M D S UNIVERSITY, AJMER
M Sc (Physics) Syllabus
Semester Scheme 2015-16
Scheme of Examination
First Semester

Four Theory Papers	Max marks: 400	
Paper -I **Classical Mechanics**	3 hrs duration	100 marks
Paper -II **Classical Electrodynamics (I)**	3 hrs duration	100 marks
Paper -III **Quantum Mechanics**	3 hrs duration	100 marks
Paper -IV **Mathematical Methods in Physics**	3 hrs duration	100 marks

Scheme of Examination
Second Semester

Four Theory Papers	Max marks: 400	
Paper -V **Classisical Electrodynamics (II)**	3 hrs duration	100 marks
Paper -VI **Atomic & molecular Physics**	3 hrs duration	100 marks
Paper -VII **Electronics**	3 hrs duration	100 marks
Paper -VIII **Numerical methods and Computer Programming**	3 hrs duration	100 marks
Practical:	12 hours duration	Max marks 400

Electronics Lab/General & Computer Lab

Note: A combined practical examination (Maximum 400 marks with break up as below) shall be conducted at the end of semester II and IV. Thus examination of practical course in semester I shall be combined with Semester II and that of Semester III shall be combined with semester IV.

There will be two experiment of 6 hrs. Duration each selecting one from each lab for two days

The distribution of marks will be as follows:

1. Two experiments(each of 120 marks)	-	240 marks
2. Viva voce	-	80 marks
3. Record	-	80 marks
TOTAL	-	400 marks

Sc**heme of Examination**
Third Semester

Four Theory Papers	Max marks: 400	
Paper -IX **Nuclear Physics I**	3 hrs duration	100 marks
Paper - X **Statistical and Solid State physics**	3 hrs duration	100 marks
Paper -XI **Advanced Quantum Mechanics (I)**	3 hrs duration	100 marks
Paper -XII Elective paper-		
Anyone out of the following special papers	3 hrs duration	100 marks

Paper XII (a) Microwave Electronics
Paper XII (b) Solid State electronics
Paper XII (c) Plasma physics -I
Paper XII (d) Energy Studies -I

Scheme of Examination
Fourth Semester

Four Theory Papers	Max marks: 400	
Paper -XIII **Nuclear Physics II**	3 hrs duration	100 marks
Paper - XIV **Solid State physics**	3 hrs duration	100 marks

Paper -XV **Advanced Quantum Mechanics II** 3 hrs duration 100 marks
Paper -XVI 3 hrs duration 100 marks
Elective paper-Anyone out of the following special papers
Paper XVI (a) **Microwave Electronics** (Only for students who opted Paper XII (a) in third semester)
Paper XVI (b) **Solid State electronics** (Only for students who opted Paper XII (b) in third semester)
Paper XVI (c) **Plasma physics-II** (Only for students who opted Paper XII (c) in third semester)
Paper XVI (d) **Energy Studies –II** (Only for students who opted Paper XII (d) in third semester)
Practical: 12 hours duration Max marks 400
For students opting Microwave electronics as special paper
Microwave Lab/Advanced physics Lab
OR
For students opting Solid state electronics as special paper
Solid state electronics Lab/Advanced physics Lab
OR
For students opting other special papers
Advanced physics Lab 1/Advanced physics Lab 2
Note: A combined practical examination (Maximum 400 marks with break up as below) shall be conducted at the end of semester II and IV. Thus examination of practical course in semester I shall be combined with Semester II and that of Semester III shall be combined with semester IV. There will be two experiment of 6 hrs. duration each, selecting one from each lab for two days. The distribution of marks will be as follows:

