-SiO_2 MOS diode-(real case) interface trapped charge, oxide charges.

Charged Couple Device (CCD) : Basic structure, working principle, charge transfer with clock voltage.

UNIT – III

Microwave devices: Tunnel Diode – Introduction, Definition, Tunneling Phenomenon, Energy band Structure, Volt-Ampere Characteristics, Negative Resistance of tunnel diode (Characteristics of tunnel diode)

Transfer Electron Devices: Transfer Electron Effect, Gun Diode- Introduction and characteristics.

Backward Diode: Introduction and Characteristics.

IMPATT Diode : Introduction, Structure, Principle of operation, Static and Dynamic Characteristics.

UNIT – IV

Modulation : Definition , Types of Modulation, Mathematical expression of modulation, Percentage of modulation, Amplitude modulation, Generation of Amplitude modulation, Demodulation, Demodulation of Amplitude modulated wave, side bands, band width, DSBSC modulation, Generation of DSBSC waves. SSB modulation, Generation and Detection of SSB waves,

Multiplexing: Frequency division multiplexing (FDM)

Text and Reference Books:

1. Principles of Electronics – V.K. Mehta , Rohit Mehta (S.Chand & Company Ltd.)
2. Basic Electronics (Solid state) – B.L. Theraja (S. Chand & Company Ltd.)
3. Electronic Devices and Circuits – Jacob Millman , Christos C. Halkias (Tata McGraw Hill)
4. foundation of Electronics – D. Chattopadhyay, P.C. Rakshit, B. Saha, N. N. Purkait.
5. Hand Book of Electronics – Gupta Kumar (Pragati Prakashan)
6. Physics of semiconductor Devices – S.M. Sze (Wiley Eastern Ltd.)

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Lab. Course – A

Time : 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

Lab. Course – B

Time : 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

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Scheme of M. Sc. (PHYSICS)

Semester - II (JAN. 2014)

Semester II	Paper	Title of Theory/ Practical Paper	Theory	Internal	Total
	1	Mathematical Methods II	80	20	100
	2	Quantum Mechanics I	80	20	100
	3	Electrodynamics	80	20	100
	4	Electronics II	80	20	100
	Lab. Course A	Computer Programming			100
	Lab. Course B	Electronics			100
		TOTAL MARKS			**600**

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M.Sc. (PHYSICS)
SEMESTER - II (Jan. - 2014)
PAPER – I
(Mathematical Methods - II)

Unit –I

Boundary value problems: Transverse vibration of a stretched string, different modes of vibration, D'Alembert solution, Stationary wave formation, Two dimensional heat flow, rectangular membrane, Poisson's and Laplace equations and its solution.

Unit –II

Transmission line: Linear waves in electrical transmission line, linear dispersion, group velocity, dispersion induced wave packet broadening, nonlinear and dispersion-less transmission line, combined effect of dispersion and nonlinearity.

Unit –III

Tensor analysis: Rotation of axes and vectors, rank of a tensor, outer product and contraction, the quotient rule, kronecker delta and Levi- Civita tensor, vector analysis using tensor notation, tensor analysis in curvilinear coordinates, covariant and contra variant tensors.

Unit –IV

Complex Variables: Function of Complex Variables, limit, continuity and differentiability , Analytic function, the necessary and sufficient condition for a function to be analytic , Cauchy-Riemann condition, Cauchy integral theorem, evaluation of line integral by indefinite integration, Cauchy's integral formula, Derivatives of an analytic function. Singularities of analytic functions, Residues and their Evaluation, Cauchy's residue theorem, Contour integration.

Text and Reference Books:

1. Mathematical Methods for Physics, by G. Arfken
2. Applied Mathematics for Engineers and Physicists by L.A. Pipes
3. Mathematical Physics by Gupta, Kumar, Rajput.
4. Advanced Engineering Mathematics, by E. Kreyszing.
5. Mathematics for Physicists , by Mary L. Boas
7. Differential Equations by Simmons.

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M. Sc. (PHYSICS)
SEMESTER - II (Jan. - 2014)
PAPER – II
(QUNATUM MECHENICS - I)

UNIT – I

Inadequacy of classical mechanics; Schrodinger equation; Continuity equation; Expectation value of dynamical variable, Ehrenfest theorem; Solution of Schrodinger wave equation; Stationary states.

