



DR. RAM MANOHAR LOHIA AVADH UNIVERSITY,
AYODHYA

Structure of Syllabus for the
Program: M.Sc., Subject: CHEMISTRY

Structure of Syllabus Developed by				
S.N.	Name of BoS Convener/ BoS Member	Designation	Department	College/ University
1.	Prof. D. N. Singh	Professor & Convener	Department of Chemistry	K. S. Saket PG College Ayodhya, U.P.
2.	Dr. Ram Vishun Prasad	Assistant Professor & Internal Expert	Department of Chemistry	A.N. D. Kishan PG College Bahhar, Gonda, U.P.
3.	Prof. Nanhai Singh	Ex-Professor & External Expert	Institute of Science, Department of Chemistry	BHU Varanasi, U.P.
4.	Prof. Lal Bahadur	Ex-Professor & External Expert	Institute of Science, Department of Chemistry	BHU Varanasi, U.P.
5.	Prof. D.S. Pandey	Professor & External Expert	Institute of Science, Department of Chemistry	BHU Varanasi, U.P.
6.	Prof. Abha Bishnoi	Professor & External Expert	Department of Chemistry	University of Lucknow, U.P.
7.	Prof. S.S. Yadav	Ex-Professor & External Expert	Department of Chemistry	DDU University Gorakhpur, U.P.

Nanhai Singh

Abha Bishnoi

S.S. Yadav

D.S. Pandey

16/05/2023

Program: M.Sc., Subject: CHEMISTRY

Course Code		Course Title	Credits	T/P	Evaluation	
A	B				C	D
SEMESTER I (YEAR I)						
B020701T	CORE	Spectroscopy-I	5	T	25	75
B020702T	CORE	Symmetry & Molecular Vibrations	5	T	25	75
B020703T	CORE	Organic Reaction Mechanism	5	T	25	75
B020704T	FIRST ELECTIVE (Select any one)	Chemical Kinetics & Thermodynamics	5	T	25	75
B020705T		Surface & Solid-State Chemistry	5	T	25	75
B020706P	SECOND ELECTIVE (Select any one)	Chemistry Laboratory Course-I A	5	P	50	50
B020707P		Chemistry Laboratory Course-I B	5	P	50	50
SEMESTER II (YEAR I)						
B020801T	CORE	Chemistry of Main Group Elements	5	T	25	75
B020802T	CORE	Stereochemistry & Spectroscopy-II	5	T	25	75
B020803T	CORE	Advanced Quantum Mechanics	5	T	25	75
B020804T	THIRD ELECTIVE (Select any one)	Research Aptitude	5	T	50	50
B020805T		Environmental Science	5	T	50	50
B020806P	FOURTH ELECTIVE (Select any one)	Chemistry Laboratory Course-II A	5	P	50	50
B020807P		Chemistry Laboratory Course-II B	5	P	50	50
SEMESTER III (YEAR II)						
B020901T	CORE	Coordination & Bioinorganic Chemistry	5	T	25	75
B020902T	CORE	Pericyclic, Photochemistry & Rearrangement Reactions	5	T	25	75
B020903T	CORE	Electrochemistry	5	T	25	75
B020904T	FIFTH ELECTIVE (Select any one)	Natural Products	5	T	25	75
B020905T		Medicinal Chemistry	5	T	25	75
B020906P	SIXTH ELECTIVE (Select any one)	Chemistry Laboratory Course-III A	5	P	50	50

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B020907P		Chemistry Laboratory Course-III B	5	P	50	50
SEMESTER IV (YEAR II)						
B021001T	CORE	Organotransition Metal Chemistry	5	T	25	75
B021002T	CORE	Organic Synthesis	5	T	25	75
B021003T	SEVENTH ELECTIVE (Select any one)	Analytical Chemistry	5	T	25	75
B021004T		Polymer Chemistry	5	T	25	75
B021001P	RESEARCH PROJECT/ DISSERTATION	Practical Based Major Research Project /Dissertation	10	P	50	50

NOTE:

