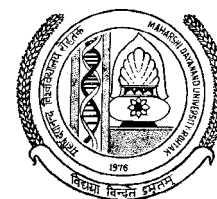# Maharshi Dayanand University
Rohtak

Ordinance, Scheme of Examination &
Syllabi of M.Sc. Physics
Reading for
(I & IInd Semester)

Session - 2008-2009

ORDINANCE : MASTER OF SCIENCE (PHYSICS) EXAMINATION

1. Two year Master of Science in Physics examintion shall be held in four semesters. Theory examination shall be held at the end of each semester.

2. The examination for I & III semester shall be held ordinarily in the month of December and for II & IV semester in the month of May. A supplementary examination in Semester III & IV of M.Sc. (Physics) will be held ordinarily in March for those candidates who have passed all the papers of semester I & II examination but have got 'reappear' or have failed or want to improve their score in paper(s) of semester III & IV examination. However, total number of chances will not exceed given in the ordinance.

3. The last date of the receipt of admission form and fee, without late fee as fixed by the Vice-Chancellor, shall be notified to the Heads of the University Teaching Departments and the colleges concerned.

4. A candidate's admission form and fee may be accepted after the last date on payment of late fee as prescribed upto the date notified by the University.

Note :- *No late fee shall be charged if the admission form and fee are received within three working days of grace after the last date for the receipt of the same without late fee.*

5. No one shall be eligible to join the semester I class of M.Sc. (Physics) course, unless he has passed one of the following examinations :-

   a) B.Sc. (Hons) examination of this University with atleast 45% marks in the aggregate in Physics offered for the M.Sc. Course.

   b) B.Sc. (Pass) examination with atleast 50% marks in the aggregate.

   c) an examination of any other university recognized by the University as equivalent to (a) or (b) above.

   Provided that :

   i) To be eligible to join M.Sc. Course in Physics, a candidate must have passed B.Sc. Examination with Physics and Mathematics as two of the main subjects.

Note : A candidate who is placed under compartment in the qualifying examination shall not be allowed to join M.Sc. Course. He/ She will be eligible only after clearing the qualifying examination.

6.1. A candidate who has failed in one or more papers or fails to appear in the examination shall be allowed two additional subsequent chances only to pass the examination.

6.2 A candidate who fails to pass the M.Sc. examination within a period of four years of his admission to the course shall be deemed to be unfit for postgraduate studies in the subject of Physics.

6.3 A person who has passed the M.Sc. I & III semester examination in the subject of Physics from this University shall be eligible to join the M.Sc. Physics II/IV semester. This is subject to Clause 6.2 above. However the candidate who have passed atleast two theory papers out of four will be promoted to next semester provisionally.

7. M.Sc. Physics examination in semester I-IV shall be open to a student who :-

   a) has passed the requisite qualifying examination or is covered under Clause-6 and

   b) has his name submitted to the controller of examinations by the head of the University Department/Principal of the college.

He has most recently attended and produces the following certificates signed by him :-

i) of possessing good character.

ii) of having remained on the rolls of the Department/College during the semester preceding the examination.

iii) of having attended not less than 65% of full course of lectures and tutorial separately and 75% of practicals in each part the course to be counted upto the last day when the classes break up for the preparatory holidays.

8. A candidate whether a regular student or an ex-student shall submit his admission application to the Registrar/Controller of examination duly signed by the Principal of the College/Head of the University Department he has last attended.

9. Every candidate shall be examined according to the Scheme of examination and syllabus as approved by the Academic Council from time to time.

10. The amount of Examination fee to be paid by a candidate for each part shall be as prescribed from time to time.

Note : A candidate who re-appears in one or more theory or practical papers for the purpose of passing the examination or a candidate who appears in one or more theory papers for the purpose of improvement of score of marks/result shall pay fee as for the whole examination.

11. The medium of instructions and examination shall be English.

12.1 The minimum number of marks required to pass the examination shall be as under :-

i) 33% in each paper (written and practical) separately;

ii) 40% in aggregate.