1. Two experiments(each of 120 marks) - 240 marks
2. Viva voce - 80 marks
3. Record - 80 marks
   TOTAL - 400 marks

Workload:
Each theory paper must be given 4 hrs. per week for theory. Practical must be given 20 hrs. per week per batch. Each laboratory batch for practical must not be of more than 10 students.
Criteria to Pass: The number of papers and the maximum marks for each paper/practical are shown in the scheme above. It will be necessary for a candidate to pass in the theory as well as in the practical part of a paper/subject separately.
A candidate for a pass at each of the Semester Examinations shall be required to obtain
(i) at least 36% marks in the aggregate of all the papers prescribed for the examination* and
(ii) at least 36% marks in Combined practical examination each year,
*provided that if a candidate fails to secure at least 25% marks in each individual paper at the examination and also in the Project work/Seminar, wherever prescribed, he/she shall be deemed to have failed at the examination notwithstanding his/her having obtained the minimum percentage of marks required in the aggregate for the examination.
(iii) Division shall be awarded only at the end of the examination of the final semester on the combined marks obtained in all semesters taken together, as noted below:
First division: on $\geq$ 60% marks and
Second division: on $\geq$ 48% marks.
(iv) Due Paper: If a candidate passes only in 2 papers in Semester I or III or in 3 papers in Semester II or IV, he/she will be allowed to appear in the due paper only with the students appearing in the same paper next year.

(v) Division after due paper: If a candidate clears any paper(s) prescribed for a semester's examination after a continuous period of three years, then for the purpose of working out his/her division the minimum passing marks only viz. 25% (36% in case of practical) shall be taken into account in respect of such paper(s)/practical(s) cleared after expiry of the aforesaid period of three years; provided that in case where a candidate requires more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him/her will be taken into account as would enable him/her to make up the deficiency in the requisite minimum aggregate.

Note: Non collegiate candidates are not eligible to appear in the examination, where practical is involved.

COURSE DETAIL - FIRST SEMESTER

Paper -I Classical Mechanics **3 hrs duration** **100 marks**

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Constraints, holonomic and non-holonomic constraints, D'Alembert's Principle andLagrange's Equation, velocity dependent potentials, simple applications of Lagrangian formulation. Hamilton Principle, Calculus of Variations, Derivation of Lagrange's equation from Hamilton's principle. Extension of Hamilton's Principle for non-conservative and non-holonomic systems, Method of Lagrange's multipliers, Conservation theorems and Symmetry Properties, Noether's theorem. Conservation of energy, linear momentum and angular momentum as a consequence of homogeneity of time and space and isotropy of space.

UNIT-II

Generalized momentum, Legendre transformation and the Hamilton's Equations of Motion, simple applications of Hamiltonian formulation, cyclic coordinates, Routh's procedure, Hamiltonian Formulation of Relativistic Mechanics, Derivation of Hamilton's canonical Equation from Hamilton's variational principle. The principle of least action.

UNIT-III

Canonical transformation, integral invariant of Poincare: Lagrange's and Poisson brackets as canonical invariants, equation of motion in Poisson bracket formulation. Infinitesimal contact transformation and generators of symmetry, Liouvilee's theorem, Hamilton-Jacobi equation and its application.

Action angle variable adiabatic invariance of action variable: The Kepler problem in action angle variables, theory of small oscillation in Lagrangian formulation, normal coordinates and its applications.

Reference Books:

(1)Herbert Goldstein -Classical Mechanics, Narosa Publishing House

(2)Landau and Lifshitz -Classical Mechanics
(3)A. Raychoudhary -Classical Mechanics

Paper -II Classisical Electrodynamics (I) 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Electrostatics: Electric field, Gauss Law, Differential form of Gaussian law. Another equation of electrostatics and the scalar potential, surface distribution of charges and dipoles and discontinuities in the electric field and potential, Poisson and Laplace equations, Green's Theorem, Uniqueness of the solution with the Dirichlet or Neumann boundary Conditions, Formal Solutions of electro static Boundary value problem with Green's function, Electrostatic potential energy and energy density, capacitance.Boundary Value Problems in Electrostatics: Methods of Images, Point charge in the presence of a grounded conducting sphere, point charge in the presence of a charged insulated conducting sphere, point charge near a conducting sphere at a fixed potential, conducting sphere in a uniform electric field by method of images, Green's function for the sphere, General solution for the potential, conducting sphere with hemispheres at different potentials.

