



Hemchandracharya North Gujarat University, Patan

PH.D. COURSE WORK SYLLABUS

SUBJECT : CHEMISTRY

Scheme & Course

Sr.	Paper	Nomenclature	Credits	Marks
1.	Paper-I - CHE-CW-101	Research Methodology	04	70+30
2.	Paper-II - CHE-CW-102	Analytical Techniques	04	70+30
3.	Paper-III - CHE-CW-103	Computer Applications to the subject	04	70+30
4.	Paper-IV - CHE-CW-104	Review of published research in the relevant field	04	70+30
5.	Paper-V - CHE-CW-105	Comprehensive Viva	04	100

Notes:

1. The candidate has to obtain a minimum of 55% of marks or its equivalent grade points in aggregate in the course work in order to be eligible to continue in the Ph.D. programme.
2. If candidate obtains 'F' or 'Ab.' grade in the course/ subject. He/ she will be treated to have failed in that course. He/ She has to reappear in the examination in the next semester.

Paper-I	CHE-CW-101	Research methodology	Credit-4	(70+30)
UNIT-1	Introduction to research methodology, design and implementation of research methods, types and steps in research, Objectives of research, Techniques of research formulating, reviewing the literature. Mode of approach of actual investigation, drawing inferences from data Qualitative and Quantitative research approaches, assessing the status of the problem, Characteristics and components of research problem.			
UNIT-2	Basic concepts of research Paper /Thesis writing and report generation, Writing research abstract, summary, Introduction, review of literature, materials and methods, presenting the results, writing the discussions and citing the references, Types of research studies and research methods, Data collection and data analysis. Writing scientific report: Planning, preparation, draft, revision and refining; writing project proposal to funding agency.			
UNIT-3	Testing of Hypothesis: Meaning, Basic concepts, Flow diagram, Power of a hypothesis test, Important Non-Parametric tests: Sign, Run, Kruskal-Wallis tests and Mann-Whitney test, Important parametric tests, Hypothesis Testing of Means, between variance, Comparing Two related samples, Testing of Proportion, Difference proportions, Comparing variance to hypothesized population Chi-square tests-ANOVA-One way and Two way, Equality of variances of two normal populations, hypothesis testing of Correlation coefficients, Limitations of Tests of hypothesis.			
UNIT-4	Ethical Issues : Code of Ethics in Research, Ethics and research process, Importance of ethics in research, Ethical committees, Commercialization, copy right, royalty, intellectual property and patent law, track related aspects of intellectual property rights, Reproduction of published material, Plagiarism, citation and acknowledgement, reproducibility and accountability, Editing			
UNIT-5	Sampling -introduction, definitions, theory of sampling, techniques of sampling, central limit theorem, Sandler's A test, statistical criteria of good sampling and required size, stratified sampling vs random sampling, minimization of variance in stratified sampling, transmission and storage of samples, Concept of standard error.			

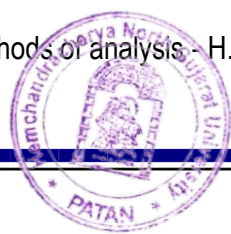


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- UNIT-1** IR and Raman spectroscopy, Instrumentation, preparation of samples and pellet making, Molecular vibrations, selection rules, force constant – band assignments, applications, organic structures, finger printing, identification of common functional groups, applications. Effect of isotopic substitution on the vibrational spectra of metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations (group theoretical treatment) Raman spectroscopy: Stokes and anti-Stokes lines, Polarizability ellipsoids, Rotational and Vibrational Raman spectroscopy, Selection rules, Polarization of Raman lines, Applications of Raman Spectroscopy, Photo electron spectroscopy-principle and applications, Auger electron spectroscopy, electron spectra in chemical analysis.
- UNIT-2** NMR spectroscopy Bloch equations, the quantum mechanical description of the NMR experiment, transition probabilities, Fourier transform NMR, Relaxation effects, measurements of T1 and T2. Spectral simplification and determination of signs of coupling constants, elementary aspects of Solid State NMR. ¹H NMR spectroscopy, coupling constant, first order and second order splitting spin, spin splitting, dependence of J on dihedral angle, vicinal and germinal coupling constants, Karplus equation, long range coupling constants, influence of stereo chemical factors on chemical shift of protons, simplification of complex spectra, double resonance techniques, shift reagents, chemical spin decoupling of rapidly exchangeable protons (OH, SH, COOH, NH, N₂, an elementary treatment of NOE phenomenon, 2D technique (COSY, N²ESY and ROESY) ¹³C NMR spectroscopy. Basic theory of FT NMR, Relaxation, broad band decoupling. Off resonance decoupling and chemical shift correlations (CH, CH₂, CH₃, =CH₂, =C, aromatic), NMR in medicine.
- UNIT-3** UV Visible spectroscopy, Electronic excitation, origin of different bands, intensity of bands, selection rules - laws of photochemistry, correlation of electronic absorption with Molecular structure, chromophoric groups, conjugated systems, systems of extended conjugation, aromatic systems, empirical rules, experimental methods, photometric titration Jablonskii diagram, Fluorescence and phosphorescence and factors affecting these, Calculation of excited state life-times from absorption data, Quenching of fluorescence, Stern-Volmer equation
- UNIT-4** Mass Spectrometry Principles, Instrumentation, Different ionizing techniques (EI, CI, FD, FAB, ESI, M⁻DI) - Various analysers (Magnetic sector, Quadrupole, Ion trap, ToF), factors affecting fragmentation, ion analysis. Ion abundance, Analysis of mass spectrum, simple cleavage, 1,3 cleavage, allylic cleavage, benzylic cleavage, Factors affecting fragmentation pathways, McLafferty rearrangement, ortho effect, Fragmentation patterns of common organic compounds. Problems based on UV, IR, NMR and Mass spectral data.
- UNIT-5** Separation Methods: Theory and applications of separation methods in analytical chemistry, liquid-liquid extraction: Distribution coefficient, distribution ratio, solvent extraction of metals, multiple batch extractions, countercurrent distribution, multiple extractions solvent extraction, ion exchangers including liquid ion exchangers. Introduction, fundamentals, principle, instrumentation and applications of gas chromatography, HPLC and other hyphenated Techniques: LC-MS, GC-MS, ICMS, HP-TLC, and ICP-MS Spectroscopy