12.2. A candidate who has completed the prescribed course of instructions in a college/University Teaching Department for

I/II/III/IV semester examination but has not appeared in it or have appeared fails may be allowed on the recommendation of the Principal of the college/Head of University teaching department concerned to appear in the subsequent years in the examination paper(s) as the cases may be without attending a fresh course of instructions while reappearing in the examination, the candidates shall be exempted from re-appearing in the paper(s) and/or practical(s) in which he has obtained atleast 40% marks.

13. As soon as possible, after the termination of the examination the Registrar/Controler of Examinations shall publish the result of the candidates and issue Detailed Marks Card.

14. The result of candidates who have passed M.Sc. examination shall be classified into divisions, as under and the division obtained by the candidate will be stated in this degree.

a) Those who obtain 60%   First Division
or more marks

b) Those who obtain 50% or   Second Division
more but less than 60% marks

c) All below 50%   Third Division
(Subject to Clause 12.1)

15. A candidate who has already passed the Master of Science (Physics) examination from this University may appear in one or more optional/Special paper(s) of Physics at an subsequent examination when held as a regular student only. The examination fee shal be as prescribed from time to time.

Such a candidate shall in order to pass, be required to obtain atleast 40% marks in each paper in theory and practical separately.

16. A person who has passed the M.Sc. I and II semester examinations of this University will be allowed to appear as

an ex-student in the M.Sc. I & IInd semester examinations for improvement alongwith M.Sc. III & IV examinations respectively, only once, in one ore more theory paper(s) within a period of 3 years of passing M.Sc. I & IInd Semester.

A person who has passed the M.Sc. examination of this University and desirous of improving his score of marks will be allowed to appear as an ex-student in the M.Sc. III and IV semester examinations, for improvement only one in one more theory paper(s) within a period of two years of his passing the M.Sc. Physics examination. In all a candidate will be allowed to avail one chance within the period specified above. Improvement in practical paper is not permissible.

The result of such a candidate shall be declared only if he improved his score of marks, by taking into account the marks obtained by him in the paper(s) in which he re-appeared and the marks obtained by him earlier in the remaining paper(s). The fact that the candidate has improved the division shall be mentioned in the Detail Marks Cards. If a candidate opts to appear in I to IV semester examination for the purpose of improvement but finds that he has improved the score of marks obtained by him in the I & II semester examination, he may not appear in the III & IV semester examination as the case may be and inform the Controller of Examinations for the declaration of his result.

Provided further that the candidate will take the examination according to the syllabus in force for the regular students for that examination.

17. Notwithstanding the integrated nature of this course which is spread over more than two semester, the Ordinance in force at the time a student joints the course shall held good only for the examination held during or at the end of the each semester and nothing in this ordinance shall be deemed to debar the

university from amending the Ordinance and the amending Ordinance, if any, shall apply to all students whether old or new.

18. Candidates admitted to M.Sc. Physics Course in 2007-08 are earlier shall be governed by the old rules. The new rules shall be applicable w.e.f. the admission of academic session 2008-09 for I and II semester and 2009-10 for III and IV semester.

M.Sc. Physics I & II Semester 2008-09

Ist Semester

Paper	Title	Marks
Paper-I	Mathematical Physics	80
	Internal Assessment	20
Paper-II	Classical Mechanics	80
	Internal Assessment	20
Paper-III	Quantum Mechanics I	80
	Internal Assessment	20
Paper-IV	Electronic Devices	80
	Internal Assessment	20
Paper-IX	Practicals	200
Paper-X	Practicals	200

IInd Semester

Paper-V	Statistical Mechanics	80
	Internal Assessment	20
Paper-VI	Quantum Mechanics II	80
	Internal Assessment	20
Paper VII	Nuclear and Particle Physics	80
	Internal Assessment	20
Paper-VIII	Atomic and Molecular Physics	80
	Internal Assessment	20
Paper-IX	Practicals	200
Paper-X	Practicals	200

M.Sc. Physics III & IV Semester 2008-09

IIIrd Semester

Paper-XI	Computational methods and Programming	80
	Internal Assessment	20
Paper-XII	Special Paper from Group A	80
	Internal Assessment	20
Paper-XIII	Elective Paper	80
	Internal Assessment	20
Paper-XIV	Special Paper from Group B	80
	Internal Assessment	20
Paper-XIX	Practicals	200
Paper-XX	Practicals	200