UNIT-II

Multipoles, electrostatics of Macroscopic Media Dielectric: Multipole expansion, multipole expansion of the energy of a charge distribution in an external field, Elementary treatment of electrostatics with permeable media. Boundary value problems with dielectrics. Molar polarizability and electric susceptibility. Models for molecular polarizability, electrostatic energy in dielectric media.

Magnetostatics: Introduction and definition, Biot and Savart Law, the differential equations of magnetostatics and Ampere's law, Vector potential and magnetic induction for a current loop, Magnetic fields of a localized current distribution, Magnetic moment, Force and torque on and energy of a localized current distribution in an external magnetic induction, Macroscopic equations, Boundary conditions on B and H. Methods of solving Boundary value Problems in magnetostatics, Uniformly magnetized sphere, magnetized sphere in an external fields,permanent magnets, magnetic shielding, spherical shell of permeable material in an uniform field.

UNIT-III

Time varying fields, Maxwell's equations conservation laws:Energy in a magnetic field, vector and scalar potentials, Gauge transformations, Lorentz gauge, Coulomb gauge, Green function for the wave equation, Derivation of the equations of Macroscopic Electromagnetism, Poynting's Theorem and conservation of energy and momentum for a system of charged particles and EM fields. Conservation laws for macroscopic media. Electromagnetic field tensor.

Reference Books:

1.J.D. Jackson: Classical Electrodynamics
2.Panofsky & Phillip: Classical electrodynamics and magnetism
3.Griffith: Introduction to Electrodynamics
4.Landau & Lifshitz: Classical Theory of Electrodynamics
5.Landau & Lifshitz: Electrodynamics of continuous media

Paper -III Quantum Mechanics 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

(a)Origins of Quantum Physics : inadequacy of classical mechanics ,Particles versus Waves , Complementarity ,Principle of Linear Superposition , Indeterministic Nature of the Microphysical World

(b) Mathematical Tools of Quantum Mechanics :The Hilbert Space and Wave Functions, Dimension and Basis of a Vector Space , Dirac Notation ,Operators ,Hermitian Adjoint ,Projection Operators , Commutator Algebra, Uncertainty Relation between Two Operators ,Functions of Operators ,Inverse and Unitary Operators ,Eigenvalues and Eigenvectors of an Operator ,Infinitesimal and Finite Unitary Transformations ,Representation in Discrete Bases ,Matrix Representation of Kets, Bras, and Operators ,Change of Bases and Unitary Transformations ,Matrix Representation of the Eigenvalue Problem ,Representation in Continuous Bases ,Position Representation , Momentum Representation, Connecting the Position and Momentum Representations , Parity Operator ,Matrix and Wave Mechanics

UNIT-II

Postulates of Quantum Mechanics: The State of a System, Probability Density ,The Superposition Principle ,Observables and Operators ,Measurement in Quantum Mechanics , ,Expectation Values ,Complete Sets of Commuting Operators, Measurement and the Uncertainty Relations , Time Evolution Operator, Stationary States: Time-Independent Potentials ,Time Evolution of Expectation Values.

