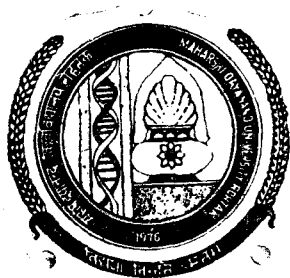


# Maharshi Dayanand University Rohtak



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

Session—1997-98

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*Available from :*

Deputy Registrar (Publication)  
Maharshi Dayanand University  
Rohtak-124001 (Haryana)

*Price :*

At the Counter : Rs. 20/-  
By Regd. Parcel : Rs. 30/-  
By Ordinary Post : Rs. 25/-

## **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 Rs. 105/- 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) to be eligible to join M.Sc. Chemistry, a candidate 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) to be eligible to join M.Sc. course in Bio-Science, a candidate must have passed B.Sc. Examination with Botony, Zoology, Bio-Sciences and any one of the subjects viz. Chemistry, Bio-Chemistry, Micro-Biology Fisheries and Geology.

**Note:** The candidates will be required to opt for Animal Sciences or Plant Sciences or Environmental Biology in M.Sc. final course which will be allowed after taking into consideration the performance of the candidate in M.Sc. previous examination. However, an indication to this effect will be required to be given by the candidate at the time of his admission.

- 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 Botony, 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 candidates 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 Examinations 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 follows:-

Regular student	Ex-student
Rs. 100/-	Rs. 110/-

**Note:-** Plus Rs. 20/- per practical subject.

*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;
  - iii) 40% in the 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 candidate 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 his 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 account of the Investigation research conducted and its main findings (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 Rs. 35/- each paper.

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.

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

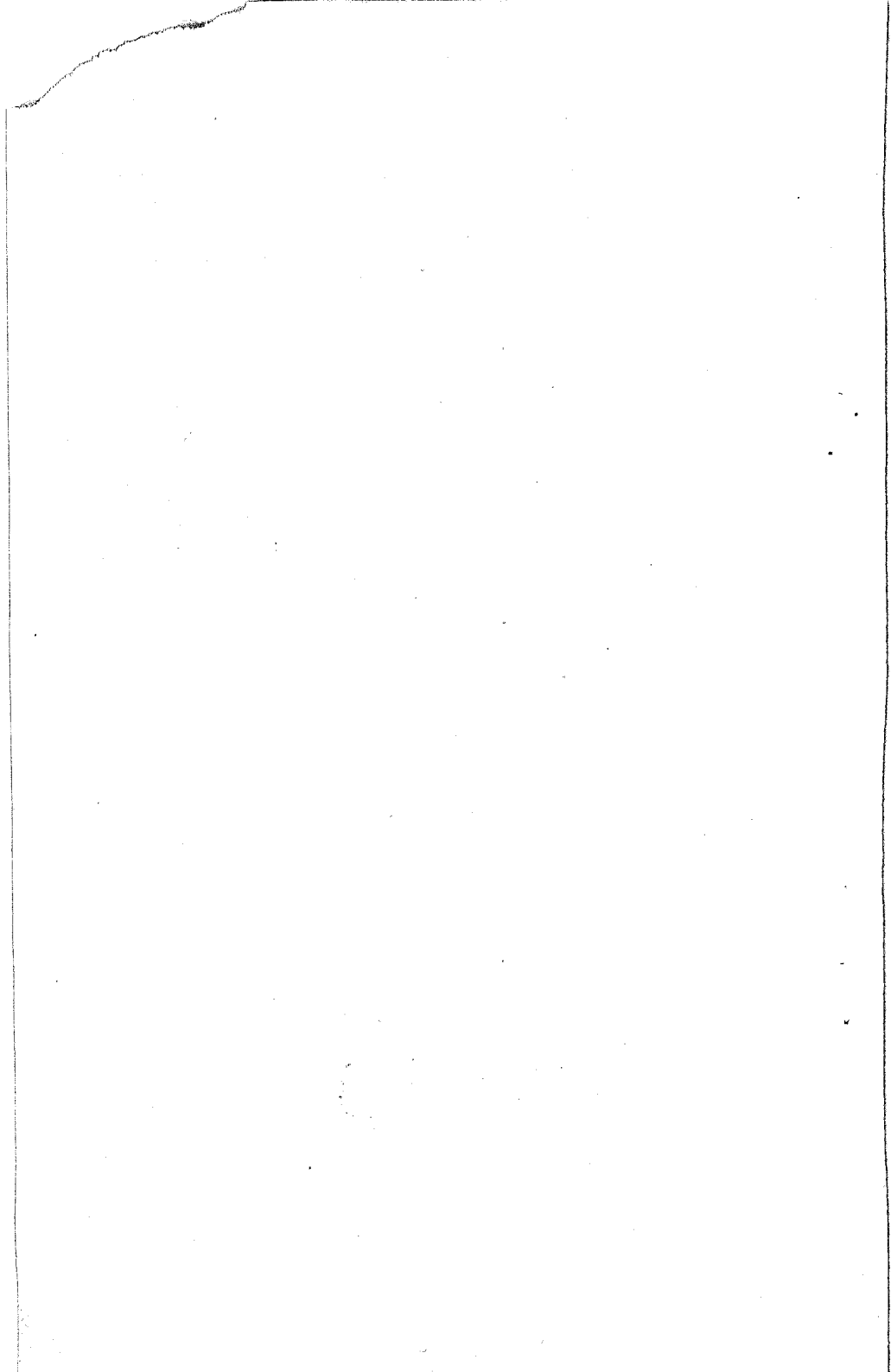
inform the Controller of Examinations for the declaration of his result.

