Program: Ph.D. (Chemistry)

PROGRAM OUTCOMES (POs)

PO 1: Constructing a concrete foundation for theoretical, quantitative, and logical thinking that underlies theories and models related to the chemical sciences

PO 2: Integrate concepts and ideas learned in theory with skills learned in laboratories to formulate hypotheses, collect & compile data to deduce results and draw logical conclusions.

PO 3: To develop skills to use of both classical and modern tools for investigation of chemical systems.

PO 4: Exploring new areas of research in interdisciplinary and multidisciplinary areas.

PO 5: Design proper procedures and rules for safety and handling of chemicals.

PO 6: Create awareness of the benefits and impacts of chemistry on environment, society and other disciplines outside the scientific community.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Learners will get advanced understanding in the area of characterization techniques in chemistry.

PSO2: Students will understand chemical and molecular processes in chemical reactions.

PSO3: Students will gain knowledge of design and perform experiments efficiently and effectively, and analyze the data to draw conclusions.

PSO4: Developing a mechanistic understanding of selectivity and synthetic strategy and research skills applicable to modern chemistry.

PSO5: Learners can also acquire practical skills to work as chemist, faculty and other industrial supporting services.

Ph.D. (Chemistry)	
Course	**Course Outcomes (COs)**
Nanomaterial and Applications (CHEM-601)	CO1: To know historical developments, synthesis, characterization and important applications of nanomaterials. CO2: Learn the physicochemical properties of nanomaterials and Preparation of nanostructured oxides. CO3: Understanding the influence of nanomaterials on health, communication, Energy, Environment, safety, security and defence. CO4: Enhance the sufficient scientific background to advanced inorganic materials and metal chalcogenides, and their characterization by modern techniques. CO5: To understand the importance of nanotechnology for sustainability, Nanomedicine, Environmental, health, and safety issues.
Advance Physical Chemistry (CHEM-602)	CO1: Learner will come to know the various techniques for preparation of Materials and applications in soid state devices. CO2: To know the kinetics of redox reactions, catalysis, their types and theories of catalysis. General mechanism, difference between phase transfer and mecellar catalysis. CO3: To understand the structure of liquids, relationship between structure and the thermodynamics properties, influence of solute on structure of water and structure of water near a surface. CO4: Enhance scientific background to dipolar interactions, dipolar molecules in gases and liquids, methods for determination of dipole moments.
Advance Organic Chemistry (CHEM-603)	CO1: Enhance the sufficient scientific background to Neighbouring Group Mechanism, Neighbouring Group (NG) participation by π and σ bonds. CO2: To understand isotope effect, its origin and importance in determining reaction mechanism. CO3: Enhancing the knowledge in stereochemistry, methods of determination of Chemical transformation, Asymmetric Synthesis and Quaciracemates.

	CO4: To understand some naming rearrangements in organic reactions.
Structure from Spectra (CHEM-604)	CO1: To learn basic principle of Ultra-violet spectroscopy and its application to study absorption maximum for dienes, polyenes, carbonyl compounds and α,β-unsaturated carbonyl compounds using Woodward rule. CO2: To understand importance infrared spectroscopy, Fingerprint region and interpretation of IR spectra in synthetic or natural products chemistry. CO3: To learn interpretation of spectra, chemical shift, shielding mechanism and anisotropic effects, chemical exchange and chemical exchange and chemical shifts in chiral molecules in NMR Spectroscopy and CMR Spectroscopy. CO4: To know principle, working , interpretation of spectra by using Mass Spectrometry
Advance Inorganic Chemistry (CHEM-605)	CO1: Learner will come to know about principle, working and types of electrodes used in polarography - Electro analytical Techniques. CO2: To understand Principles, theory and applications of Amperometry, Coulometry and AC Polarography. CO3 To know about Phosphorescent Materials, light emitting diodes, types and principle of organic light emitting diodes. CO4: To understand general characteristics of different types of main group organometallics, their stability and routes of M-C bond formation.
Disconnection Approach and Heterocyclic Chemistry (CHEM-606)	CO1: To know the application of stereochemistry in organic synthesis. CO2: To understand the use and application of disconnection approach for organic synthesis. CO3: Learner will know the basic principles of green chemistry and application of non-conventional techniques in organic synthesis CO4: To learn general synthesis of compounds with three or more heteroatoms in the ring
Research Methodology (CHEM-609)	CO1: The students would learn about various research methods used in research. CO2: To know how to do survey of literature in specific field and how to write synopsis for research proposal.

	CO3: To understand research as career; current status and future prospects of a specific research field. CO4: To learn experimental designs, sampling designs, recording of observation, measurement and scaling techniques.
Seminar (CHEM-607)	CO1: Learning how to pick a problem for their research project and to provide latest facts and updated information by consulting latest editions of textbooks, reference books, monographs and peer-reviewed national & international research journals.
Dissertation (CHEM-701)	CO1: Students will learn how to work on a research topic assigned to him/her by their supervisor/mentor with a purpose to develop a collective approach to study, analyze and solve the problem.