Angular Momentum: Orbital Angular Momentum ,General Formalism of Angular Momentum ,Matrix Representation of Angular Momentum ,Geometrical Representation of Angular Momentum ,Spin Angular Momentum ,Experimental Evidence of the Spin ,General Theory of Spin, Spin 1/2and the Pauli Matrices , Eigen functions of Orbital Angular Momentum

Addition of Angular Momenta: Addition of Two Angular Momenta-General Formalism ,Calculation of the Clebsch–Gordan Coefficients

UNIT-III

Three-Dimensional Problems: 3D Problems in Cartesian Coordinates ,The Harmonic Oscillator , 3D Problems in Spherical Coordinates ,Central Potential: General Treatment ,The Spherical Square Well Potential, The Isotropic Harmonic Oscillator

Identical Particles: Many-Particle Systems ,Interchange Symmetry ,Systems of Distinguishable Non interacting Particles ,Systems of Identical Particles ,Exchange Degeneracy ,Symmetrization Postulate ,Constructing Symmetric and Anti-symmetric Functions ,Systems of Identical Non-interacting Particles ,The Pauli Exclusion Principle

Reference Books:

Nouredine Zettili -----Quantum Mechanics: Concepts and Applications

Paper - IV Mathematical Methods in Physics 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Orthogonal curvilinear coordinates, scale factors, expressions for gradiant, divergence and curl and their applications to cartesian, cylinderical and spherical polar coordinate system,

Coordinate transformation, transformation of covariant, contravariant and mixed tensors. Addition , multiplication and contraction of tensors, quotient Law, pseudo tensors. Metric tensors and its use in transformation of Tensors.

UNIT-II

Vector spaces and Matrices:Linear independence, Bases;Dimensionality, Inner product, Linear transformation, Matrices,Inverse orthogonal and unitary matrices;Independent elements of a matrix; eigen values and eigen matrix; Diagnolization: complete orthonormal sets of functions.

Differential equations and special functions: Second order linear differential equation with variable coefficients, solution by series expansion, Legendre, Bessel, Hermite and Lagaurre equations, physical application, generating function,reccurance relations.

UNIT-III

Integral transforms:Laplace transform, First and second shifting theorems, inverse L T by partial fractions; LT derivative and integral of a function; Fourier series: FS of arbitary period; half wave expansion;Partial sums;Fourier integral and transforms, FT of a delta function

Reference books:

1. Mathematical Methods for Physicists: George Arfken (Academic Press)
2. Applied Mathematics for Engineers and Physicists: L. A. Pipe (McGraw Hill)
3. Mathematical Methods - Potter and Goldberg (Prentice Hall of India)
4. Elements of Group Theory for Physicists: A.W. Joshi (Wiley Eastern Ltd.)
5. Mathematical Physics by Satya Prakash
6. Mathemetical Physics by B.S. Rajput

Second Semester

Paper -V Classical Electrodynamics –II 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Plane Electromagnetic Waves and Wave Equation : Plane wave in a nonconducting medium. Frequency dispersion characteristics of dielectrics, conductors and plasma, waves in a conducting or dissipative

medium, superposition of waves in one dimension, group velocity, casualty connection between D and E. Kramers-Kroning relation.

Magnetohydrodynamics and Plasma Physics : Introduction and definitions, MHD equations, Magnetic diffusion, viscosity and pressure, Pinch effect, instabilities in pinched plasma column, Magnetohydrodynamics waves, Plasma oscillations, short wave length limit of plasma oscillations and Debye shielding distance.

UNIT-II

Covariant Form of Electrodynamic Equations : Mathematical properties of the space-time special relativity, Invariance of electric charge covariance of electrodynamics. Transformation of electromagnetic field. Radiation by moving charges : Lienard-Wiechert Potential for a point charge, Total power radiated by an accelerated charge : Larmour's formula and its relativistic generalization, Angular distribution of radiation emitted by an accelerated charge, Radiation emitted by a charge in arbitrary extremely relativistic motion. Distribution in frequency and angle of energy radiated by accelerated charges, Thomson scattering and radiation, Scattering by quasifree charges, coherent and incoherent scattering, Cerenkov radiation.

UNIT-III

Radiation damping, self fields of a particle, scattering and absorption of radiation by a bound system; Introductory considerations, Radiative reaction force from conservation of energy, Abraham Lorentz evaluation of the self force, difficulties with Abraham Lorentz model, Integro-differential equation of motion including radiation damping, Line Breadth and level shift of an oscillator, Scattering and absorption of radiation by an oscillator, Energy transfer to a harmonically bound charge.