One-dimensional problems: Potential step, Rectangular potential barrier, The Square well problem, Schrodinger equation for Harmonic Oscillator

UNIT- 2

Uncertainty relation of x and p, mathematical proof of uncertainty principle for one dimensional wave packet; Form of minimum packet; The Gaussian wave packet, Spread of minimum wave packet with time; Direct delta function; bra and ket notation.

Matrix representation of an operator; Unitary transformation. Harmonic Oscillator and its solution by Matrix Method.

UNIT – 3

Angular momentum; Commutation relations of total Angular momentum with components , Eigen values, Spin Angular Momentum , Paulis Matrices , Addition of Angular Momentum, Clebsch-Gordon coefficients.

Central force problem: Solution of Schrodinger equation for spherically symmetric potentials; Hydrogen atom. Three-Dimensional Square Well Potential and Energy levels.

UNIT- 4

Time-independent perturbation theory; Non-degenerate cases; First order Perturbation with the example of an Oscillator Degenerate cases, Applications such as Stark effect. Zeeman effect without electron spin , First order Stark Effect in Hydrogen .

Text and Reference Books:

1. L I Schiff, Quantum Mechanics (McGraw-Hill)
2. S Gasiorowicz, Quantum Physics (Wiley)
3. B Craseman and JD Powell, Quantum Mechanics (Addison Wesley)
4. A P Messiah, Quantum Mechanics
5. J J Sakurai, Modem Quantum Mechanics
6. Mathews and Venkatesan Quantum Mechanics

M.Sc. (PHYSICS)
SEMESTER - II (Jan. - 2014)
PAPER – III
(Electrodynamics)

Unit – I

Equation of continuity, Maxwell's equations (SI unit) and its derivation, Integral form of equation, Maxwell's equations in some particular cases , Electromagnetic energy: Poynting Theorem. The wave equation. Plane electromagnetic waves in free space. Plane electromagnetic waves in a non-conducting isotropic medium (i.e. Isotropic dielectrics) . Plane electromagnetic waves in Anisotropic Non-conducting medium (Anisotropic dielectric) , Plane electromagnetic waves in conducting medium. A simple model for dynamic conductivity. Propagation of electromagnetic waves in ionized gases.

Unit –II

Boundary conditions at the interface of two media, Reflection and Refraction of electromagnetic waves at the interface of Non-conducting media,. Fresne"s equations experimental verification of fresnel's equations.

Reflection and transmission coefficients at the interface between two non conducting media, Brester's law and degree of polarisation , Total internal reflection , Group velocity , Propagation of Electromagnetic waves between parallel conducting planes. Wave guides. TM modes and TE modes, Rectangular wave guides.

Unit –III

Postulates of Einstein's special theory of relativity, Galliean transformations. Lorentz's transformations and it's consequence, Transformation of differential operator, Invariance of D'Alembertian operator, Invariance of charge, Transformation of charge density, Electric field measured in different frames of reference, Minkowski space, concept of four vector, Lorentz transformation of space and time in four vector form, Transformation for charge and current density, Transformation of electromagnetic potential A and ϕ . Lorentz condition in covariant form, Covariance or Maxwell field equation in terms of four vector.

Unit –IV

Electromagnetic vector and scalar potential , Lorentz Gauge, Lienard Wiechart potentials, the electromagnetic field of a uniformly moving point charge, Radiation from an accelerated charge at low velocity – Larmer's formula , Relativistic generalization of Larmer's formula, Angular distribution of radiation emitted by an accelerated charge, Radiation damping, The Abraham Lorentz formula, Cherenkov radiation, Radiation due to an oscillating electric dipole, electric quadra pole radiation, Radiation due to small current element, Radiation from linear antenna, Half wave antenna, Antenna array.

Text and Reference Books:

1. Classical electrodynamics by –J.D. Jackson
2. Electromagnetic theory and electrodynamics by Satyaprakash.
3. Classical theory of fields – by Landau L.D. and lifshitz
4. Electrodynamics of continuous media- Landau L.D. and lifshitz
5. Electromagnetic theory – Chopra and Agrawal .

