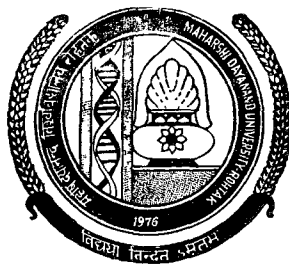


Maharshi Dayanand University Rohtak



Ordinances, Syllabus and Courses of Reading for M.Sc. (Prev.) Physics Examination

Session—2002-2003

Available from :

Deputy Registrar (Publication)

Maharshi Dayanand University

Rohtak-124 001 (Haryana)

Price :

At the Counter : Rs. 50/-

By Regd. Parcel : Rs. 75/-

By Ordinary Post : Rs. 60/-

ORDINANCE - 'MASTER OF SCIENCE EXAMINATION'

1. The Master of Science Examination shall be held in two parts. Part-I examination shall be held at the end of the first year and Part-II Examination at the end of the second year.
2. The Examination in Part-I and Part-II shall be held once a year ordinarily in the month of April on such dates as may be fixed by the Vice-Chancellor.
A supplementary examination in Part-II of M.Sc. will be held in December for those candidates who have passed all the papers of part-I examination but have got 'reappear' or have failed or want to improve their score in paper(s) of part-II examination. However, total number of chances will not exceed as given in the Ordinance.
3. The last date for 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 from time to time up to the date notified by the University.
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 first year (Part-I) class of M.Sc. Course unless he has passed one of the following examination:-
 - a) B.Sc. (Hons.) examination of this University with atleast 45% marks in the aggregate in the subject 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 recognised 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:

(ii)

- ii) to be eligible to join M.Sc. Chemistry, a candidates must have passed B.Sc. Examination with Chemistry as one of the main subject.

Note : A Minimum of 25% of the total seats shall be filled in by the students who have passed the B.Sc. Examination with Chemistry, Physics and Mathematics. Any seat remaining unfilled out of this quota may be offered to other eligible candidates

- iii) The eligibility condition for admission to M.Sc. courses shall be as follows :

Bio-Chemistry and Bio-Technology:

B.Sc. (Hons.) exam. of this university in the subject offered for the M.Sc. course or an examination of another University recognised as equivalent thereto with atleast 45% marks in the aggregate.

OR

B.Sc. (Pass) examination of this University or an examination of another University recognised as equivalent thereto with atleast 50% marks in the aggregate provided that a candidate must have passed B.Sc. examination with any three of the subjects Botany, Zoology, Chemistry, Microbiology, Genetics, Environmental Science, Medical Bio-Chemistry, Bio-Technology, Bio-Chemistry, Bio-Chemical Engineering, Fermentation Technology, Food Processing, Medical Laboratory Technology, Industrial Chemistry, Applied Haematology and Industrial Microbiology.

Note :

Out of the three subjects atleast one should be related to Biology.

OR

Bachelor degree with 50% marks in Pharmacy/Home Science/Agriculture/Veterinary Science from a recognised University.

M.Sc. (Previous) in Botany, Environmental Sciences, Genetics and Zoology.

- a) B.Sc. (Hons.) examination of this university in the subject offered for the M.Sc. course or an examination of another University recognised as equivalent thereto with atleast 45% marks in the aggregate.

(iii)