Reference Books :

1. Classical Electrodynamics : Jackson
2. Classical Electricity and Magnetism : Panofsky and Philips.
3. Introduction to Electrodynamics : Griffiths.
4. Classical Theory of Field : Landan and Lifshitz.
5. Electrodynamics of Continuous Media : Landau and Lifshitz.

Paper -VI Atomic And Molecular Physics 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Gross structure of energy spectrum of hydrogen atom. Non degenerate first order perturbation method, relativistic correction to energy levels of an atom, atom in a weak uniform external electric field – first and second order Stark effect, calculation of the polarizability of the ground state of hydrogen atom and of an isotropic harmonic oscillator; degenerate stationary state perturbation theory, linear Stark effect for hydrogen atom levels, inclusion of spin orbit interaction and weak magnetic field, Zeeman effect, effect of strong magnetic field. Magnetic dipole interaction, hyperfine structure and Lamb shift (only qualitative description).

UNIT-II

Indistinguishability and exchange symmetry, many particle wave functions and Pauli’s exclusion principle, spectroscopic terms for atoms.The helium atom, Variational method and its use in calculation

of ground state energy. Hydrogen molecule, Heitler London method for hydrogen molecule. WKB method for one dimensional problem, application to bound states (Bohr Sommerfeld quantization) and the barrier penetration.

Spectroscopy (qualitative):General features of the spectra of one and two electron system – singlet, doublet and triplet characters of emission spectra, general features of alkali spectra. Rotation and vibration band spectrum of a molecule, P,Q and R branches. Raman spectra for rotational and vibrational transitions, comparison with infrared spectra – application to learning about molecular symmetry. General features of electronic spectra, Frank and Condon's principle.

UNIT-III

Laser cooling and trapping of atoms: The scattering force, slowing an atomic beam, chirp cooling, optical molasses technique, Doppler cooling limit, magneto optical trap. Introduction to the dipole force, theory of the dipole force, optical lattice. Sisyphus cooling technique – description and its limit. Atomic fountain. Magnetic trap (only qualitative description) for confining low temperature atoms produced by Laser cooling, Bose-Einstein condensation in trapped atomic vapours, the scattering length, Bose-Einstein condensate, coherence of a Bose-Einstein Condensate, The Atom Laser.

Reference Books :

1. G. Banewell – Atomic and Molecular spectroscopy
2. Christopher J. Foot – Atomic Physics, Oxford Master series, 2005
3. G.K. Woodgate, Elementray Atomic Structure, Second Edition Clarendon Press, Oxford.
4. T.A. Littlefield - Atomic and Molecular Physics.
5. Eistaberg and Rasmic- Quantum Physics of Atoms. Molecules Solids and Nuclear Particles.
6. Ashok Das and A.C. Melfessions. Quantum Mechanics; A Modem Approach (Gordon and Breach Science Publishers).
7. White - Atomic Spectra.
8. Herzberg- Molecular spectra.

Paper -VII Electronics 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Operational Amplifiers: Differential amplifier - circuit configurations - dual input balanced output differential amplifier- DC analysis, inverting and non-inverting inputs, CMRR-constant current bias level translator. Block diagram of typical OP-Amp analysis. Open loop configuration, inverting and non-inverting amplifiers, Op-Amp with negative feedback, voltage series feedback, effect of feed back on closed loop gain, input resistance, bandwidth and output offset voltage, voltage follower. Practical Op-Amp, input offset voltage-input bias current-input offset current, total output offset voltage, CMRR frequency response. DC and AC amplifier. integrator and differentiator.

O**scillators and wave shapping Circuits:** Oscillator Principle, Frequency stability response, the phase shift oscillator, Wein bridge oscillator, LC tunable oscillators, Multivibrators- Monostable, astable and bistable, Comparators, Square wave and triangle wave generation, clamping and clipping circuits.