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 hold 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.

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## M.Sc. PHYSICS (Previous) EXAMINATION—1997-98

### SCHEME OF EXAMINATION

		Marks	Time
Paper-I	Mathematical Physics and Group Theory	60	3 Hours
Paper-II	Classical Mechanics and Statistical Mechanics.	60	3 Hours
Paper-III	Quantum Mechanics-I	60	3 Hours
Paper-IV	Electronics	60	3 Hours
Paper-V	Solid State Physics	60	3 Hours
Practicals		100	6 Hours (each paper)

#### Paper-VI & VII

Note :

1. Detailed elaborations regarding the scope of the syllabus will be conveyed each year to the A.R. (Secrecy) by the Head of the Department after the approval by the Post-Graduate Board of Studies in Physics, for onward transmission to the paper setters.
2. The syllabus is divided into five units. Two questions should be set from each unit. The student must answer one question from each unit.

**Paper-I Mathematical Physics and Group Theory**

Max. Marks : 60

Time : 3 Hours

**Unit-I Complex variables**

Functions of a complex variable. Derivative of Cauchy-Riemann differential equations, Cauchy integral theorem, Cauchy integral formula, Taylor series, Laurent series, Singular points of an analytic function, Residues, Evaluation of Residues, Cauchy's residue theorem. Jordan's lemma. Evaluation of definite integrals: (a) integrals around unit circle (b) integrals between limits  $-\infty$  to  $\infty$  using semi-circle contours only.

**Unit-II Linear differential equations**

Linear second order differential equations with variable coefficients. The method of Frobenius, Ordinary point, Regular singular point, Solution of Legendre equation, Solution of Bessel's equation, Solution of Hermite equation. Solution of Laguerre equation. The Wronskian and thesecond solution.

**Unit-III Special functions I**

Lagendre polynomials  $P_n(x)$ , Generating function for  $P_n(x)$ , Recurrence relations, Orthonormality of Legendre polynomials, Associated Legendre Polynomials  $P_n^m(x)$ , Orthonormality of  $P_n$ .

**Special Functions-II**

Special Functions, Generating functions for Bessel functions of integral order  $J_n(x)$  Recurrence relations. Integral representation, Bessel function of the second kind, Spherical Bessel functions, Hermite polynomials, Generating function, Recurrence relation.

**Unit-IV Matrices**

Definition, Different types of matrices, Multiplication of matrices, Inverse of a matrix, Eigenvalues, eigenvectors and the reduction of a matrix to diagonal form using similarity transformation

**Abstract Group Theory**

Definite of a group. The group of symmetry of a square, Multiplication tables, Rearrangement theorem, Cyclic groups, sub-groups and cosets, permutation group, Conjugate elements and classes, Normal divisors and factor groups. Isomorphism and homomorphism, Class multiplication.

Note :- Definitions only.

Unit-V Theory of Group Representations

Group Representation, Definitions of reducible and irreducible representations, Schur's Lemma I, Schur's lemma 2, Orthogonality theorem, Character of a representation, Rules for construction of character tables, character tables.

- Ref :-
1. Applied Mathematics for Engineers and Physicists by L.A. Pipes and L.R. H arwell.
  2. Mathematical Physics by J. Mathews and R.L. Walker.
  3. Group Theory and Quantum Mechanics by Tinkham.
  4. Elements of Group Theory for Physicists by A.W. Joshi.

Paper-II Classical Mechanics & Statistical Mechanics

Max. Marks : 60

Time : 3 hrs.