OR

- b) B.Sc. (Pass) examination of this University or an examination of another University recognised as equivalent thereto with atleast 50% marks in the aggregate provided that :
- i) to be eligible to join M.Sc. Botany, a candidate must have passed B.Sc. examination with Botany and any two of the subjects viz. Zoology, Chemistry, Microbiology, Environmental Science, Bio-Chemistry, Bio-Technology, Anthropology, Fisheries and Genetics.
 - ii) to be eligible to join M.Sc. Environmental Science a candidate must have passed B.Sc. examination with any three of the subjects viz. Botany, Zoology, Chemistry, Microbiology, Environmental Science, Bio-Chemistry, Bio-Technology, Anthropology, Fisheries and Genetics.
 - iii) to be eligible to join M.Sc. Genetics a candidate must have passed B.Sc. examination with any three of the subjects viz. Botany, Zoology, Chemistry, Microbiology, Environmental Science, Bio-Chemistry, Bio-Technology, Anthropology, Fisheries, Geology and Genetics.
 - iv) to be eligible to join M.Sc. Zoology, a candidate must have passed B.Sc. examination with Zoology and any two of the subjects viz. Botany, Chemistry, Microbiology, Environmental Science, Bio-Chemistry, Bio-Technology, Anthropology, Fisheries and Genetics.
- iv) conditions for admission to M.Sc. Course in Mathematics shall be same as prescribed for admission viz. M.A. Course in this subject.
- v) To be eligible to join M.Sc. Course in Geology, a candidate must have passed B.Sc. Examination with atleast 50% marks in the aggregate with Geology and any of two of the subjects viz. Physics, Mathematics, Chemistry, Botany, Zoology, Bio-Science and Geography;
- vi) to be eligible to join M.Sc. Course in

Mathematical Statistics and Operations Research a candidate must have passed B.A./B.Sc. (Pass) Examination with atleast 50% marks in the aggregate with Mathematics or Statistics as one of the subjects or have passed B.A./B.Sc. (Hons.) Examination in Mathematics or Statistics with atleast 45% marks in Mathematics/Statistics.

There shall be a Project Report in M.Sc. Mathematical Statistics (Final) and that the project report shall be evaluated by the external examiner on five point grading. The last date for submission of Project Report will be two months after the theory papers which can be extended further by two months with the permission of the Vice-Chancellor.

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 concerned.
- 6.3 A person who has passed the M.Sc. (Previous) examination in the subject concerned from this University shall be eligible to join the M.Sc. final class. This is subject to Clause-6.2 above. However, the candidate who have passed atleast two theory papers out of four or five theory papers or atleast three theory papers out of six or seven theory papers of part-I examination of this University will be promoted to Part-II Class provisionally.
7. M.Sc. Examination in Part-I/Part-II 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 year 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 dissertation/viva-voce where prescribed;
 - ii) 40% in aggregate.

- 12.2 A candidate who has completed the prescribed course of instructions in a college/University Teaching Department for Previous/Final 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 re-appearing 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/Controller 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% or more marks First Division
- b) Those who obtain 50% or more but less than 60% marks Second Division
- c) All below 50% Third Division.

15.1 A candidate who has passed M.Sc. Previous examination with atleast 55% marks may offer dissertation wherever prescribed in the Scheme of Examination for the course. The subject of dissertation shall to approved by the Head of Department concerned. A candidate shall submit to the Head of the University Department an application for the approval of the topic for the dissertation alongwith a synopsis within one month of his admission to M.Sc. (Final) examination.

Provided in the case of M.Sc, (Geology) exam. there shall be a dissertation based on days field work (surface mapping) in the M.Sc. Previous. The work of dissertation will be done in the M.Sc. previous and viva-voce examination of dissertation will be held at the end of M.Sc. previous alongwith practical examination. Provided further that the condition of obtaining 55% marks in M.Sc. previous examination, for offering dissertation in M.Sc. final shall not be applicable in the case of students of M.Sc. (Geology) course.

15.2 Every candidate who offers dissertation shall be required to submit three copies of his dissertation alongwith a brief abstract of the same giving an

(vii)

account of the Investigation research conducted and its main finding (which will not exceed 500 words). The dissertation shall be examined by one external examiner only.

15.3 The last date for receipt of the dissertation in the office of the Controller of Examinations shall be one month before the commencement of the theory examination : Provided that in exceptional cases; the Vice-Chancellor shall have the power to extend, on the recommendation of the Head of the Department the last date for receipt of the dissertation upto three months. If a candidate fails to submit the dissertation even during the extended period he will be considered to have absented in the dissertation paper and his result shall be declared accordingly.

15.4 A candidate who has submitted a dissertation as part of his examination may withdraw the same before it has been examined but once it is examined and the candidate obtains the minimum pass marks he shall not be permitted to withdraw it or submit another dissertation in lieu thereof. The marks obtained by him for the dissertation shall be taken into account when he appears in any future examination for the purpose of passing therein or for improving score of marks/result.