1. T/P in Column-E stands for **Theory/Practical**.
2. CIE in Column-F stands for '**Continuous Internal Evaluation**' and depicts the maximum internal marks. Respective examination will be conducted by subject teacher.
3. ETE in Column-G stands for '**External Evaluation**' and depicts the maximum external marks. Respective Examination will be conducted by the University.
4. Column-B defines the nature of course/paper. The word **CORE** herein stands for **Compulsory Subject Paper**.
5. Column-D depicts the credits assigned for the corresponding course/paper.
6. **First Elective:** It will be a Subject Elective. Students may select one of the two subject papers under this category.
7. **Second Elective:** It will designate a Practical Paper or equivalently a Field Visit or Project Presentation. In case of Field Visit, student is required to submit a detailed report of the visit for the purpose of evaluation. The report should include the observational features and benefits of the visit. In case of Project Presentation, the student may be assigned to go for a survey/practical or theoretical project/assignment or seminar with presentation.
8. **Third Elective:** It will be a Generic Elective. The student may study or receive training of the any subject of his interest (depends on the availability in his institution of enrollment). The Generic elective paper will be evaluated in two parts, first part (50 marks) would be a continuous internal evaluation (03 tests 20+20+10 marks) whereas the examination and evaluation of the second part (50 marks) would be arranged by the college itself (01 exam).
9. **Fourth Elective:** It will accommodate a practical paper or Industrial Training or Project Presentation. In case of Industrial Training, student may be allowed for the summer training and is required to submit a detailed training report including training certificate for the evaluation.
10. **Fifth Elective:** It will be a Subject Elective. Students may select one of the two subject papers under this category.
11. **Sixth Elective:** It will be a Practical Paper or equivalently a-Project Presentation based on Survey/ Seminar/ Assignment. In case of Project Presentation, student has to submit an exhaustive report on respective topic and to face an open presentation for the evaluation.

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12. **Seventh Elective:** It will be a Major Research Project or equivalently a research-oriented Dissertation on the allotted topic. The student straight away will be awarded 05 credits if he publishes a research paper on the topic of Research Project or Dissertation.
13. There will be a Major Research Project or equivalently a research oriented Dissertation on Semester-IV. The Student straight away will be awarded 05 Credits if he publishes a research paper on the topic of the research Project or Dissertation.
14. Methodology for the practical examination and examiner appointment will be governed by the Clause-13 of the NEP Guideline of RMLAU dated 27-06-2022 except the marks distribution for continuous internal evaluation and external evaluation.
15. Evaluation of the Chemistry laboratory Course will be done by three Examiners i.e. one internal and two externals having different specialized area as this Course covers three specialized area of Chemistry i.e. Inorganic, Organic and Physical Chemistry.

Program Outcomes (POs):

- The program has been designed to enable the students to acquire strong theoretical, practical and research knowledge in the various areas of Chemistry.
- The program covers maximum branches of Chemistry and Experimental Laboratory Courses as well as also gives emphasis on the research programme in Chemistry.
- The practical courses have been designed to prepare the students to have experience of the laboratory skills in Chemistry so that students can work in any scientific laboratories which are the need in the current scenario for becoming the ATMANIRBHAR. Students will be able to design and conduct experiments as well as to analyze and interpret scientific data in useful form.
- Program will equip students to face the employment challenges and instill confidence to turn into entrepreneur and also step into research career.
- The program will offer students with the knowledge and skill base that would enable them to undertake advanced studies in Chemistry and related areas or in multidisciplinary areas that involve Chemistry.
- The students will gain domain knowledge and have right temperaments to know how to lead for successful career in academia, industry and research.

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Subject Prerequisites:

To study this course, a student must have passed B.Sc. III Year, VI Semester with Chemistry as a major subject.

