2. Experimental Physical Chemistry, Berman and Tipper

3. Practical Physical Chemistry, Arthur M. James

4. Advanced Physical Chemistry Experiment, J. Rose

5. Experiments in Physical Chemistry, Wilson, New Cowrbe, Denaro, Rickert and Wincent

6. Practical Physical Chemistry, J.B. Yadav

7. Experiments in Physical Chemistry, J.C. Ghosh

8. Findlay's Practical Physical Chemistry revised by B.P. Levitt.

9. Experimental Physical Chemistry, D.P. Shoemaker, C.W Garland and J.W Niber.

M.Sc. (FINAL) CHEMISTRY, 2008-2009

The examination shall consist of four theory papers and one practical. The candidate will select two papers from any group- Group A, B, C or D.

Paper & Course		Hrs/week	M. Marks
Paper-I	Group theory and Spectroscopy	4	100
Paper-II	Photochemistry and Supramolecular Chemistry	4	100
Elective Papers			
Paper-III-A	Coordination and Organo-metallic Chemistry	4	100
Paper-IV-A	Modern Interfaces of Inorganic Chemistry	4	100
Paper-III-B	Modern Aspects of Organic Chemistry	4	100
Paper-IV-B	Chemistry of Heterocyclic and Natural Products	4	100
Paper-III-C	Chemical Kinetics	4	100
Paper-IV-C	Quantum Mechanics and Photochemistry	4	100
Paper-III-D	Electroanalytical and Separation Methods	4	100
Paper-IV-D	Analytical Chemistry and Spectral Metods	4	100
Practicals	Group A	18	200
	Group B	18	200
	Group C	18	200
	Group D	18	200

PAPER–I
GROUP THEORY AND SPECTROSCOPY

Time: 3 Hrs. **M.M. 100**

Note: The paper will be divided into THREE sections.

Section-A : Ten questions (short type answer) two from each Unit will be asked. Each question will be of one mark and the candidates are required to attempt all questions. **Total 10 marks**

Section-B : Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt all questions. Each question will be of 10 marks.

Total 50 marks

Section-C : Four questions may be in parts covering all the five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any TWO questions. Each question will be of 20 marks.

Total 40 marks

UNIT-I

Symmetry and group theory in chemistry – Symmetry elements and symmetry operations, definitions of group, subgroups, relation between orders of a finite group and its subgroup, similarity transformation and classes, point groups, Schonflies symbols, representation of groups by matrices (representation for the C_n, C_{nv}, C_{nh}, $D_{nh,}$ etc. groups to

be worked out explicitly), character of a representation, the great orthogonality theorem (without proof) and its importance, character tables and their use.

UNIT-II

Applications of group theory – The reduction formula, hybridisation in BF_3, CH_4 or $[PtCl_4]^{2-}$, vibrational modes in H_2O, BF_3, crystal field splitting of orbitals in octahedral complexes, delocalisation energy of butadiene.

UNIT-III

Ultra-violet and visible spectroscopy – Electronic transitions, instrumentation, shift of bands with solvents, the isolated double bond, conjugated dienes, effects of geometrical isomerism (steric effect, effect of alkyl substitution and ring residues), exocyclic double bonds, Woodward-Feiser rule, effect of strain around the diene chromophore, polyenes, UV spectra of carbonyl compounds, unsaturated aldehydes and ketones, UV spectra of benzene and its derivatives, other applications of UV spectroscopy.

Infra-red spectroscopy – Molecular vibrations, calculation of vibrational frequencies, instrumentation, finger print region, i.r of alkanes and effect of some functional groups, effect of hydrogen bonding, Fermi resonance, overtones, shifting of bands due to inductive and mesomeric effects, aromatic and heteroaromatic compounds, effect of ring strain, applications of IR spectroscopy, brief idea of FT-IR.

Nuclear magnetic resonance spectroscopy – Theory, instrumentation, chemical shift, spin-spin coupling, coupling constants, factors affecting chemical shift, vincinal coupling and stereostructure, proton exchange reactions, geminal non-equivalence (rotation around single bonds), ring inversion, shifts reagents, spin decoupling, deuterium labelling and exchange, nuclear overhauser effect, C^{13} n.m.r., applications of ^{1}H and ^{13}C n.m.r spectroscopy, brief idea of COSY, NOESY, DEPT, INEPT, APT, 2D nmr and INADEQUATE techniques.

UNIT-IV

Mass spectrometry - Ionisation of a molecule on electron impact-EI, CI, FD, FAB, instrumentation, molecular ion, the base peak, the metastable peak, the nitrogen rule, the effect of isotopes, mass spectra of different classes of compounds, McLafferty re-arrangement, Retro Diels-Alder reaction.

Optical rotatory dispersion – Principle, Cotton effect curve, octant rule, applications.

Electron spin resonance spectroscopy - Principles, instrumentation, applications, Combined applications of UV-visible, I.R., NMR and Mass spectroscopy for elucidation of structure of some simple molecules

UNIT-V

Vibrational spectroscopy – Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6 molecules, mode of bonding of ambidentate ligands, ethylene diamine and diketonato complexes.

NMR of paramagnetic substances – The contact and pseudo contact shifts, factors affecting nuclear relaxation, applications to inorganic systems including biochemical systems.

Nuclear quadrupole spectroscopy – Quadrupole, nuclear quadrupole moments, electric field gradient, coupling constant splitting and applications.

Books Recommended -

1. Group Theory and its Application to Chemistry, K.V. Raman, Tata McGraw Hill, New Delhi
2. Symmetry and Group Theory, Ramashanker and S.C. Ameta, Himanshu Publications.
3. Group Theory, F.A Cotton.
4. Spectroscopy of Organic Compounds, P.S Kalsi, Wiley Eastern.
5. Application of Absorption Spectroscopy of Organic Compounds, J.R. Dyer, Prentice-Hall
6. Carbon-13 NMR Spectroscopy, J.B Stothers, Academic Press.
7. Mass Spectroscopy-R Davis, M. Frearson, Wiley Eastern.
8. Spectrophotometric Identification of Organic Compounds, Silverstein and Basseler, Wiley
9. Spectroscopy, Y.R Sharma, S. Chand and Co, New Delhi