



UTTARANCHAL
UNIVERSITY

UTTARANCHAL UNIVERSITY

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun,
Uttarakhand-248007, INDIA

Detailed Course Structure & Syllabus of

**Pre Ph.D. (Chemistry)
Course Work
(As per CBCS system)**

Session: 2019-20 (ODD)



Course Structure & Syllabus of Pre Ph.D. (Chemistry)
Session: 2019-20 (ODD)

EVALUATION SCHEME
Pre Ph.D. (Chemistry)
Course Work

Course Structure & Syllabus of Pre Ph.D. (Chemistry)
Session: 2019-20 (ODD)

Scheme of Pre-Ph.D. Course Work

S. No	Course Code	Course Name	Credits	Evaluation - Scheme							
				Period			Sessional			Examination	
				L	T	P	CT-I	CT-II	Total	ESE	Sub. Total
1.	RM-101	Research Methodology & Computer Application	7	6	1	0	20	20	40	60	100
2.	CHY-102	Discipline Specific Electives (Chemistry)	7	6	1	0	20	20	40	60	100
3.	RLS-103	Review of Literature & Seminar Presentation	6	0	0	10	20	20	40	60	100
Total			20	12	2	10	60	60	120	180	300

List of Electives

S. No.	Course Code	Course Name
1	CHY-102 (i)	Advances in Chemistry
2	CHY-102 (ii)	Advanced Instrumentation



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

RM 101: Research Methodology

Course Objectives:

1. To Equip the Students with the Concept and Methodology of Research.
2. To provide knowledge about type of research, preparation of reports and thesis, designing of Research using Scientific Methods like statistical methods and computer skills.

UNIT-I

Introduction to Research: Definition, Nature and significance, Role and Objectives; Types of Research; Doctrinal and non-doctrinal research methods; Scientific Research Process: Overview, Problem identification and formulation of research statement. Types and nature of various research design, Research design decisions, Types and nature of various research designs. Structures of experimental research designs.

UNIT-II

Data Collection: sources of secondary data methods of primary data collection: personal interview, questionnaire method, observation method questionnaire Vs. schedules; Data Processing: Editing, Coding Organization and Presentation; Attitude Measurement and scaling: Measurement Scales, Sources of Errors in Measurement, Techniques of Developing Measurement Tools, Classification and Testing (Reliability, Verification and Validity) Scales, Designing Questionnaires. Data collection methods in qualitative research.

UNIT-III

Sampling, Sampling Methods, Sampling Plans, Sampling Error, Sampling Distributions: Theory and Design of Sample Survey, Census Vs Sample Enumerations, Objectives and Principles of Sampling, Types of Sampling, Sampling and Non-Sampling Errors. Sampling design process. Sample size determination, Sampling design process, Sample size determination.



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

UNIT-IV

Statistical Tools / Methods for research – Univariate and Bivariate Analysis. Hypothesis and Hypothesis Testing: Parametric & Non-Parametric Tests, Use of Various Statistical Tools on SPSS F-Test, t-Test, z-Test, ANOVA, Kruskal-Wallis Test, Chi Square Test, Run Test, Wilcoxon's signed rank test, Man Whitney's U-test, K-S median test

UNIT-V

Interpretations and Report Writing: Meaning, Techniques, Precautions and Significance of Report Writing & interpretation, Precautions in Writing Research Reports. Limitations of RM: Ethics in Research, Philosophical Issues in Research. Use of Internet for Research Work and Exploring Various Websites and Search Engines for Collecting Quality Literature Review and Secondary Data.

Text Readings

1. William G. Zikmund, "Business Research Methods", Orlando: Dryden Press.
2. C. William Emory and Cooper R. Donald, "Business Research Methods", Boston, Irwin.
3. Fred N Kerlinger, "Foundations of Behavioural Research", New Delhi: Surjeet Publications.
4. Naresh Malhotra, Marketing Research : An Applied Orientation, Pearson publication David Nachmias and Chava Nachmias, "Research Methods in the Social Sciences", New York: St.Marlia's Press.
5. C. R. Kothari, "Research Methodology: Methods and techniques", New Delhi: Vishwa Prakashan.



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

CHY 102 (i)- Advances in Chemistry

Course Objectives:

1. To understand Spectroscopic, Analytical and physical techniques used in characterisation of materials.
2. To assess nano material & techniques for application in applied field.

UNIT-I

Application of Spectroscopic Studies in Chemical Research, Fundamental Concepts, Principle, Instrumentation, Interpretation of Spectrum and Applications of IR and UV-Visible Spectroscopy, Mass Spectroscopy & NMR Spectroscopy. Chromatographic Techniques: Applications of Chromatographic Techniques in Chemical Research. Concept, Principle & Instrumentation of HPLC & GC-MS. Thermal Analysis: TGA, DTA & DSC – Principle, Interpretation of Spectra and Application.

UNIT-II

Organometallic Chemistry of Li, Mg, Pb: Preparation, Reaction & Applications. Green Chemistry; Environmental Chemistry (Water- Pollutants, Hardness- Types and Determination, Heavy Metals and Their Effect). Photo Chemistry- Photon Molecule Interactions; Absorption, Fluorescence and Phosphorescence; Quantum Yield; Phosphorescence; Flash Photolysis; Types of Photochemical Reactions. Introduction & Classification, Nomenclature of Antibiotics and Pharmacological Activities.

