ANDHRA KESARI UNIVERSITY ::ONGOLE

Department of Chemistry

Ph.D. Part –I Couse structure

With effect from Academic Year 2023-2024

Papers	Paper Code	Title of the paper	Marks	Credits
Paper -I	CHR1	Research Methodology	100	4
Paper -II	CHR2	Analytical Chemistry	100	4
	CHR3	Organic Chemistry	100	4
Paper – III	CHR4	Advanced Analytical Chemistry	100	4
	CHR5	Organic Spectroscopy	100	4
	CHR6	Chemical Dynamics	100	4
Paper - IV	CHR7	Seminar	100	2

ANDHRA KESARI UNIVERSITY::DEPARTMENT OF CHEMISTRY

SYLLABUS FOR Pre-Ph.D. EXAMINATIONS

Each candidate has to study three papers for Pre-Ph.D. examination. **Paper I** (Research Methodology) is compulsory paper and two papers from the respective specialization.

In **Paper-II**, there are two papers **[CHR2 (or) CHR3**] for selection of the students based on their specialization. Similarly in **Paper-III**, there are three optional papers **[CHR4/ CHR5/ CHR6**] for selection of the students based on their subject of research as shown below. Moreover, each candidate must give a presentation on their research topic in **Paper-IV**. Each paper will be of 100 marks including seminar and the pass mark is 50% in each paper.

Paper Code.	Paper No. &Title	Max. Marks
	PAPER I	100
CHR1	**Research Methodology** (Compulsory for all specialization)	
	PAPER -II	100
CHR2	Analytical Chemistry	
	OR	
CHR3	Organic Chemistry	
	PAPER-III	100
CHR4	Advanced Analytical Chemistry	
	OR	
CHR5	Organic Spectroscopy	
	OR	
CHR6	Chemical Dynamics	
	PAPER-IV	100
CHR7	Seminar	

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/ Pre-Ph.D Examinations

PAPER-I **RESEARCH METHODOLOGY** **Code No. CHR1**

***Note*:** Examiner will set 8 questions, two from each unit and the candidates will be required to attempt only five questions.

All questions will carry equal marks. (5x20=100)

UNIT-I

Research Methodology: Types and methods of research, classification of research, pure and applied research, exploring or formulative research, descriptive research, diagnostic research/study, Evaluation of research/study, action research, and experimental research-problem selection. Meaning, Scope, Primary sources of literature survey, Journals, patents etc., secondary sources of literature survey, Books, Reference books, Text books, listing of letters.

UNIT-II

Scientific Writing: Scientific Document; Organization and writing of research paper, short communications, review articles, monographs, technical and survey reports, authored books, and edited books and dissertation. Abstracts and Journals in chemistry, Electronic forms of Journals, major libraries, subscribing Journals related to chemistry in the region and country and Patents and Patents writing.

UNIT-III

Research ethics: Ethical issues, copy right, royalty, intellectual property rights, citation and acknowledgement. Reproducibility. Safety rules of laboratory acquaintance of experimental set up, importance of safety and security of data. Review of published research in the relevant field, training, field work.

Computer applications in research: Application and uses of common software's in chemistry-origin, chemsketch, chemdraw, basic ideas on the use of internet in chemistry education.

UNIT-IV

Concepts of chemical safety: Chemical safety and ethical handling of chemicals, safe working procedure and protective environment, emergency procedure and first aid, laboratory ventilation, safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmosphere, safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals.

Reference Books:

1. William Kemp, Organic Spectroscopy, ELBS London, 1987.
2. RM Silverstein, CG Bassler and TC Morril, Spectroscopic Identification of Organic Compounds, 4th Edition, John Wiley & Sons, New York, 1981.
3. Donald L Pavia, Gary M Lampman and George S Kriz, Introduction to Spectroscopy, 3 rd Edition, Saunders Golden Sunburst Series.
4. CN Banwell and Elaine M McCash, Fundamentals of Molecular Spectroscopy, 4th Edition.
5. Raymond Chang, Basic Principals of Spectroscopy, RE Krieger Publishing Co., Huntington, New York, 1978.
6. Paul D Leedy, Jeanne E Ormrod and Jeanne Ellis Ormrod, Practical Research: Planning and Design, Prentice Hall, 2004.
7. Robert V Smith, Graduate Research: A Guide for Students in the Sciences, University of Washington Press, 1998.
8. Anthony M Graziano and Michael L Rau, Research Methods: A Process of Inquiry, Prentice Hall, 2006.
9. Peter C Jurs, Computer Software Applications in Chemistry, 2nd Ed., John Wiley & Sons, New York, 1996. 10 Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyer.