IVth Semester

Paper-XV	Electro dynamics and Wave Propagation	80
	Internal Assessment	20
Paper-XVI	Condensed Matter Physics	80
	Internal Assessment	20
Paper-XVII	Special Paper from Group C	80
	Internal Assessment	20
Paper XVIII	Special Paper from Group D	80
	Internal Assessment	20
Paper XIX A	Practicals	100
Paper XIX B	Practicals	100
Paper XX	Practicals	200

Note : Break up of internal assessment marks :

Two theory paper :	10 marks (5 marks each)
Attendance :	5 marks
Assignment/term paper : & presentation	5 marks
Total :	20 marks

Note :

The M.Sc. Physics programme will be of four semesters (two years) duration. The theory examination will be held at the end of each semester. There will be four theory papers in each semester. The two practical laboratory courses (Paper IX and X) will run at the same time in semester I and II. Similarly the two practical laboratory courses (Paper XIX A & B and XX) will run simultaneously in semester III and IV. The practical examination will be held at the end of semester II and IV. No elective/special paper shall be offered unless the number of students opting for particular paper equals are exceeds ten. Elective papers/Special papers will be offered according to the availability of the teachers in the department.

The distribution of percentage marks in practical papers (IX, X, XIX & XX) will be as follows:

Experiment	60%
Viva	20%
Seminar	10%
Laboratory Report	10%
Total	100%

Elective Papers (One of the following will be offered by the Department depending on the availability of expertise.

EI. 1.	Quantum Electrodnamics
EI. 2.	Physics of Liquid Crystals.
EI. 3.	Science and Technology of solar hydrogen and other renewable energies.
EI. 4.	Reactor Physics.
EI. 5.	Numerical Methods and Programming.
EI. 6.	Physics of Laser and Laser applications.
EI. 7.	Structure, Spectra and Properties of Bio-Moleculars.
EI. 8.	Diagram Techniques.
EI. 9.	Physics of Electronic Devices & Fabrication of IC and Systems.
EI. 10.	Atmospheric Science.
EI. 11.	Plasma Physics
EI. 12.	Quantum Many-body Physics.
EI. 13.	Non-linear dynamics.
EI. 14.	Environmental Physics.
EI. 15.	Physics of Nano-materials.
EI. 16.	Solid State Electronics.

Special Papers (The students must choose one special paper each from group A, B, C, and D).

Group A

A1.	Condensed matter Physics-I.
A2.	Digital Electronics.

A3.   Nuclear and Particle Physics I.

A4.   Atomic and Molecular Physics-I

A5.   Informatics-I.

Group B

B1.   Condensed Matter Physics-II

B2.   Electronics I

B3.   Nuclear and Particle Physics II.

B4.   Atomic and Molecular Physics-II

B5.   Informatics-II.

Group C

C1.   Condensed Matter Physics-III

C2.   Electronics II

C3.   Nuclear and Particle Physics III.

C4.   Atomic and Molecular Physics-III.

C5.   Informatics-III.

Group D

D1.   Condensed Matter Physics-IV

D2.   Electronics III

D3.   Nuclear and Particle Physics IV

D4.   Atomic and Molecular Physics-IV

D5.   Informatics

M.Sc Physics I Semester Paper-I
MATHEMATICAL PHYSICS

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   Vector spaces and Matrices

Definition of a linear vector space, Linear independence, basis and dimension, scalar Product, Orthonormal basis, Gram-Schmidt Orthogonalization process, Linear operators, matrics, Orthogonal, Unitary and Hermitian matrices, Eigenvalues and eigenvectors of matrices, matrix diagonalization.

Unit -II   Differential equations

Second order linear differential equation with variable coefficients, ordinary point, singular point, series solution around an ordinary point, series solution around a regular singular point; the method of Frobenius, Wronskian and getting a second solution, Solution of Legendre's equation, Solution of Bessel's equation, Solution of Laguarre and Hermite's equations.

Unit -III   Special Functions

Definition of special functions, Generating functions for Bessel function of integral order $J_n(x)$, Recurrence relations, Integral representation; Legendre polynomials $P_n(x)$, Generating functions for $P_n(x)$, Recurrence relations; Hermite Polynomials, Generating functions, Rodrigue's formula for Hermite polynomials; Laguerre polynomials, Generating function and Recurrence relations.