UNIT-II

Digital Electronics: Combinational logic: Standard representations for logic functions, Karnaugh Map Representation of logical functions, Simplification of logical functions using K-Map, Minimization of Logical functions specified in Minterms / Maxterms or truth table, Don't care conditions, Adder (half and full), Subtractor (half and full), comparator, Multiplexers and their uses, Demultiplexer / Decoders and their uses. BCD arithmatics, Parity generators / Checkers, Code Converters, Priority Encoders, Decoder / Drivers for display devices, Seven Segment display device. ROM, Programmable Logic Array. Basic concepts about fabrication and characteristics of integrated circuits.

UNIT-III

Sequential Logic: Flip-Flops: one - bit memory, RS, JK, JK master slave, T and D type flip flops, shift resisters - synchronous and asynchronous counters, cascade counters, Binary counter, Decade counter. A/D and D/A conversion- Basic principles, circuitry and simple applications. Voltage regulators - fixed regulators, adjustable voltage regulators, switching regulators. Basic idea of IC 555 and its applications as multivibrator and sqaure wave generator. Opto-electronic Devices: Photo diode, Phototransistor, Light emitting Diode and their applications

Reference Books:

1. "Electronic Devices and Circuit Theory" by Robert Boylested and Louis Nashdsky, PHI, New Delhi - 110001, 1991.
2. "OP-AMP and Linear Integrated Circuits" by Ramakanth, A. Gayakwad, PHI, Second Edition 1991.
3. "Digital Principle and Applications" by A.P. Malvino and Donald P. Leach, Tata McGraw Hill Company, New Delhi, 1993.

Paper -VIII Numerical methods and Computer Programming 3 hrs duration 100 marks

Note: Syllabus of each question paper is divided into three units. The question paper is divided into three parts: Part-A, Part-B and Part-C (total 100 Marks).

Part-A (30 Marks) is compulsory and contains 10 questions (50 words each). At least three questions will be set from each unit. Each question carries 3 marks.

Part-B (25 Marks) 9 questions (100 words each) will be set taking 3 from each unit and candidate is required to attempt 5 questions taking at least one question from each unit but not more than 2 from any unit. Each question carries 5 marks.

Part-C (45 Marks) contains 06 questions two from each unit. Candidate is required to attempt three questions taking one from each unit. Each question carries 15 marks (400 words).

UNIT-I

Errors in Numerical Analysis: Source of Errors, Round off error, Computer Arithmetic, Error Analysis, Condition and stability, Approximation, Functional and Error analysis, the method of Undetermined Coefficients. use of interpolation formula, Iterated interpolation, Inverse interpolation, Hermite interpolation and Spline interpolation, Solution of Linear equations : Direct and Iterative methods, Calculation of eigen values and eigen vectors for symmetric matrices.

UNIT-II

Solution of Nonlinear equation : Bisection method, Newton's method, modified Newton's method, method of Iteration, Newton's method and method of iteration for a system of causation Newtons' method for the case of complex roots. Integration of a function. Trapezoiddal and Simpson's rules. Gaussian quadrature formula, Singular integrals, Double integration.

Integration of Ordinary differential equation : Predictor-corrector methods, Runga-Kutta method. Simultaneous and Higher order equations. Numerical Integration And Differentiation of Data, Least-Squares Approximations, Fast Fourier Transform.

UNIT-III

Programming in C: Character set, variables and constants, keywords, Instructions, assignment statements, arithmetic expression, comment statements, simple input and output, Boolean expressions, Relational operators, logical operators, control structures, decision control structure, loop control structure, case control structure, functions, subroutines.

Arrays and strings, structures, array of structures, Unions of structures, operations on bits, usage of enumerated data types. Bit-fields, Pointers to Function, Function returning Pointers.

Reference Books: 1. A Ralston and P. Rabinowitz: A First Course in Numerical Analysis, McGraw Hill (1985).