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PAPER-II **ANALYTICAL CHEMISTRY** **Code No: CHR2**

Student has to write any **FIVE**questions out of eight questions carrying 20 marks each

UNIT I -- Solvent Extraction, Ion Exchange And Chromatography

Introduction, Principle, techniques, factors affecting solvent extraction, quantitative treatment of solvent extraction equilibria-chelate and ion association systems-synergism.

Introduction to action of ion exchange resins, separation of inorganic mixtures, application.

Introduction to –column, paper chromatography – Thin layerchromatography and HPLC and Gas. Chromatography: Equipment and functioning of Gas liquid – Chromotography.

UNIT-II – Mass Spectrometry:

Principle – theory – instrumentation – interpretation of spectr of metal compounds – identification of compounds of metal compounds from fragmentation pattern. – applications.

UNIT-III – X-Ray Spectroscopy

Principles-theory,X-ray diffraction - identification of substances by the powder diffraction method- applications. X-ray fluorescence,instrumentation and applications.

UNIT-IV – Thermometric Methods

Theory and applications of techniques pertaining of thermogravimetric analysis, differential thermal analysis and differential scanning calorimetry- Mossbauer and photoelectron spectroscopy,

Suggested Books:

1. A.I.Vogel - A text Book of qualitative Inorganic analysis – ELBS.
2. D.A.Skoog, D.M.West and F.J.Holler—Fundamentals of Analytical Chemistry.
3. H.H.Willard, H.Dean and L.Merritt Advanced quantitative analysis- Affiliated East West Press – Delhi.
4. G.H.Morrison and H.Frieser- Solvent extraction in Analytical Chemistry, John Wiley A sons.
5. M.N.Sastri--Separation Techniques - - Himalaya Publications.
6. Instrumental methods of Chemical Analysis by B.K.Sharma
7. Instrumental methods of Analysis by H.Kaur.
8. Instrumental methods of Analysis by Chatwal and Anand.

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I Pre-Ph.D Examinations

PARER – II **ORGANIC CHEMISTRY** **Code No: CHR3**

Student has to write any **FIVE**questions out of eight questions carrying 20 marks each

UNIT I – Concept of Chirality

Recognition of symmetry elements and chiral structures; R-S nomenculature, disteroisomerism in acyclic and cyclic systems; E-Z isomerisms. Conformational Analysis of simple cyclic (chair and boat cyclo hexanes) and acyclic systems. Interconversion of Fischer, Newman and Sawhorse projections.

Stereochemistry and conformational Analysis. Nwere method of asymmetric synthesis (including enzymatic and catytic nexus), enantio and diastereo selective synthesis. Effects of conformation on reactivity in acyclic compounds and cyclohexane derivatives.

Methods of determining reaction mechanisms – energy profile diagrams – Intermediate versus transition state – testing of intermediates – cross-over experiments – isotopic labeling – kinetic method of determining reaction mechanisms.

UNIT-II – Common Organic Reactions and Mechanism:

Reactive intermediates. Formation and stability of carbonium ions, carbanions, carbenes, nitrenes, radicals and arynes. Nucleophilic, electrophilic, radical substitution, addition and elimination reactions.

Familiar name reactions: Aldol, Perkin, stobbe, Dieckmann condensations; Hofmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangements; Reimer- Tiemann, Reformatsky and Grignard reactions. Diels- Alder reactions; Claisen rearrangements; Friedel— Crafts reactions; Wittig reactions; and Robinson annulation. Routine functional group transformations and interconversions of simple functionalities.

Hydroboration, Oppenaur oxidations.

Selective Organic Name Reactions: Favorski reaction; Stork enamins reaction; Michael addition, Mannich Reaction; Sharpless asymmetric epoxidation; Ene reaction, Barton reaction, Hofmann-Loffler- Freytag reaction, Shapiro reaction, Baeyer-Villiger reaction, Chichibabin reaction.

UNIT-III – Oxidations

Oxidation of hydrocarbons, alcohols by chromic acid, chromium(Vl)oxide- pyridine complex, manganese(lV)oxide, silver carbonate. Oxidation of C=C with ruthenium tetroxide, thallium(Ill)nitrate.

UNIT-IV - Reductions:

Catalytic hydrogenations - reduction by dissolving metals - metal-acid reductions, reduction of carbonyl compounds, reduction with metal in liquid ammonia(Birch reduction), reduction by hydride transfer agents like LiHAl4, MPV, NaBH4, sodiumcyanoborohydride reduction with diimide.