Unit -IV   Integral Transforms

Integral transform, Laplace transform some simple properties of Laplace transforms such as first and second shifting property, Inverse Laplace Transform by partial fractions method, Laplace transform of derivatives, laplace Transform of integrals, Fourier series, Evaluation of coefficients of Fourier series Cosine and Sine series, Fourier Transforms, Fourier sine Transforms, Fourier cosine Transforms.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Mathematicsl Physics by P.K. Chattopadhyay (T)
Mathematics Physics by B.S. Rajput
Matrices and Tensors for Physicists, by A W Joshi.
Mathematicsl Physics by Mathews and Walkers.
Mathematics for Physics by Mary L Boas.

M.Sc Physics I Semester Paper-II
CLASSICAL METHANICS

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   Survey of Elementary Principles and Lagragian Formulation.

Newtonian mechanics of one and many particle systems; conservation laws, work-energy theorem; open systems (with variable mass), constraints, their classification; D'Alembert's principle, Lagrange's equations; dissipative forces generalized coordinates and momenta; integrals of motion; symmetries of space and time and their connection with conservation laws; invariance under Galilian transformation.

Unit -II   Moving coordinate systems and Motion in a central force field.

Rotating frames; intertial forces; terrestrial applications of coriolis force. Central force; definition and characteristics; two body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's Laws and equations; artificial satellites; Rutherford scattering.

Unit -III   Variational Principle, Equation of motion and Hamilton-Jacobi Equation

Principle of least action; derivation of equations of motion; variation and end points; Hamilton's principle and characteristic functions; Hamilton-Jacobi equation.

Unit -IV   Small Oscillations and Canonical Transformations.

Canonical transformations; generating functions, properties of Poisson bracket, angular momentum Poisson brackets; small oscillations; normal modes and coordinates.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Classical Mechanics by N C Rana and P S Joag (Tata Mcgraw Hill, 1991)
Classical Mechanics by H Goldstein (Addison Wesley, 1980).
Mechanics by A Sommerfeld (Academic Press, 1952).
Introduction to Dynamics by I Perceival and D Richards (Cambridge University Press, 1982).

M.Sc Physics I Semester Paper-III
QUANTUM MECHANICS-I

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   General formalism of Quantum Mechanics :

Representation of States and dynamical variables; Linear vector space; Bra Ket Notation, Linear operators; Orthonormal set of vectors,

Completeness relation; Hermitian operators, their eigenvalues and eigenvectors, The fundamental commutation relation; Commutation rule and the uncertainty relation; Simultaneous eigenstates of commuting operators; The unitary transformation; Dirac delta function; Relation between kets and wave functions; Matrix representation of operators; Solution of linear harmonic oscillator problem by operator methods.

Unit -II   Angular momentum operator :

Angular momentum operators and their representation in spherical polar co-ordinates; Eigenvalues and eigenvectors of L^2, spherical harmonics; Commutation relations among L_x L_y L_z ; Rotational symmetry and conservation of angular momentum; Eigenvalues of J^2 and J_z and their matrix representation; Pauli spin matrices; Addition of angular momentum.

Unit -III   Solution of Schrodinger equation for three dimensional problems :

The three dimensional harmonic oscillator in both cartesian and spherical polar coordinates, eigenvalues eigenfunctions and the degeneracy of the states; Solution of the hydrogen atom problem, the eigenvalues eigenfunctions and the degeneracy.

Unit -IV   Perturbation Theory

Time independent perturbation theory; Non degenerate case, the energies and wave functions in first order the energy in second order; Anharmonic perturbations of the form x^3 and x^4; Degenerate perturbation theory; Stark effect of the first excited state of hydrogen.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Quantum Mechanics by Ghatak and Loknathan
Quantum Mechanics by Powell and Craseman
Quantum Mecyhanics by S. Gasiorowicz

Quantum Mechanics by A.P. Messiah
Modern Quantum Mechanics by J.J. Sakurai
Quantum Mechanics by L.I. Schiff
Quantum Mechanics by Mathews and Venkatesan.