1. Lagrange's equations of motion and Kinematics of rigid body motion.  
Hamilton's Principle.  
Derivation of Lagrange's equations from Hamilton's Principle, conservation Theorems and Symmetry Properties. The Eulerian angles, Rate of change of a vector, Coriolis force, Angular momentum and kinetic energy of motion about a point, inertia tensor and moment of inertia.
2. Hamilton's Equation of Motion, Canonical Transformations  
Legendre Transformations and the Hamilton's equations, cyclic coordinates, Conservation Theorems and the physical significance of the Hamiltonian, The equations of canonical transformation, Poisson bracket, the Hamilton Jacobi equation for Hamilton's principle function.
3. The two body central force problem and small oscillation  
Reduction to the equivalent one body problem. Equations of motion and first integrals. The equivalent one dimensional problem and classification of orbits. The differential equation of the orbit, the Kepler problem, scattering in a central force field. Formulation of the problem, Frequencies of free vibration and normal coordinates.
4. Classical, Statistical Mechanics  
The postulates of classical statistical mechanics, phase space, Liouille's Theorem, Definitions of Ensemble, Canonical ensemble. Micro canonical ensemble, grand canonical ensemble, Equipartition Theorem.

5. Quantum Statistical Mechanics

Identical particles and symmetry requirements, Bose-Einstein Statistics, Fermi-Dirac statistics, Maxwell Boltzmann Statistics, Bose-Einstein condensation, Liquid Helium, Electron Gas, Thermionic emission.

- Refs :- 1. Statistical Mechanics by K. Huang Wiley Eastern Limited.  
2. Theoretical Chemistry by S. Glasstone (East-West Press Pvt. Ltd., Nhw Delhi (1973).  
3. Classical Mechanics by N. Goldstein.

Note :- Detailed elaborations regarding the scope of the syllabus will be conveyed each year to the A.R. (Secy.) by the Head of the Deptt. after approval of the P.G. Board of Studies in Physics for onward transmission to the paper setters.

2. The syllabus is divided into five unit. Two questions should be set from each unit. The student must answer one question from each unit.

**Paper-III Quantum Mechanics**

Max. Marks : 60

Time : 3 Hrs.

I. The Schrodinger Equation (Three dimensional)

Schrodinger's equation : time dependent and time independent form, Ehrenfest's theorem, Solution of Schrodinger equation for spherically symmetric potentials : Three dimensional harmonic oscillator (Cartesian and polar coordinates), the hydrogen atom.

II. Operators and Eigen-functions.

The operator formalism in quantum mechanics, orthogonal systems, Expansion in Eigenfunctions, Hermitean operators, Simultaneous eigen functions, the fundamental commutation rule, Equations of motion, Commutation rule and the uncertainty principle.

III The Bra and Ket Algebra

Vector representation of states : Bra and Ket notations, Linear operators, Eigen value equation, orthogonality condition, the completeness condition, Relationship between Kets and wave functions, the linear harmonic oscillator problem; creation and annihilation operators Eigenvalues and Eigenfunction, the uncertainty product for harmonic oscillator, the coherent states Simultaneous Eigenkets of Commuting operators, the unitary transformation. The Schrodinger and Heisenberg picture, The interaction picture.

**IV Angular momentum**

Angular momentum operators and their representation in spherical polar coordinates, Eigen values and Eigen-functions of  $L^2$ , spherical harmonics, commutation relations among  $L_x$ ,  $L_y$  and  $L_z$ , Rotational symmetry and conservation of angular momentum, Eigen values of  $J$  and  $J_z$  and their matrix representation. Angular momentum matrices for  $J = \frac{1}{2}$  and Pauli spin matrices. Addition of angular momenta.

**V Scattering Theory**

The scattering cross-section, scattering by a spherically symmetric potential. The method of partial waves, The phase shift, cross-section in terms of phase shifts, scattering by a hard sphere, Solution for the scattered wave function, Neumann Series, Born approximation, Validity of Born approximation.

- Ref :-
1. Quantum Mechanics by J.L. Powell and B. Crasemann.
  2. Quantum Mechanics by A. Ghatak and S. Lokanathan.
  3. Quantum Mechanics by L.I. Schiff.

- Note :-
1. The syllabus is divided into five units. Two questions should be set from each unit. The students must answer one question from each unit.
  2. Detailed instructions regarding the scope of the syllabus will be conveyed each year to A.R. (Secy.) by the Head of the Department, for onward transmission to the paper setters.

**Papri-IV****Electronics**

Max. Marks 60

Time 3 Hours

- Note : The syllabus is divided into five units. Two questions should be set from each unit. The students must attempt atleast one question from each unit.

**Unit-I BJT/FET and Active Network**

**Bipolar Junction Transistor :** Transistor action biasing, configuration and characteristics. (Current and voltage notations, current and current gains volt-ampere relations for BJT), the load line, voltage breakdown, Ebers-Moll model, Field Effect transistors, Circuit characteristics of FET. Two port network analysis, active circuit models. An equivalent circuit for the BJT, Trans-conductance model. Basic BJT amplifiers (CE, CB and CC amplifiers).