Suggested Books:

1. Sterio Chemistry of carbon compounds by E.L. Eliel.
2. Confirmational analysis by E.L. Eliel
3. Mechanism and structure in organic Chemistry by ES Gould.
4. Text Book of Organic Chemistry Vol I & KK I.L. Finar.
5. Text Book of organic Chemistry by Jerry March.
6. Modern methods of organic synthesis by W. Carruthers.
7. Reactions rearrangements and reagents by S.N. Sanyal.

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PARER – III **ADVANCED ANALYTICAL CHEMISTRY** **Code No: CHR4**

Student has to write any **FIVE** questions out of eight questions
All questions carry 20 marks each

UNIT I – Optical Methods

Theory and Applications of Atomic and molecular absorption and Flame emission spectroscopy in quantitative analysis. Inductively Coupled Spectrometer and its applications – Principles – Instrumentations – Advantages over Atomic Absorption Spectroscopy – Applications.

UNIT-II – Electro-Analytical Techniques

Theory and Applications of Electro-analyticaltechniques: Voltametry, Cyclicvoltametry, polarography, amperometry, Bi-Amperometric titrations - Chrono potentioimetry. Electro gravimetry Coulometry. Annodic stripping *voltam*etry;. Importance and utility of ion selective electrodes in analysis.

UNIT-III – Electron Paramagnetic Resonance Spectroscopy

Principle-theory-instrumentation -hyperfine interactions-determination of 'g' value-endor and eldor applications-study of free radicals-structural determination-reaction velocities and mechanisms- study of inorganic compounds-study of catalysis.

UNIT-IV – Nuclear Magnetic Resonance Spectroscopy

Principles-theory-instrumentation-differences betweenNMR and EPR-chemical shift -spin-spin coupling effect of chemical exchange on spin-spin interactions-spin decoupling-limitations of NMR-cause of chemical shift and shielding-applications- qualitative and quantitative analysis-kineticstudies.

Suggested Books:

1. A.I.Vogel - A text Book of qualitative Inorganicanalysis – ELBS.
2. D.A.Skoog, D.M, Wesl and F.J.Holier-- Fundamentals of Analytical Chemistry.
3. H.H.Willard, H.Dean and L.Merrill Advancedquantitative analysis-Affiliated East West Press – Delhi.
4. Instrumentalmethods of Chemical Analysis byB. K.Sharma.
5. Instrumental methods of Analysis by H.Kaur.
6. Instrumental Methods of Analysis by Chatwal and Anand.

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I /Pre-Ph.D Examinations

PARER – III ORGANIC SPECTROSCOPY Code No: CHR5

Student has to write any **FIVE**questions out of eight questions carrying 20 marks each

UNIT I – Nuclear Magnetic Resonance

Chemical Shift- atomic and molecular shielding – Vanderwalls effect – electromagnetic and dipole shielding, magnetic anisotropy – solvent effects – chemicals shifts of C13NMR-Effect of chemical and agnetic equivalence – germinal couplings, long range couplings – structure analysis and multiple resonance (INDOOR)

2D NMR spectroscopy-definition and importance of COSY,DEPT., HOMCOR, HETCOR, INADEQUATE, INDOR,INEPT NOESY, HOM 205, DQF COSY – Studies of simple organic compounds and related problems – menthol.

UNIT-II –Vibrational Spectroscopy

Preliminary analysis fundamental vibrations, stretching frequencies of CN, C=o, aromatic compounds, compounds containing CH3, CH2, C-O-C, C-OH, N-OH, CH, unsaturated and heterocyclic compounds interpretation of spectra.

UNIT-III – Electronic Spectroscopy

The shapes of the absorption curves – Frank-Condon Principle – Singlet and triplet states – ORD and CD application of visible and chiro optical spectroscopy – structure and hydrogen bonding studies – charge transfer bonds – solvent and temperature effects – assignment of configuration – sector and recent developments.

UNIT-IV Mass Spectroscopy

Ion formation and detection – mass analysis – sample inlet systems – molecular formula and elemental composition isotopic incorporation – compound identification molecular structure elucidation and analysis of mixtures by GCMS.

References:

1. Organic Structure analysis by Lambert
2. Spectrometric identification of organic compounds by Silverstein
3. Spectroscopic methods in organic chemistry by Williams and Fleming.
4. Two dimensional NMR Spectroscopy – Application for chemists and Bio chemists, Edited by William R Crusmun and Robert M.K. Carlion MSA9. 1987, New York USA, VCH publications.