M.Sc. Physics I Semester Paper-IV
ELECTRONIC DEVICES

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   Transistors :

Bipolar junction Transistor (BJT) Transistor operating modes, Transistor action, Transistor biasing configurations and characteristics, Transistor ratings, The Moll model, Field Effect Transistors: Junction Field Effect Transistor (JFET), Metal Oxide Semiconductor Field Effect Transistor (MOSFET) FET Parameters.

Unit -II   Integrated circuits and Their Fabrications

Types of Integrated Circuits, Analog and Digital Integrated Circuits, Semiconductor Fabrication; Planar Technology, Fabrication of Monolithic, Integrated Circuits, Monolithic Passive and Active Circuit components, Typical IC Low Frequency Amplifier, New Technology Trends.

Unit -III   Photoelectric and other Electronic Devices :

Zener Diode, Power Diode, Photodiode, Varactor Diode, Light Emitting Diode (LED), Piezo-electric Crystals, Diode Lasers, Condition for Laser Action, Optical Gain, Memory Devices; Random Access Memory.

Unit -IV   Negative Resistance Devices

Tunnel Diode, Backward Diode, Unijunction Transistor, p-n-p-n devices, p-n-p-n characteristics Thyristor, Silicon Controlled switch, SCS Characteristics, Addition four Layer Devices.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Semiconductor Devices- Physics and Technology by S.M. Sze, Wiley (1985).
Introduction to Semiconductor Devices by M.S. Tyagi, John Wiley & Sons.
Measurement, Instrumentation and Experimental Design in Physics and Engineering by M. Sayer and A. Mansingh, Prentice Hall, India (2000).
Optical electronics by Ajoy Ghatak and K. Thygarajan, Cambridge University Press.
Semiconductor Electronics by A.K. Sharma, New Age International Publisher (1996).
Laser and Non-Linear optics by B.B.Laud., Wiley Eastern Limited (1985).
Pulse, Digital and Switching Waveforms by Jacob Millman and Herbert Taut, Mc Graw Hill Book Company (1965).

M.Sc Physics II Semester Paper-V
STATISTICAL MECHANICS

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

**Unit -I   **Phase space, Ensembles, Liouville theorem, conservation of extensions Equation of motion, Equal a priori probability, Statistical equilibrium, Microcanonical ensemble, Quantization of phase space, classical limit, symmetry of wave functions.

**Unit -II   **Entropy of an ideal gas, Gibbs paradox, Sackur-Tetrode equation, Entropy of a system in contact with a reservoir, Ideal gas in a canonical ensemble, Grand canonical ensemble, Ideal gas in Gran Canonical ensemble, Comparison of various ensembles.

Unit -III   Transition from classical statistical mechanics to quantum statistical mechanics, Indistinguishability and quantum statistics, identical particles and symmentry requirements, Bose Einstein statistics, Fermi Dirac statistics, Maxwell Boltzmann statistics. Bose Einstein Condensation, Thermal properties of B.E. gas, liquid Helium, Energy and pressure of F-D gas, Electrons in metals, Thermionic Emission.

Unit -IV   Cluster expansion for a classical gas, virial equation of state, Van der waals gas, Phase transition of second kind. Ising Model, Bragg Williams Approximation, Fowler Guggenhein Approximation, Ising Model in one and two dimensions, fluctuations in ensembles. Energy fluctuation in quantum statistics, Concentration fluctuation in quantum statistics, One dimensional random walk, Brownian motion.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Statistical Mechanics by K Huang
Statistical Mechanics by B.K. Aggarwal and M. Eisner
Statistical Mechanics by R.K. Patharia
Elementary Statistical Mechanics by Gupta and Kumar
Statistical Mechanics R Kubo
Statistical Physics Landau and Lifshitz.

M.Sc. Physics II Semester Paper-VI
QUANTUM MECHANICS-II

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   **Variational Methods :**

Ground state of Helium by both variational and perturbation methods; The hydrogen molecule; WKB approximation; Time dependent perturbation theory; Constant perturbation; Harmonic perturbation; Fermi's golden rule; Adiabatic and sudden approximation.

Unit -II   **Semiclassical theory of radiation:**

Transition probability for absorption and induced emission; Electric dipole transition and selection rules; Magnetic dipole transitions; Forbidden transitions; Higher order transitions; Einstein;s coefficients.