UNIT-III

Electrochemistry: Laws, Electrolytic and Electrochemical Cells, Fuel Cells; Solar Cells (Photochemical, Photovoltaic); Batteries (Solid-State & Conventional, Corrosion –Types, Mechanism and Control. Kinetics: Zero, First, Second, N^{th} Order Reactions. Chemical Equilibrium – Systems and Factors Affecting Equilibrium.

UNIT-IV

Nanocomposites, Refractory Materials, Polymers: Introduction and Classification, Copolymerization, Reinforcing and Fiber Spinning Film and Laminates. Preparation And Applications of Nylon, Polyesters (Terylene and Dacron), Rubber, Vulcanization of Rubber, Synthetic Rubber, Buna-N Rubber, Copolymers of Butadiene and Acrylonitrile. Vinyl Polymers, Characterization: Significance and Measurement of Molecular Weight, Solution Viscosity, Light-Scattering Property, X-Ray Diffraction Study, Thermal Analysis and Physical Testing. The Physical Properties of Polymers., Transition Temperature In Polymers, Glass



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

Transition (T_g), Melt Transition (T_m), Relationship Between T_g and T_m ; Upper and Lower Glass Transition Temperatures,

Reference Books-

1. Inorganic Chemistry by J.D.Lee.(Wiley Publication).
2. Organic Chemistry by I.L.Finnar
3. Advanced Physical Chemistry by Gurtu & Khera
4. Advanced Physical Chemistry by Atkins
5. Instrumental Chemistry by Chatwal and Anand.



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

CHY 102 (ii)- Advanced Instrumentation

Course Objectives:

1. To understand Chromatographic, UV-Visible, IR, NMR and thermal techniques for characterisation of materials in research.
2. To apply analytical techniques for application in chemical research.

Unit 1

Chromatographic Methods of Analysis Classification, basic principles of chromatography, theories of chromatography, plate theory and rate theory, retention factor, retention time, distribution partition coefficient. HPLC: Principle and instrumentation of HPLC, pumping systems used in HPLC, types of detectors used in HPLC. **Gas Chromatography:** Theory of gas chromatography, parts of gas chromatograph-MS.

Unit 2

UV-Visible spectroscopy: Basic principle, Various electronic transitions Beer-Lambert law, effect of solvent on electronic transitions, molar extinction coefficient, concept of chromophores and auxochromes, bathochromic, hypsochromic, hyperchromic and hypochromic, UV spectra of conjugated enes and enones, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Woodward-Fiesher rules for conjugate dienes and carbonyl compounds.

Unit 3

Infrared spectroscopy: Infra-red spectroscopy: Basic principle, Instrumentation Selection rules, fundamental modes of vibration, overtones, combination bands, Fermi resonance, Factors affecting IR spectra. Effect of hydrogen bonding, solvent effect on IR of gaseous, solids and polymeric Interactions with molecules: absorption and scattering. Means of excitation (light sources), detection of the signal (heat differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

(FTIR). Interpretation of IR spectra of aliphatic, aromatic hydrocarbons, amines, amides, carbonyl compounds etc

Unit 4

NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Uses of TMS equivalent and non-equivalent protons, chemical shifts, factors affecting chemical shifts, shielding of magnetic nuclei, deshielding, anisotropic effects in alkene, alkyne, aldehydes and aromatics, spin-spin coupling, coupling constant, chemical exchange, Simple applications, Interpretation of NMR spectra of aliphatic, aromatic hydrocarbons, carbonyl compounds etc.

Unit 5

Thermal methods of analysis: Thermal methods: Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture. DTA Principle instrumentation and application DSC : Principle instrumentation and applications. Scanning electron Microscopy: Introduction, principle and application.

Reference Books:

1. Spectroscopy of Organic Compounds, New Age International Publishers; PS Kalsi
2. Spectrometric Identification of Organic Compounds, John Wiley; Silverstein, Robert M.; Webster, Francis X.; Kiemle
3. Practical NMR Spectroscopy, ML Martin, JJ Delpeach and GJ Martin, Heyden.
4. Fundamentals of Molecular Spectroscopy Colin N. Banwell and Elaine M. Mc Cash Tata McGraw Hill.
5. Introduction to NMR Spectroscopy: RJ Abraham, J Fischer and P Loftus, Wiley.
6. Spectroscopic Method in Organic Chemistry: DH Williams, I Fleming, Tata MacGraw Hill.
7. Instrumental Method of Analysis: Seventh Edition, Willard Merritt, Dean, Settle. CBS



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

RLS-103: Review of Literature and Seminar Presentation

Course Objectives:

Main objective of this course is to develop presentation skills in the scholars and knowledge about review of literature so that they can review properly in the concerned field.

Review of Literature and Seminar

Presentation-Candidate/Research Scholar has to go through the review of literature in the concerned field of research. Review of literature guidelines will be given by the concerned faculty/Dean of Department/School/College. Research Scholar has to give prepare presentation on review of literature in the concerned field/ topic assigned by the department (DRC) periodically during course work.

There will be minimum 3 presentations of review of literature during pre-Ph. D course work. Final presentation would be required at the time of end term/semester examination on proposed synopsis. General guidelines would be issued by Dean-Research for seminar presentation.