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PARER – III **CHEMICAL DYNAMICS** **Code No: CHR6**

Student has to write any **FIVE**questions out of eight questions carrying 20 marks each

UNIT I – Reaction Kinetics

Rates of chemical reactions (Zero, first and second order reactions) – effect of temperature on reaction rates – Theories of reaction rtes – collision theory – Elementary account of absolute theory of reaction rates.

UNIT-II - Thermodynamic formulations

Thermodynamic formulation of reaction rates – Unimolecular reactions – Lindmann's theory – ionic reaction – effect of dielectric constant – Primay and second salt effects – Elementary account of linear free energy relationships – Hammet and Taft equations – complex reactions – opposing, parallel and consecutive reactions – Branching chin reactions.

UNIT-III Fast Reactions

Luminescence and Energy transfer process. Study of Kinetics by stopped flow technique relazation method, Flash photolysis and Magnetic Resonance Method.

UNIT-IV Photo Chemistry

Cis-trans isomerisation, Paterno- Buch reaction, Nerrish type I and II reactions photo reduction of ketones, dipimethane [rearrangement, Photo chemistry of arenes., Macro Molecules – Number-average and Weight average molecular weights; determination of molecular weights. Kinetics of polymerization. Sterochemistry and mechanism of polymerization.

References:

1. Advanced Organic Chemistry – Reaction Mechanism and Structure by J. March.
2. Mechanism and structure in Organic Chemistry, by ES Goud.
3. Mechanisms of Inorganic Reactions, by F. Basalo and R.G. Pearson,
4. Chemical Kinetics, by J. Laidier.
5. Kinetics and mechanism, by AA Frost and R.G. Pearson.

MODEL QUESTION PAPER

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PAPER-I **RESEARCH METHODOLOGY** **Code No. CHR1**

Note : There must be two questions from each Unit)
Student has to write any five questions out of eight questions carrying 20 marks each

Time : 3 hrs Max Marks : 100

1)a)

b)

2) a)

b)

3) a)

b)

4) a)

b)

5) a)

b)

6) a)

b)

7) a)

b)

8) a)

b)

MODEL QUESTION PAPER

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PAPER-II **ANALYTICAL CHEMISTRY** **Code No: CHR2**

Note : There must be two questions from each Unit)
Student has to write any five questions out of eight questions carrying 20 marks each

Time : 3 hrs Max Marks : 100

1)a)

b)

2) a)

b)

3) a)

b)

4) a)

b)

5) a)

b)

6) a)

b)

7) a)

b)

8) a)

b)

MODEL QUESTION PAPER

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PARER – II **ORGANIC CHEMISTRY** **Code No: CHR3**

Note : There must be two questions from each Unit)
Student has to write any five questions out of eight questions carrying 20 marks each

Time : 3 hrs Max Marks : 100

1)a)

b)

2) a)

b)

3) a)

b)

4) a)

b)

5) a)

b)

6) a)

b)

7) a)

b)

8) a)

b)

MODEL QUESTION PAPER

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PARER – III ADVANCED ANALYTICAL CHEMISTRYCode No: CHR4

Note : There must be two questions from each Unit)
Student has to write any five questions out of eight questions carrying 20 marks each

Time : 3 hrs Max Marks : 100

1)a)

b)

2) a)

b)

3) a)

b)

4) a)

b)

5) a)

b)

6) a)

b)

7) a)

b)

8) a)

b)

MODEL QUESTION PAPER

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PARER – III **ORGANIC SPECTROSCOPY** **Code No: CHR5**

Note : There must be two questions from each Unit)
Student has to write any five questions out of eight questions carrying 20 marks each

Time : 3 hrs Max Marks : 100

1)a)

b)

2) a)

b)

3) a)

b)

4) a)

b)

5) a)

b)

6) a)

b)

7) a)

b)

8) a)

b)

MODEL QUESTION PAPER

ANDHRA KESARI UNIVERSITY:: DEPARTMENT OF CHEMISTRY

Part-I/Pre-Ph.D Examinations

PARER – III **CHEMICAL DYNAMICS** **Code No: CHR6**

Note : There must be two questions from each Unit)
Student has to write any five questions out of eight questions carrying 20 marks each

Time : 3 hrs Max Marks : 100

1)a)

b)

2) a)

b)

3) a)

b)

4) a)

b)

5) a)

b)

6) a)

b)

7) a)

b)

8) a)

b)