Unit -III   **Collision in 3D and scattering:**

Laboratory and C.M. reference frames; scattering amplitude; Differential scattering cross section and total scattering cross section; The optical theorem; Scattering by spherically symmetric potentials; Partial waves and phase shifts; Scattering by a perfectly rigid sphere and by square well potential; Complex potential and absorpiton; The Born approximation.

Unit -IV   **Idential Particles :**

The principle of indistinguishibility; Symmetric and antisymmetric wave functions; Spin and statistics of identical particles; The Slatter determinant; The pauli exclusion principle; Spin states of a two electron system; States of the helium atom; Collision of identical particles.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Quantum Mechanics by Ghatak and Liknathan
Quantum Mechanics by Powell and Crassman
Quantum Mechanics by S. Gasiorowicz
Quantum Mechanics by A.P. Messiah
Modern Quantum Mechanics by J.J. Sakurai
Quantum Mechanics by L.I. Schiff
Quantum Mechanics by Mathews and Venkatensan.

M.Sc. Physics II Semester Paper-VII
NUCLEAR AND PARTICLE PHYSICS

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   Two nucleon problem and nuclear forces :

The deuteron : binding energy, dipole moment quadrupole moment and the evidence of non-central (Tensor) force, spin dependence of nuclear force, ortho and para hydrogen scattering. Nucleon-nucleon scattering; s-wave effective range theory, charge independence and charge symmetry of nuclear forces, iso-spin formalism.

Unit -II   Nuclear Models :

Liquid drop model, stability of nuclei, fission; evidence of shell structure, the shell model spin parity and magnetic moment in extreme single particle model, evidence of collective excitations, collective vibration of a spherical liquid drop, rigid rotor model.

Unit -III   Nuclear decays and nuclear reactions :

Electromagnetic decays, selections rules, Fermi's theory of beta decay, selection rules, comparative half lines, Kurie plot Fermi and Gamow-Teller Transitions; Parity non-conservation in beta decay. Reaction cross section, compound nuclear reactions and direct reactions, the optical model, Breit-Winger resonance formula for $1=0$.

Unit -IV   Elementary Particle:

Basic interactions in nature: Gravitational Electromagnetic, weak and strong, classification of elementary particles, Leptons, Hadrons, Mesons, Baryons. Baryon, Lepton and Muon number, Strangeness and Hypercharge, Gelleman-Nishijima formula. Quark model, mesons and baryons as bound state of quarks, SU (2) and SU (3) groups and hadron classification; Intrinsic Parities of subatomic particles, charge conjugation, Time reversal.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

A . Bohr and B.R. Mottelson, Nuclear Structure, Vol. 1(1969) and Vol. 2 (1975).
Benjamin, Reading A, 1975.
Kenneth S. Kiane, Introductory Nuclear Physics, Wiley, New York, 1988.
Ghoshal, S.N. Atomic and Nuclear Physics Vol. 2.
P.H. Perkins, Introduction to High Energy Physics, Addison-Wesley, London, 1982.
A Preston and A Bhaduri: Nuclear Physics.
H. Frauenfelder and E. Henley : Subatomic Physics.

M.Sc. Physics II Semester Paper-VIII
ATOMIC AND MOLECULAR PHYSICS

Theory Marks : 80
Internal Assessment Marks : 20
Time : 3 Hrs.

Unit -I   One Electron systems and Pauli Principle :

Quantum states of one electron atoms, atomic orbitals, Hydrogen spectrum Pauli principle, spectra of alkali elements, spin orbit interaction and fine structure in alkali spectra, equivalent and non equivalent electrons.

Unit -II   The influence of external fields. Two electron system Hyperfine structure and Line broadening :

Normal and anomalous Zeeman effect, Paschen Back effect, Stark effect, Two electron systems, interaction energy in LS and jj coupling, Hyperfine structure (Magnetic and electric, only qualitative), general ideas of line broadening mechanics.

Unit -III   Diatomic molecules and their rotational spectra:

Types of molecules, Diatomic linear symmetric top, asymmetric top and spherical top molecules, Rotational spectra of diatomic molecules as a rigid rotator, energy levels and spectra of non-rigid rotor, intensity of rotational lines.