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M. Sc. (PHYSICS)
SEMESTER - II (Jan. 2014)
PAPER – IV
(ELECTRONICS – II)

UNIT – I

Radiative and non radiative transistors , Optical Absorption, bulk and thin film, photoconductive devices (LDR) , Emission spectra , Luminescent efficiency , method of excitation. Light emitting diode (LED) : high frequency limit, effect of surface and indirect combination current , operation of LED, Visible LEDs and Infrared LEDs. Diode Laser (Condition for population inversion in active region, light confinement factor , optical gun and threshold current for lasing, Fabry Perrot Cavity Length for losing and the separation.

UNIT – II

Photo detectors: Photoconductor, equivalent circuit of photoconductor. Phototransistor. Bipolar phototransistor, photo – Darlington transistor, V-I characteristic of bilateral hetero structure phototransistor, Solar cells, Solar radiation, solar spectrum, ideal conversion efficiency, Energy band diagram of solar cell, IV characteristics of solar cell, PN junction solar cells, Hetero junction, Interface thin film solar cells.

UNIT – III

Basic Op-amp. Differential amplifier – circuit configurations, dual input, balanced output, differential amplifier –DC analysis, Ac analysis, inverting and non-inverting inputs, CMRR, Constant current bias level transistor.

Block diagram of a typical Op-amp. Analysis, open loop configuration, inverting and non-inverting amplifier, Op-amp. With negative feedback, Voltage series feed back, effect of feed back on closed loop gain input persistence output , resistance bandwidth and output offset voltage , voltage follower.

UNIT – IV

Practical Op-amp. Input offset voltage, Input offset current, total output offset voltage, CMRR frequency response, DC and AC amplifier summing scaling and averaging amplifiers instrumentation amplifier, integrator and differentiator

Oscillators principles, oscillator types, frequency stability response, The phase shift oscillator. Wein bridge oscillator, Multivibrators, Monostable and Astable , Comparators, square wave and triangle wave generators.

Text and Reference Books :

1. Semiconductor Devices – Physics and Technology – S.M. Sze, Wiley, 1985
2. Introduction to Semiconductor Devices – M.S.Tyagi, John Wiley & sons
3. Electronic Devices and circuit theory – Robert Baylested and louis Nashdsky, PHI, New Delhi, 1991
4. Electronic Fundamentals and applications – John D. Ryder PHI, New Delhi, 1987.
5. Operational Amplifier and their applications – Subir Kumar Sarkar, S.Chand & Sons, New Delhi1999.
6. Op-amps & linear integrated circuits- Ramakanth A. Gayakward, PHI, 2 Ed. 1991

Lab. Course – A

Time : 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

Lab. Course – B

Time : 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

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GOVT. NAGARJUNA PG COLLEGE OF SCIENCE, RAIPUR

DEPARTMENT OF PHYSICS

SYLLABUS

M. Sc.
(3^{rd} and 4^{th} Semester System)

2013-2014

M. Sc. PHYSICS

Scheme of Semester Examination (2013-2014)

Semester	Paper	Title of Theory/ Practical Paper	Theory	Internal	Total
III	1	Quantum Mechanics II	80	20	100
	2	Statistical Mechanics	80	20	100
	3	Condensed Matter Physics I	80	20	100
	4	Electronics III	80	20	100
	Lab. Course	Condensed Matter Physics			100
		Project			
		TOTAL MARKS			**500**
IV	1	Condensed Matter Physics II	80	20	100
	2	Nuclear Physics	80	20	100
	3	Atomic and Molecular physics	80	20	100
	4	Electronics IV	80	20	100
	Lab. Course	Digital Electronics			100
		Project			200
		TOTAL MARKS			**700**
GRAND TOTAL [SEMESTER I (600) + SEMESTER II (600) + SEMESTER III (500) + SEMESTER IV (700)]					**2400**

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Scheme of M. Sc. (PHYSICS)

Semester - III (JULY - 2013)

Semester III	Paper	Title of Theory/ Practical Paper	Theory	Internal	Total
	1	Quantum Mechanics II	80	20	100
	2	Statistical Mechanics	80	20	100
	3	Condensed Matter Physics I	80	20	100
	4	Electronics III	80	20	100
	Lab. Course	Condensed Matter Physics			100
		Project			
		TOTAL MARKS			**500**

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M. Sc. (PHYSICS)
SEMESTER - III (July -2013)
PAPER – I
Quantum Mechanics – II

UNIT - I

Variational method, principle, Application to problems like H atom, He atom, harmonic oscillator. WKB method, connection formula, energy levels of potential well quantization rule, tunneling through potential barrier, application to α decay.