**Unit-II Feedback and Bias for Transistor (Amplifiers.)**

An amplifier back box with Feedback, stabilization of gain by negative feedback, reduction on non-linear distortion by negative feedback, Types of feedback (Voltage series and shunt feedback, current series and shunt feedback), location of Q point for BJT variation of bias currents, fixed bias emitter feedback bias, Q-point stabilization.

**Unit-III Amplifier and power Amplifiers**

The amplifier pass band, couplings for multistage amplifiers, R.C. Coupled CE amplifier, frequency response of RC amplifier, gain frequency plots for amplifier response.

Operating conditions for power amplifiers, power relations ideals transformer, voltage limitations of transistor, non-linear distortions, intermodulation distortions, push-pull principle, circuits without the output transformers, class B push-pull amplifier, phase inverter for push-pull input.

**Unit-IV Oscillators Multivibrators and Modulation & Demodulation**

Feedback requirements for oscillations, circuit requirement for oscillations, Basic oscillator analysis (Colpitts and Hartley oscillators) piezoelectric frequency control Switching action of a transistor. Stable states of a binary, fixed biased transistor binary, self biased transistor binary, commutating capacitors, monostable, astable collector coupled and bistable multivibrator, amplitude modulation, modulated class-c amplifier, Linear demodulation of AM signals.

**Unit-V Negative Resistance Devices**

Tunnel diode, backward diode, unijunction transistor, four layer diode,  $p^n-p^n$  characteristics, silicon controlled switch, SCS characteristics, additional four layer devices, the thyristor.

The negative resistance, characteristics, basic circuit Principles, monostable operation, bistable operation, astable operation, voltage controlled negative resistance switching circuits.

## Ref. Books

1. Electronic Fundamentals and applications by J.D. Ryder, V. Edition
2. Pulse Digital & Switching Waveforms by Millman and Taub.
3. Semiconductor Electronics by A.K. Sharma, Published by New Age International publishers, 1996.

Paper—V Solid State Physics

Max. Marks 60

Time : 3 hours

## I Crystal Structure and Crystal binding

Lattice translation vectors, the basis and crystal structure, primitive lattice vectors, simple crystal structures (FCC, BCC HCP, NaCl, CsCl, Diamond and Cubic Zns), Inert gas crystals, Ionic Crystals, evaluation of Madelung const., Cohesive energy of ionic crystals, quasi crystals.

## II Crystal diffraction and lattice vibrations.

Bragg diffraction condition, scattered wave amplitude, Laue equations, reciprocal lattice vectors, Ewald construction, Point defects and dislocations, vibration of mono and di-atomic lattices, quantisation of lattice vibrations, phonon momentum, inelastic scattering of neutrons by phonons, density of normal modes in one and three dimensions, Debye model of heat capacity, Debye  $T^3$  law.

## III Free electron theory and Energy bands

Free electron Fermi gas, energy levels and density of orbitals in one dimension, free electron gas in three dimension, Heat capacity of electron gas, electrical conductivity and Ohm's law, motion in magnetic field, Thermal conductivity of metals, Thermoelectric power, Hall effect, Nearly free electron model, Bloch function, Kronig-Penney model, Tight binding approximation.

## IV Semiconductor and Superconductor

Band gap in semi conductors, equation of motion in an energy band, intrinsic carrier concentration, Law of mass action, impurity conductivity, Thermal ionisation of donors and acceptors, Amorphous semiconductors, Glass transition, glass for-



mation Exptl. Survey of Superconductivity, thermodynamics of superconducting transition, London equation, Coherence length elements of BCS theory, BCS ground state (Physical concept only,) type I and II superconductors, High Tc Superconductors.

#### V Dielectrics and Magnetism

Macroscopic electric field local field at an atom, Dielectric const. and polarisability, Clausius-Mossotti relation, Langevin-Debye theory of temperature dependence of polarisability, Dia and para magnetism, Q.T. of para magnetism, para magnetic susceptibility, Curie point, Exchange integral in ferro magnetism, temperature dependence of saturation magnetism.

#### References :

1. Int. to Solid State Physics by C. Kittel
2. Solid State Physics by A.J. Dekker.
3. Solid State Physics by H.C. Gupta.

Note :- The syllabus is divided into five units. Two questions should be set from each unit. The students must answer one question from each unit.

#### Practicals

#### Paper VI & VII

Max. Marks	Time
100	6 hours
(for each paper)	

Distribution of Marks for M.Sc. Physics (Previous & Final)

Practical Examination shall be as under :-

- |   |  |
|---|--|
| i) Seminars :                                     | 10% (to be awarded as per performance of the individual student in the seminar)  |
| ii) Lab Record :                                  | 10% (to be awarded as per performance and No. of experiments done by the individual student during the academic session, |
| iii) Viva-Voce :                                  | 10%  |
| iv) Performance of experiment in the examination. | 70%  |