Unit -IV   Vibrational and Rotational Vibration spectra of Diatomic Molecules :

Vibrational energy of diatomic molecule, Diatomic molecules as a simple harmonic oscillator, Energy levels and spectrum, Morse potential energy curve, Molecules as vibrating rotator, vibration spectrum of diatomic molecules, PQR Branches.

Note :- The syllabus is divided into four units. Nine questions will be set in all. Question No. 1 will be compulsory having four to eight parts covering the whole syllabus. In addition there will be two questions from each unit and the student is to answer one question from each unit.

Text and Reference Books :-

Introduction to Atomic and Molecular Spectroscopy by V.K. Jain.
Introduction to Atomic Spectra by H.E. White.
Fundamentals of molecular spectroscopy by C.B. Banwell.
Spectroscopy Vol. 1 and II by Walker and Straughen.
Introduction to Molecular spectroscopy by G.M. Barrow.
Spectra of diatomic molecules by Herzberg.
Molecular spectroscopy by Jeanne. L. McHale.
Molecular spectroscopy by J.M. Brown.
Spectra of atoms and molecules by P.F. Bemath.
Modern spectroscopy by J.M. Holias.

M.Sc. Physics (I & II Semester)
LABORATORY/PRACTICAL COURSE
PAPER-IX

Maximum Marks : 200
Time : 4 Hrs.

1. Design/study of a Regulated Power Supply.
2. Design of a Common Emitter Transistor Amplifier.
3. Experiment on Bias Stability.
4. Negative Feedback (voltage series/shunt and current series/ shunt).
5. Astable, Monostable and Bistable Multivibrater.
6. Characteristics and applications of Silicon Controller Rectifier.
7. Testing goodness of fit of poison distribution to cosmic ray bursts by chi-square test.
8. Determination of Half Life of 'In'.
9. Determination of range of Beta-rays from Ra and Cs.
10. X-ray diffraction by Telexometer.
11. Determination of Ionization Potential of Lithium.
12. Determination of e/m of electron by Normal Zeeman Effects using Febry Perot Etalon.
13. Determination of Dissociation Energy of Iodine (I) Molecule by photography the absorption bands of I in the visible region.
    a) Measurement of Wavelength of He-Ne Laser light using ruler.
    b) measurement of thickness of thin wire with laser.
14. Study of Rectifiers and filter circuits.
15. Flashing of quenching of Neo gas.
16. Study of Network theorems.
17. Frequency variation in oscillagtors.
18. Frequency response of RC coupled Amplifier.
19. Temperature effect on a transistor amplifier.
20. e/m of electron by Helical method.

Setting of new experiments will form tutorial for this lab. Course.

M.Sc. Physics (I & II Semester)
LABORATORY/PRACTICAL COURSE
PAPER-X

Maximum Marks : 200
Time : 4 Hrs.

1.   Experiments on FET and MOSFET Characterization and application as an amplifier.
2.   Experiment on Uni-junction transistor and its application.
3.   Digital I : Basic Logic Gates, TTL, NAND and NOR.
4.   Digital II : Combinational Logic.
5.   Flip-Flops.
6.   Operational Amplifier (741).
7.   Differential Amplifier.
8.   Measurement of resistivity of a semiconductor by four probe method at different temperatures and Determination of band gap.
9.   Determination of Lande's factor of DPPH using Electron-Spin resonance (E.S.R.) Spectrometer.
10. Measurement of Hall coefficient of given semiconductor: Identification of type of semiconductor and estimation of charge carrier concentration.
11. To study the flourescence spectrum of DCM dye and to determine kthe quantum yield of fluoreescence maxima and full width at hall maxima for this dye using monochromator.
12. To study Faraday effect using He-Ne Laser.
13. Experiments on Prism/Granting spectrometer.
14. Characteristics of Photovoltic Cell.
15. Energy band gap of Ge Crystal.
16. Hall effect.
17. Dielectric constant of Liquids.
18. Magnetic susceptibility by Gauy's method.
19. B.H. Curve.
20. Experiments on G.M. counter.

Setting of new experiments will form tutorial for this lab. Course.