UNIT - II

Time dependent perturbation theory, harmonic perturbation theory, harmonic perturbation, constant perturbation, Fermi's Golden rule, absorption and induced emission forbidden transitions, selection rule.

UNIT - III

Collision in 3d., scattering, scattering amplitude scattering cross section, Born approximation and its validity scattering by spherically symmetric potential. Application to screened coulomb potential, square well potential, Partial wave, phase shift, scattering by rigid sphere and square well.

UNIT - IV

Identical particle symmetric anti symmetric wave function, spin angular momentum.

Relativistic quantum mechanics, Klein Gorden equation, Dirac equation for free particle, α and β matrices, charge and current densities free particle solution existence of spin and magnetic moment theory of positron, γ matrices Covariant formulation.

Text and Reference Books:

1. Davidow : Quantum Mechanics.
2. L.I. Schiff : Quantum Mechanics.
3. Powerll and Craseman : Quantum Mechanics.
4. Ghatak and loknathan : Quantum Mechanics.

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M. Sc. (PHYSICS)
SEMESTER - III (July -2013)

PAPER – II

Statistical Mechanics

UNIT1

Basics of thermodynamics, laws of thermodynamics, reversible and irreversible processes, concept of entropy, kinetic theory of gases, phase diagram and concept of triple point. Specific heat capacities of gases, law of equi-partition of energy. Thermal conduction, convection and radiation, black body, kirchoff's law, Stepan –Boltzman law,

UNIT2

The statistical basis of thermodynamics, probability and equilibrium, principle of equal apriory brobability, probability distribution, phase space, statistical description of entropy, partition function and its relation with thermodynamic quantities. Maxwell- Boltzman statistics and its applications.

UNIT3

Indistinguishability of particle and its consequences, , Bose-Einstein statistics, derivation of Plank's law, application to liquid helium, Fermi- Dirac distribution , Fermi theory of free electron gas, information theory and statistical mechanics, Shannon's entropy.

UNIT 4

Fluctuation, fluctuation in energy, pressure, volume and enthalpy, one dimensional random walk, Brownian movement, Fokker- Plank equation, Fourier analysis of random function, Wiener- Khintchine theorem, electrical noise, Nyquist Theorem.

References:

1. Fundamentals of Statistical Mechanics- B.B.Laud
2. Statistical Mechanics- B.K.Agrawal and Melvin Eisner
3. Statistical Mechanics- Gupta and Kumar
4. Statistical Mechanics- K.T. Thorpe

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M. Sc. (PHYSICS)
SEMESTER - III (July -2013)
PAPER – III
Condensed Matter Physics – I

UNIT - I

Crystalline and amorphous solids, unit cells and direct lattice. Two and three dimensional Bravais lattices, fundamental elements of symmetry, concept of point group and space groups, crystal planes and Miller indices, closed packed structures . Interaction of X rays, electrons and neutrons with matter, Elastic scattering from an perfect lattice , Laue's equation, Bragg's Law, Reciprocal lattice, Ewald's construction, Brillolin Zones,

UNIT - II

Defects or imperfections in crystals and their classification, Point defects, Schottky and Frenkel defects, vacancies, interstitical and colour center in ionic crystals, their types and production, line defects or dislocations, Edge and Screw dislocations, Burger Vectors, the role of dislocations in Plastic deformation and crystal growth.

UNIT - III

Electron's in a periodic lattice, Block theorem, Kroning-Panny model, Band theory, Classification of solids, effective mass, Tight bonding, cellular and pseudo potential methods, Fermi surface and its construction, de Haas von Alfen effect, cyclotron resonance, magnetoresistance , quantum Hall Effect.

UNIT - IV

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Curie-Weiss law for susceptibility, Ferri and Antiferromagnetic order, Doman's and Block wall energy. Spin waves and magnoins , susceptibility below Neel temperature.

Text and Reference Books:

1. Kittel: solid state physics
2. Azroff: Introduction to solids
3. Varma and Shrivastava: Crystallography for solid state Physics
4. Singhal: solid state physics
5. Ziman: Principal of theory of solids
6. Ascrroff and mermin: solid state physics
7. Madelung : Introduction to solid state theory
8. Huong: Theoretical solid state physics
9. Omar: Elementary solid state physics
10. Kittel : Quantum theory of solids

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M. Sc. (PHYSICS)
SEMESTER - III (July - 2013)
PAPER – IV
ELECTRONICS – III

UNIT -I

Number system : Decimal, Binary, Octal and Hexadecimal Number System with mutual conversion, BCD addition and subtraction, 1's and 2's compliments, multiplication & division BCD code (8421), Excess –3 code, gray code, binary to gray code and gray code to binary code conversion.