16. A candidate who has already passed the Master of Science examination from this University, in a subject in which different optional papers are permitted, may appear in one or more optional paper(s) of that subject at an subsequent examination when held as a regular student only. The examination fee shall 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.

17.1 A person who has passed the M.Sc. previous examinations of this University will be allowed to appear as an ex-student in the M.Sc. previous examinations for improvement alongwith M.Sc. final examinations respectively, only once, in one or more theory paper(s) within a period of 3 years of passing M.Sc. previous examination.

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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. final examinations, for improvement only once in one or more theory paper(s) within a period of two years of his passing the M.Sc. 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 improves 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 both previous and final examinations for the purpose of improvement but finds that he has improved the score of marks obtained by him in the previous examination, he may not appear in the final 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. Provided that the syllabus for the candidates for the special examination to be held in September/October shall be the same as was in force for the regular student in the last annual examination.

18. Notwithstanding the integrated nature of this course which is spread over more than one academic year, the Ordinance in force at the time a student joins the course shall held good only for the examination held during or at the end of the academic year and nothing in this ordinance shall be deemed to debar the University from amending the Ordinance and the amended Ordinance, if any, shall apply to all students whether old or new.
19. candidate admitted to M.Sc. Course in 1990-91 or earlier shall be governed by the old rules. The new rules shall be applicable w.e.f. the admission of academic Session 1991-92.

Maharshi Dayanand University, Rohtak

Annexure - I

Syllabi for M.Sc. Previous and Final

M.Sc. Physics (Previous)

Paper	Title	Marks
Paper-I	Mathematical Physics	100
Paper-II	Classical Mechanics	100
Paper-III	Quantum Mechanics I	100
Paper-IV	Electronic Devices	100
Paper-V	Quantum Mechanics II	100
Paper-VI	Statistical Mechanics	100
Paper-VII	Electrodynamics & Wave Propagation	100
Paper-VIII	Atomic and Molecular Physics	100
Paper-IX	Practicals	200
Paper-X	Practicals	200
		Total : 1200

M.Sc. Physics (Final)

Paper-I	Condensed Matter Physics	100
Paper-II	Nuclear and Particles Physics	100
Paper-III	Computational methods and Programming	100
Paper-IV	Elective Paper	100
Paper-V	Special paper 1 from Group A	100
Paper-VI	Special paper 2 from Group A	100
Paper-VII	Special paper 1 from Group B	100
Paper-VIII	Special paper 2 from Group B	100
Paper-IX	Practicals	200
Paper-X	Practicals	200
		Total : 1200

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

- EI. 1 Quantum Electrodynamics
- EI. 2 Physics of Liquid Crystals.

- El. 3 Science and Technology of solar hydrogen and other Renewable energies.
- El. 4 Reactor Physics
- El. 5 Numerical Methods and Programming
- El. 6 Physics of Laser and Laser applications.
- El. 7 Structure, Spectra and Properties of Bio-Molecules.
- El. 8 Diagram Techniques.
- El. 9 Physics of Electronic Devices & Fabrication of IC and Systems.
- El. 10 Atmospheric Science.
- El. 11 Plasma Physics.
- El. 12 Quantum Many-body Physics.
- El. 13 Non-linear dynamics.
- El. 14 Environmental Physics.
- El. 15 Physics of Nano-materials

Special Papers : (The students must choose two special papes from group A and two special papers from Group B).

Group A

- A1 Condensed matter Physics I.
- A2 Electronics I.
- A3 Atomic and Molecular Physics I.
- A4 Nuclear and Particle Physics I.
- A5 Informatics I
- A6 Condensed matter Physics II.
- A7 Electronics III
- A8 Atomic & Molecular physics III.
- A9 Nuclear and Particle Physics II.
- A10 Informatics III

Group B

- B1 Condensed matter Physics III.
- B2 Electronics II.
- B3 Atomic and Molecular Physics II.