Program Specific Outcomes (PSOs):

- After successful completion of M.Sc. Chemistry program, the student will be able to create an awareness of the impact of chemistry on the society and development outside the scientific community.
- Student will be able to analyze data obtained from various instruments viz. UV-Vis, Fluorescence, FTIR, NMR, TGA/DTA/DSC, GLC, GSC and HPLC for the structure determination and chemical analysis and student can apply different appropriate approach towards planning and execution of research in frontier areas of chemical sciences.
- After successful completion of this program, student can apply different appropriate approach towards planning and execution of research in frontier areas of chemical sciences.
- Student will become professionally trained and have caliber to do job in the various industries at all level of chemical, pharmaceutical, food products, life-oriented material industries.

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Semester I Syllabus
Core Course
Course Code: B020701T
Course Title: Spectroscopy-I

Credit 05

Hour 60

Course Objectives: Students will be provided knowledge about fundamental concepts, tools and techniques used behind UV-visible, Infrared & Raman, microwave, mossbauer and diffraction techniques for structural determination of molecules.

Unit I

Contribution of Indian scientists to Chemical Sciences and Traditional remedies : Prafulla Chandra Ray, Venkatraman Ramakrishnan, Sukh Dev, Asima Chatterjee, C. N. R. Rao, Darshan Ranganathan, Shanti Swaroop Bhatnagar; Ayurveda, Introduction to traditional Indian medicinal system, Indian medicinal plants and their therapeutics importance, validation of traditional remedies, A comparative account of traditional and modern therapy.

Unit II

Infrared Spectroscopy & Raman Spectroscopy: Linear harmonic oscillator, Vibrational energies of diatomic molecules, zero-point energy, force constant and bond strength, anharmonicity, Morse potential, Vibration-rotation spectroscopy, P, Q, R branches, Breakdown of Oppenheimer approximation, vibration of polyatomic molecules, selection rules, Group frequencies, Overtones, hot bands, factors affecting the bond positions and intensities for IR region, Problems related to Infrared Spectroscopy; *Raman Spectroscopy:* Classical and quantum theories of Raman effects, Pure rotational, Vibrational and Vibrational-rotational Raman spectra, Selection rule, Mutual exclusion principle, Resonance Raman spectroscopy, CARS.

Unit III

Microwave Spectroscopy: Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequency, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field applications.

Unit IV

Mossbauer Spectroscopy: Basic Principles, spectral parameters and spectrum display, Application of the technique to the studies of (a) bonding and structures of Fe^{+2} and

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Fe³⁺ compounds including those of intermediate spin, (b) Sn⁴⁺ and Sn²⁺ compounds – nature of M-L bond, coordination number, structure and (c) detection of oxidation state and in equivalent MB atoms.

Unit V

Diffraction Techniques: *X-ray Diffraction:* General Features of diffraction, Powder X-ray diffraction, Single crystal X-ray diffraction. The technique, structure factor, phase problem, brief description of time resolved X-rays diffraction techniques; *Electron Diffraction:* Scattering intensity vs scattering angle, Wierl equation, Measurement technique, Elucidation of structure of simple gas phase molecules, Low energy electron diffraction structure of surfaces; *Neutron Diffraction:* Brief introduction, difference with X-rays diffractions.

Recommended Books:

1. Fundamentals of Molecular Spectroscopy, 4th Ed. Mc Graw-Hill, C.N. Banwell.
2. Basic Principles of spectroscopy, Mc Graw –Hill, R. Chang
3. Modern Spectroscopy, J. M. Hollas, John Wiley.
4. Inorganic Electronic Spectroscopy, A. B. P. Lever, Elsevier.
5. Magnetochemistry, R. L. Carlin, Springer Verlag
6. K. Veera Reddy, Symmetry and Spectroscopy of Molecules. New Age.
7. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. L. Langford, Oxford
8. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
9. Inorganic Chemistry, J. E. Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.

Course Outcomes:

- CO-1. Students will acquire basic knowledge of UV-visible, infrared, Raman, microwave and diffraction techniques.
- CO-2. Students will able to interpretate the spectra obtained from the various spectral (UV-visible, infrared & Raman, microwave, mossbauer and diffraction methods) techniques.
- CO-3. Students will able to focus their aim for future prospects of research in the above these spectroscopic techniques

Narinder Singh

Bansal

Sharma

Bansal

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