Logic gates: Positive and negative logic , Basic gates, Universal building block. Basic laws of Boolean Algebra, De-Morgan's Theorem, two, three and four variable K-Map, mapping and minimization of SOP and POS expressions, pairs, quads, octet, overlapping, Rolling, concepts of Don't care condition.

UNIT – II

Ex-OR gate, Ex-NOR gate circuitry, Half adder, Full adder, binary parallel adder, Serial adder, Half Subtractor, Full Subtractor, 1's complements Subtractor circuit and 2's complements Subtractor circuit.

Digital logic Families : Introduction, Basic concepts of RTL, DTL, TTL, ECL and CMOS logic.

Decoder : 2 line to 4 line decoder, 1 of 16 decoder, BCD to decimal decoder, BCD to seven segment decoder, Encoder : decimal to BCD encoder.

Multiplexer : 2-input, 4-input, 16 input Multiplexer, DeMultiplexer : 1 line to 2 line , 1 line to 4 line and 1 line to 16 line DeMultiplexer.

UNIT – III

Flip-flop and timing diagram, RS flip-flop using NOR gate, RS flip-flop using NAND gate, Clocked RS flip-flop, D- latch flip-flop, Preset and Clear, JK flip-flop, Positive and negative edge triggered flop-flops., JK Master Slave flip-flop.

Counters : Binary ripple counter , up counter , down counter, decade counter and Ring counter and time diagram

Registers : Parallel and shift Register, Scaling, PIPO, SIPO, PISO, SOSI Bi-directional shift Register, Application of shift register.

UNIT – IV

Digital to analog converter and Analog to Digital converters : D/A converters using binary weighted resistor network and R-2R ladder Network; Counter type A/D converter, Successive approximation A/D converter and dual slope converters , applications of DACs and ADCs.

Intergraded Circuit : Introduction, Technology, Advantages and disadvantages, Basic technology of monolithic IC, Basic processes used in monolithic technology, Fabrication of components on monolithic IC, IC packing, symbol and scale of Integration.

Text and Reference Books :

1. Digital Principles and applications – Malvino and Leach, Tata McGraw Hills, New Delhi, 1991.
2. Digital and Analogue Technique- Navneet Gokhale and Kale, Kitab Mahal
3. Hand Book of Electronics – Gupta and Kumar, Pragati Prakashan, Meerut, 2008
4. Digital integrated Electronics _ Taub and Schilling, McGraw International Edition, 1977
5. Fundamentals of Digital Circuits – A.Anand Kumar, Prentice Hall of India, N.Delhi. 2007.

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Lab. Course

Time : 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

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Scheme of M. Sc. (PHYSICS)

Semester - IV (JAN. - 2014)

Semester IV	Paper	Title of Theory/ Practical Paper	Theory	Internal	Total
	1	Condensed Matter Physics II	80	20	100
	2	Nuclear Physics	80	20	100
	3	Atomic and Molecular physics	80	20	100
	4	Electronics IV	80	20	100
	Lab. Course	Digital Electronics			100
		Project			200
		TOTAL MARKS			**700**
GRAND TOTAL [SEMESTER I (600) + SEMESTER II (600) + SEMESTER III (500) + SEMESTER IV (700)]					**2400**

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Department of Physics
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M. Sc. (PHYSICS)
SEMESTER - IV (JAN. - 2014)
PAPER – I
Condensed Matter Physics – II

UNIT – I

Superconductivity, critical temperature, persistent current, Meissner effect and flux penetration, type I and type II superconductors, thermodynamics of superconducting transitions, London's equations, Interaction of electrons with acoustic and optical phonon, Cooper pairing due to phonons, BCS theory of superconductivity (qualitative).

Manifestation of energy gap in superconductors, superconducting tunneling, A.C./D.C. Josephson effect, high temperature superconductivity (elementary).