- B4 Nuclear and Particle Physics III.
- B5 Informatics II
- B6 Condensed matter Physics IV.
- B7 Electronics IV.
- B8 Atomic & Molecular physics IV.
- B9 Nuclear and Particle Physics IV.
- B10 Informatics IV

M.Sc. (Previous) Paper-I
MATHEMATICAL PHYSICS

Max. Marks 100

Time : 3 Hours

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, Matrices, 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. Getting 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 functions and Recurrence relations.

Unit - IV Integral Transforms

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

Note : Question paper will consist of three sections. Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

Text and Reference Books

Mathematical Physics by P.K. Chattopadhyay (T)

Mathematical Physics by B.S. Rajput

Matrices and Tensors for Physicists by A.W. Joshi

Mathematical Physics by Mathews and Walkers

Mathematics for Physicists by Mary L. Boas

M.Sc. (Previous) Paper II

Classical Mechanics

Max. Marks : 100

Time ; 3 Hrs.

Unit I Survey of Elementary Principles and Lagrangian Formulation

Newtonian mechanics of one and many particle system; conservation laws, work-energy theorem; Open system (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, inertial 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 Law 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 transformation; generating functions, properties of Poisson bracket, angular momentum Poisson bracket, small oscillations; normal modes and coordinates.

Note: The examination on paper will consist of three sections. Section-I consisting of one question with ten parts each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set, selecting atleast two questions from each unit. Candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. Candidates will be required to attempt any three questions each of 15 marks.

Reference Books

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

M.Sc. (Previous) Paper III**Quantum Mechanics - I****Max. Marks : 100****Time : 3 Hrs.**

Unit I General formalism of Quantum Mechanics : States and operators; 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 independence perturbation theory; Non degenerate case, the energies and wave functions in first order, the energy in second order; Anharmonic perturbations of the form λx^3 and λx^4 ; Degenerate perturbation theory; Stark effect of the first excited state of hydrogen.

Note : Question paper will consist of three sections. Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

Text and Reference Books

1. Quantum Mechanics by Ghatak and Loknathan
2. Quantum Mechanics by Powell and Craseman
3. Quantum Mechanics by S. Gassiorowicz
4. Quantum Mechanics by N.P. Messiah
5. Modern Quantum Mechanics by J.J. Sakurai
6. Quantum Mechanics by L.L. Schiff
7. Quantum Mechanics by Mathews and Venkatesan

M.Sc. (Previous) Paper IV

Electronic devices

Max. Marks : 100

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 (MOSFE) 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 Photoelectre 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-l-p-n devices, p-n-p-n characteristics Thyristor. Silicon Controlled switch, SCS Characteristics, L Addition four layer Devices.

Note : Question paper will consist of three sections. Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

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.S. Sayer and A. Mansingh, Prentice Hall, India (2000)

Optical Electronics by Ajoy Ghatak and K. Thygarajan, Cambridge univ. 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 Taub, McGraw Hill Book Company (1965)

M.Sc. (Previous) Paper V
Quantum Mechanics - II

Max. Marks : 100

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 absorption; The Born approximation.

Unit IV Identical particles : The principle of indistinguishability; Symmetric and antisymmetric wave functions; Spin and Statistics of identical particles; The Slater determinant; The Pauli exclusion principle, Spin states of a two electron system; States of the helium atom; Collision of identical particles

Note : Question paper will consist of three sections.

Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

Text and Reference Books

1. Quantum Mechanics by Ghatak and Loknathan
2. Quantum Mechanics by Powell and Craseman
3. Quantum Mechanics by S. Gasiorowicz
4. Quantum Mechanics by N.P. Messiah
5. Modern Quantum Mechanics by J.J. Sakurai
6. Quantum Mechanics by L.L. Schiff
7. Quantum Mechanics by Mathews and Venkatesan

**M.Sc. (Previous) Paper VI
Statistical Mechanics****Max. Marks : 100****Time : 3 Hrs.**

Unit I The foundations of Statistical mechanics : Specifications of States of a System, The macroscopic and microscopic states, Contact between Statistics and thermodynamics, postulate of equal a priori probability, Further Contact between statistics and thermodynamics, The Classical ideal gas, the entropy of mixing, 'Gibb's paradox, The correct enumeration of microstates, Phase space, Trajectories and density of states, Liouville's Theorem.