Reference Books:

1. Spectrometric identification of organic compounds - R.M. Silverstein, G.C. Bassler and Morril. John Wiley & Sons, New York 5th Edn (1991).
2. Physical methods in Inorganic chemistry - R. S. Drago Reinhold Pub. Corp., (1965)
3. Physical methods in Organic Chemistry - Scharz. Oliver & Boyd, (1964)
4. Applications of absorption spectroscopy of organic compounds - J. Dyer.
5. Organic spectroscopy - W. Kemp. Macmillan, (1987)
6. An introduction to spectrometric methods for the identification of organic compounds Vol. I & II - F. Schienmann. Pergamon Press, Oxford (1970)
7. Introduction to spectroscopy - A guide for students of organic chemistry - D.L. Pavia, G.M. Lampman and G.S. Kriz Jr.
8. Instrumental methods of analysis - H. Willard, L. Merritt Jr. and A. Dean, 4th Edn (1996)



9. Fundamentals of analytical chemistry-D.A.Skoog and M.West.7th Edu, Saunderson College Pub (1996)
10. Fundamentals of molecular spectroscopy - C.N.Banwell. 4th MC. GrawHill,(2008)
11. Basic principles of spectroscopy - R.Chang.
12. Spectroscopy of organic compounds - P.S Kalsi. New Age International 6th Edn (2009)
13. Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd. [Prentice Hall] (2002)

Paper-III	CHE-CW-103	Computer Applications to the subject	Credit-4 (70+30)
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| UNIT-1 | Introduction to computers- history of development of computers Main frame mini, micro and super computer systems-computer hardware CPU, input, output devices, auxiliary storage devices, interpreter, compiler, machine language, assembly language, high level languages. |
| UNIT-2 | Introductory Operatives-Package, MS Word: word basics, formatting text and documents, introduction to mail merge & macros. MS Excel: Excel basics, rearranging worksheets, working with charts and graphs, using worksheet as databases, Use formulas and functions, MS PowerPoint : PowerPoint basics, creating presentation MS Access: Database creation, screen/form design, generation using wizard, Preparation of a document, Editing of a document, Preparing a scientific manuscripts, Features of Acrobat Reader. |
| UNIT-3 | Programming with C: Character Set, Identifiers, Keywords, Variables, Character Strings, Qualifiers, Typcasting, Constants, Operator and Expression, Operator Precedence and Associativity, Input-Output Statements. Control Statements: if, if-else, nested if, if-else ladder, switch Statements, Loops: for, while do-while, break and continue statement, Arrays, Strings. |
| UNIT-4 | Literature Searching: On-line searching, Database, Scifinder, Scopus, Locating research article, Citation Index, Impact Factor Computer Software in Chemistry: Instrument Control, Instrument Maintenance and Calibration system, Graphical Display of Data and Molecular Structures, Chem Office, Chemdraw, Chemistry 4-D Draw Standard. |
| UNIT-5 | Introduction to Internet and its applications: web browsers - World Wide Web, Search Engines, e-journals, literature Survey, Popular journals and websites, literature searching and collection using e-journals.
Preparing presentations:
1) Research papers: Using word processing software - MS Word, Drawing graphs and diagrams - Excel. Paper writing for International Journals, Process for online submission
2) Seminar presentations -Power point for oral and poster presentations |

Paper-IV	CHE-CW-104	Review of published research in the relevant field	Credit-4 (70+30)
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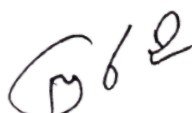
For this paper candidates will have to review literature in an area of research, prepare a research proposal and submit a report to the University at the end of the course work. The selection of the problem and preparation of the proposal will be in consultation with research guide.

Paper-V	CHE-CW-105	Comprehensive viva voce	Credit-4 (100)
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Candidate will face a Comprehensive Viva-Voce of 4 credits on the subject of Research Methodology, Advanced Course in Chemistry and literature review report submitted to the university. The Presentation will have to be made by the candidate and it will need to be prepared in consultation with research guide.

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