UNIT – II

Polarization, depolarization field, local electric field at an atom, Lorenz field, dielectric constant and polarizability, Electronic polarizability, Ionic and orientational polarizability, Debye equation for gases, the complex dielectric constant, dielectric relaxation time, Normal and anomalous dispersion, classical theory of electronic polarizability.

Ferro electric crystal, classification, ferro-electric domains, structural phase transition, Landau theory of phase transition, first and second order phase transition, anti Ferro electricity.

UNIT – III

Energy bands in semiconductor, Intrinsic and Extrinsic semiconductors, Drift velocity, mobility, carrier concentration and Fermi level for intrinsic and extrinsic semiconductors. Electrical conductivity of semiconductors, semimetals.

p-n junction, junction transistors, The tunnel diode, Zener diode, Gunn diode, photovoltaic effect, Quantum wells and super lattices.

UNIT – IV

Interatomic forces and lattice dynamics of simple metals, ionic and covalent crystals, lattice dynamics of linear monoatomic and diatomic lattices, optical and acoustical modes.

Quantization of elastic waves, phonons, momentum of phonons, inelastic neutron scattering by phonons, Anharmonicity, thermal expansion, lattice thermal conductivity.

Text and Reference Books:

1. Kittel: solid state physics
2. Azroff: Introduction to solids
3. Varma and Shrivastava: Crystallography for solid state Physics
4. Singhal: solid state physics
5. Ziman: Principal of theory of solids
6. Ascrroff and mermin: solid state physics
7. Madelung : Introduction to solid state theory
8. Huong: Theoretical solid state physics
9. Omar: Elementary solid state physics
10. Kittel : Quantum theory of solids

M.Sc. (PHYSICS)
SEMESTER - IV (JAN. - 2014)
PAPER – II
Nuclear Physics

UNIT – I

Nuclear Decay :

α decay: Measurement of α particles energies, α particle spectra , Geiger Nuttal law, barrier penetration applied to α decay,

β decay : shape of β spectrum, neutrino hypothesis, detection of neutrino, Fermi theory of β decay (kurie plot, mass of neutrino, half lives), Allowed and forbidden transitions, selection rules.

UNIT – II

Nuclear Reactions and Energy:

Conservation laws, Q equation, theories of nuclear reactions, partial wave analysis, compound nucleus: formation and breakup, resonance scattering and reactions.

Neutrons released in fission process; cross sections, nuclear chain reactions, nuclear reactor, four factor formula, critical size of reactor, General aspect of reactor design. Fusion, thermonuclear energy, prospect of controlled fusion energy.

UNIT – III

Counters and Accelerators

Gas filled counter, solid state counter, scintillation counters, neutron detection.

Accelerators: Cyclotron, linear accelerators, betatron, electron synchrotron, proton synchrotron.

UNIT - IV

Elementary Particles

Classification of elementary particles, basic particle interactions, conservation laws, invariance under parity, CP, time, CPT, Electron and positron, proton and antiproton, neutrino and antineutrino, mesons and hyperons: (their masses, decay modes and reactions) elementary particle symmetry [SU(2), SU(3)]. Quark theory.

Text and Reference Books:

1. Nuclear Physics ,Ray and Nigam (Wiley Eastern ltd)
2. Nuclear Physics, I Kaplan (Narosa)
3. Introduction to nuclear Physics, H.A. Enge (Addison Wesley)
4. Concepts of Nuclear Physics, B.L.Cohen (TMGH)

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M.Sc.(PHYSICS)

SEMESTER - IV (JAN. - 2014)

PAPER – III

ATOMIC AND MOLECULAR PHYSICS

UNIT 1

Spectra of hydrogen and hydrogen like atoms, Reduced mass of electron, Variation of Rydberg constant, Sommer feld's elliptic orbit, Space quantization, Pauli's Vector atom model, four quantum numbers, Spectral terms arising from ls coupling, s, p, d, f notation, selection rules.

Spectra of alkali atoms, Spin orbit interaction and fine structure in alkali spectra, screening constant for alkali spectra, penetrating and non penetrating orbits, equivalent and non equivalent electrons.

UNIT 2

Spectra of Helium, Alkaline earth atoms, Singlet -Triplet series, L S and J J coupling, Interaction energy.

Continuous X-ray spectrum, Dependence on voltage, Duane and Hunt's law, Characteristics X-ray, Mosle'y law, Doublet Fine structure of X-ray spectra.