Unit II Definitions of Ensembles : Microcanonical ensemble perfect gas.in Microcanonical ensemble, Canonical ensemble, Partition function for canonical ensemble, Thermodynamic functions for canonical ensemble, Grand canonical ensemble, Partition function for grand canonical ensemble, Thermodynamic functions for grand canonical ensemble, fluctuations in energy and volume.

Unit III Transition from classical statistical mechanics to quantum statistical mechanics : Indistinguishability and quantum statistics, identical particles symmetry requirements, Bose Einstein Statistics, Fermi Dirac statistics, Maxwell Boltzmann statistics, Thermodynamic interpretation of parameters α and β . Grand canonical ensembles and statistics, Bose Einstein Condensation.

Thermal properties of B.E. gas, liquid Helium , Energy and pressure F-D gas.

Unit IV Cluster expansion for a classical gas : Virial equation of state, Vander Waals gas, Ising Model, Bragg Williams Approximation, Fowler Guggenheim Approximation, Ising Model in one and two dimensions, Browman motion. The Fokker Planck Equation.

Note : Question paper will consist of three sections. Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

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 Physica Landan and Lifshitz

M.Sc. (Previous) Paper VII

Electrodynamics and wave propagation

Max. Marks : 100

Time : 3 Hrs.

Unit I Electrodynamics in four-vector notation : Review of four-vector and Lorentz transformation in four dimensional space; Conservation of charge and four current density; Electromagnetic field tensor in four dimensions

and Maxwell's equations; Lorentz invariants of electromagnetic fields. Dual field tensor; Wave equation for scalar and vector potentials and their solution. Transformation of electric and magnetic field vectors; Covariance of force equation.

Unit II Simple radiating systems : Field and radiation of a localized source; Oscillating electric dipole, Centre fed linear antenna; Lienard-Wiechert potential ; Electric and magnetic fields due to a uniformly moving charge and accelerated charge; Linear and circular acceleration and angular distribution of power radiated.

Unit III Radiative reaction : Radiative reaction force; Line breadth and level shift of an oscillator Scattering and absorption of radiation; Thompson scattering and Raleigh scattering; Normal and anomalous dispersion; Ionosphere; Propagation of electromagnetic wave through ionosphere; Reflection of electromagnetic waves by ionosphere; Motion of charged particles in uniform E and B fields; Time varying fields. Adiabatic invariants.

Unit IV Wave guides and Transmission lines : Fields at the surface of and within a conductor; wave guides. Modes in a rectangular wave guide; Attenuation in wave guides; Dielectric wave guides. Circuit representation of parallel plate transmission lines; Transmission line equations and their solutions. Characteristic impedance and propagation coefficient; Low radio frequency and transmission lines.

Note : Question paper will consist of three sections.

Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

Text and Reference Books

1. Classical Electrodynamics by J.D. Jackson
2. Introduction to Electrodynamics by D.J. Griffiths
3. Electromagnetic by B.B. Laud
4. Classical Electricity and Magnetism by Panofsky and Phillips
5. Fundamental of Electromagnetics by M.A. Wazed Miah

M.Sc. (Previous) Paper VIII

Atomic and Molecular Physics

Max. Marks : 100

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 : Question paper will consist of three sections. Section-I consisting of one question with ten parts of 2 marks each covering the whole syllabus shall be compulsory. In Section-II, 10 questions will be set selecting atleast two questions from each unit. The candidates will be required to attempt any seven questions each of five marks. In Section-III, five questions will be set, atleast one from each unit. The candidates will be required to attempt any three questions each of 15 marks.

Text and Reference Books

Introduction to Atomic Spectra by H.E. White
Fundamentals of molecular spectroscopy by C.B. Banwell
Spectroscopy Vol I 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