2. S.S. Sastry : Introductory Methods of Numerical Analysis, Prentice-Hall of India (1979).

3. Robert W. Sebesta: Concepts of Programming Language, Addison Wesley, Pearson Education Asia, 1999.

4. Deitel and Deitel: How to Program C, Addison Wesley, Pearson Education Asia, 1999.

5. Bryon Gottfried, Programming with C, McGraw Hill International.

M.Sc. I & II Semester Laboratory/ Practical Syllabus.

Note:- Students are required to perform at least eight experiments from the general laboratory and eight-experiments from Electronics Lab/General & Computer Lab. Total number of experiments to be performed by the students during the I & II Semester should be at least 16. Few experiments other than listed below, may be set at the college level, but at par with the standard of M.Sc. class.

Group: A

1. To use a Michelson Interferometer to determine:
   (I) the wave length of sodium yellow light
   (II) the difference between the wave lengths of the two sodium D-lines.
   (III) the thickness of a mica sheet.
2. To test the validity of the Hartmann's prism dispersion formula using the visible region of mercury spectrum.
3. To find the refractive index of air by means of a Fabry-Perot Etalon, the thickness between the plants being given.
4. Determination of wave length of Neon light taking Hg source as a standard source applying Hartmann formula.
5. Determine Stetan's constant.
6. X-ray diffraction by Telexometer.
7. Determination of Ionization potential of Lithium.
8. Determination of e/m of electron by Normal Zeeman Effect.
9. Determination of dissociation energy of Iodine (**I**) molecules by photography, the absorptions band of I in the visible region.
10. Using He-Ne laser light.
    (I) Measure of wavelength with the help of ruler.
    (II) Measure the thickness of the wire.
11. Testing goodness of fit of Poisson distribution to cosmic ray busts by Chi-square test.
12. To study Faraday effect using He-Ne laser.

Group: B Electronics Lab

1. Design of a Regulated Power supply.
2. Design of a Common Emitter Transistor Amplifier.
3. Experiment of Bias Stability.
4. A Stable, Monostable and Bistable Multivibrators.
5. Characteristics and applications of Silicon Controlled Rectifier.

6. Experiment on FET and MOSFET characterization and application as an amplifier.
7. Experiment on Uni-junction Transistor and its application.
8. Digital I : Basic Logic Gates, TTL, NAND and NOR.
9. Digital II : Combinational logic.
10. Flip-Flops.
11. Operational Amplifier (741)
12. Differential Amplifier.
13. Programming Exercises in FORTAN/C (Based on theory syllabus paper-VIII)
14. Simple Programming Exercises based on assembly language for microprocessor 8085.

Tutorial: Laboratory Practical Course-M.Sc. (I & II semester) Physics (Any eight)

1. Network Analysis-Thevenin and and Nortan's equivalent circuits.
2. Basics of P.N junction-Diffusion current Drift current, Junction width, Forward and reverse biasing. significance of Fermi level in stabilizing the junction.
3. Zener Diode-characteristics and voltage regulation.
4. Transistor biasing and stability.
5. Wein's bridge and phase shift oscillators.
6. Solving Boolean expressions.
7. Mechanism and production of electrical pulse through absorption of nuclear radiation in medium.
8. Dead time efficiency. counting techniques, energy resolution.
9. Lattice extinctions in X-ray diffraction.
10. Atomic scattering power and geometrical structure factor.
11. Effect of capacitance and load resistance on output of an amplifier.
12. Integrated circuit timer familiarization.
13. Op-amp differentiator.
14. Multiplexers and Demultiplexers.
15. Resistors and counters.
16. Radiation level and activity measurement.
17. Shielding, mass absorption coefficient.
18. Coincidence circuits. counters timers.
19. Coherence and its relevance in diffraction.
20. Identification of charge type by Hall voltage measurement.
21. How does four probe method solve the problem of contact resistance?