Effect of magnetic field on energy levels (mono-valent atoms), Gyromagnetic ratio for orbital and spin motion, vector model, Lande g-factor, weak and strong field effect, (normal and anamolous zeeman effect, Paschen Back effect).

Line broadening mechanism.

UNIT 3

Formation of molecular orbitals, Heitler London theory of hydrogen molecule, Singlet triplet character.

Types of molecules, Diatomic linear symmetric top, asymmetric top molecules, Energy levels, selection rules, spectra of symmetric top and asymmetric top molecules.

Rotational energy and spectra of diatomic molecules as rigid rotor and non rigid rotor, selection rule, internuclear distance, isotope effect.

UNIT 4

Vibrational energy of diatomic molecule, Energy levels, spectrum, Anharmonicity of molecular vibration, Energy levels, spectrum, isotope effect, force constant, Morse potential energy curve, dissociation energy.

Molecule as vibrating rotor, vibration rotational spectra of diatomic molecule, selection rules.

Electronic band system sequences, progression, Frank Condon principle, P, Q and R branches, I R spectrometer.

Text and Reference Books

1. H.E. White	Introduction to atomic physics
2. Barrow	Introduction to molecular physics
3. G.Herz berg	Molecular spectra and molecular structure
4. H.Kuhn	Atomic spectra
5. Walker and straugh	Spectroscopy Vol I,II,III.

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13/03/2014

M.Sc. (PHYSICS)
SEMESTER - IV (JAN. - 2014)
PAPER – IV
ELECTRONICS – IV

Unit – I

Microprocessor : Introduction and evaluation

Digital Computer : Generation of computer , Input and output devices, Central Processing Unit (CPU) ,

Primary memory: Introduction, Types of Primary memory - RAM, ROM, EROM, EPROM,

Secondary memory : Hard Disc, Floppy Disc, Optical Disc, Magnetic Bubble Memory (Construction and working principle) , Cache memory, Real and Virtual Memory.

Networking: Wide Area Networking (WAN) , Local Area Networking (LAN) , LAN topology (Bus, Star, Ring) .

Unit – II

Intel 8085: Introduction, Construction, ALU, Timing and Control unit, Registers, Data and Address Bus. Pin Configuration of 8085.

Opcode and Operand , Instruction word size, Instruction cycle, fetch operation, Execute operation, Machine cycle.

Timing Diagram : Opcode fetch cycle, Memory read, I/O read, Memory write, I/O write.

Unit – III

Instruction set of 8085 : Data transfer group, Arithmetic group, Logical group.

Machine and Assembly language, High and Low level language, Modular and Structured programming,

Assembly Language Programs: Addition of Two 8-bit number, Sum 8-bit , Addition of Two 8-bit number, sum 16-bit, 8-bit subtraction, Find the largest number in a data array, To arrange a series of numbers in Descending order, Find the smallest number in a data array, To arrange a data array in ascending order, Shift of 8-bit number of left by one bit and two bit , Shift of 16-bit number left by one and two bit.

Unit – IV

Optical Fibers: Introduction, Structure, Classification, Refraction and Snell's law, Total internal refraction, Light propagation through and optical fiber, Acceptance angle for incident ray, Numerical Aperture, Skew rays and Acceptance angel for skew rays, number of modes and cut-off parameter, single mode propagation, comparison of step and graded index fiber.

Types of Optical Fiber : HPSUU, HPSIR, Halide fiber

Optical fiber cables : Multifibre cable, Splicing and connectors.

Advantage and Disadvantage of optical fiber.

Text and Reference Books :

1. Fundamental of microprocessor and microcomputer – B. Ram, Dhanpat Rai Publication , New Delhi
2. Introduction to microprocessor – Aditya Mathur, Tata McGraw Hills, New Delhi
3. Microprocessor Architecture, programming and application with 8085/8086- Ramesh S. Gaonkar Wiley Eastern Ltd. 1987.
4. Optical Fibres and Fibre Optic Communication Systems – Subir Kumar Sarkar (S.Chand & company Ltd.)
5. Optical Fiber Communications (Principle and Practice) John M. Senior Prentice Hall of India Pvt. Ltd.

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Lab. Course

Time : 5 Hrs. **Total Marks – 100**

1.	Experiment	60
2.	Viva Voce	20
3.	Sessional	20

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