GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)

(Deemed to be University)

VISAKHAPATNAM * HYDERABAD * BENGALURU

Accredited by NAAC with A^{++} Grade

GITAM School of Science

CURRICULUM AND SYLLABUS

2 Year Postgraduate Programme
PCHEM04: M.Sc. Chemistry

w.e.f. 2025-26 admitted batch

(Updated on July 2025)

Academic Regulations

Applicable for the Postgraduate Programmes in the Schools of Humanities & Social Sciences and Science (except M.C.A)

https://www.gitam.edu/academics/academic-regulations

GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT

Vision

GITAM will be an exceptional knowledge-driven institution advancing on a culture of honesty and compassion to make a difference to the world.

Mission

- Build a dynamic application-oriented education ecosystem immersed in holistic development.
- Nurture valuable futures with global perspectives for our students by helping them find their ikigai.
- Drive impactful integrated research programmes to generate new knowledge, guided by integrity, collaboration, and entrepreneurial spirit.
- Permeate a culture of kindness within GITAM, fostering passionate contributors.

Quality Policy

To achieve global standards and excellence in teaching, research, and consultancy by creating an environment in which the faculty and students share a passion for creating, sharing and applying knowledge to continuously improve the quality of education.

GITAM School of Science

VISION

Nurturing a high-quality Science Education and Research by providing a best learning ecosystem to create world class academicians and researchers.

MISSION

- To teach the most renewed curriculum that lay the foundation for students to start exciting careers in academia, research, and industry.
- To foster an environment of healthy curiosity, an innovative mindset, and a strong desire to contribute to the science world.
- To advance our understandings of the natural processes of Physical, Chemical and Biological systems for a better habitable world.
- To inculcate a strong sense of empathy, integrity, and trust in the GITAM Fraternity with a strong commitment towards society and environment.

VISION AND MISSION OF THE DEPARTMENT

VISION

To Spread Knowledge and excel in academics in Chemical Education with cutting-edge research and innovation by creating a collaborative and active learning-based educational system

MISSION

- To teach the most renewed curriculum to match the industrial requirements
- To conduct advanced research for enriching the learning skills of students
- To address major challenges in thrust areas of research like Drug Development, Material Science, Health, Energy, Environment and Space.

Programme Educational Objectives (PEOs)

The PEOs are broad statements that describe the career and professional accomplishments that the program is preparing its graduates to achieve in a few years (for example, two years) subsequent to receiving the degree. The PEOs of the M.Sc. program in Chemistry are as follows:

PEO 1: GU Chemistry graduates will be well prepared for successful careers in the profession or in research & innovation in industry and/or in government in one or more of the disciplines of chemistry and /or sub-disciplines of Chemistry.

PEO 2: GU Chemistry graduates will be academically prepared to provide feasible and sustainable solutions for real-life problems and become licensed professional chemists in due course and will contribute effectively to serve society.

PEO 3: GU Chemistry graduates will be engaged in professional activities to enhance their own achievement and simultaneously contribute to the service of humankind.

PEO 4: GU Chemistry graduates will be successful in higher education in Chemistry and in management, if pursued.

PEO 5: GU Chemistry graduates will be successful leaders with the ability to handle all kinds of diverse circumstances by nurturing them in the interdisciplinary and multidisciplinary learning environment.

PEO Articulation

	PEO1	PEO2	PEO3	PEO4	PEO5
M1	3	2	2	2	2
M2	3	2	2	2	3
M3	3	3	2	2	3

3 - High Correlation, 2 - Medium Correlation, 1 - Low Correlation

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

At the end of the Programme the students would be able to demonstrate:

PO1:	The graduates should be able to demonstrate the acquisition of: • Advanced knowledge about a specialized field of enquiry with a critical understanding of the emerging developments and issues relating to one or more fields of learning. • Advanced knowledge and understanding of the research principles, methods, and techniques applicable to the chosen field(s) of learning or professional practice. • Procedural knowledge required for performing and accomplishing complex and specialized and professional tasks relating to teaching, and research and development.
PO2:	The graduates should be able to demonstrate the acquisition of: • Advanced cognitive and technical skills required for performing and accomplishing complex tasks related to the chosen fields of learning. • advanced cognitive and technical skills required for evaluating research findings and designing and conducting relevant research that contributes to the generation of new knowledge. • specialized cognitive and technical skills relating to a body of knowledge and practice to analyze and synthesize complex information and problems.
PO3:	The graduates should be able to demonstrate the ability to: • Apply the acquired advanced theoretical and/or technical knowledge about a specialized field of enquiry or professional practice and a range of cognitive and practical skills to identify and analyze problems and issues, including real-life problems, associated with the chosen fields of learning. • Apply advanced knowledge relating to research methods to carry out research and investigations to formulate evidence-based solutions to complex and unpredictable problems.
PO4:	The graduates should be able to demonstrate the ability to: • Listen carefully, read texts and research papers analytically and present complex information in a clear and concise manner to different groups/audiences • Communicate, in a well-structured manner, technical information and explanations, and the findings/results of the research studies undertaken in the chosen field of study. • Present in a concise manner view on the relevance and applications of the findings of recent research and evaluation studies in the context of emerging developments and issues. • Meet one's own learning needs relating to the chosen fields of learning, work/vocation, and an area of professional practice. • Pursue self-paced and self-directed learning to upgrade knowledge and skills, including research-related skills, required to pursue a higher level of education and research. • Problematize, synthesize, and articulate issues and design research proposals. • Define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships. • Develop appropriate tools for data collection for research. • Use appropriate statistical and other analytical tools and techniques for the analysis of data collected for research and evaluation studies. • Plan, execute, and report the results of an investigation.

	• Follow basic research ethics and skills in practicing/doing ethics in the field/ in one's own research work. • Make judgements and take decisions regarding the adoption of approaches to solving problems, including real-life problems, based on the analysis and evaluation of information and empirical evidence collected. • Make judgement across a range of functions requiring the exercise of full responsibility and accountability for personal and/or group actions to generate solutions to specific problems associated with the chosen fields/subfields of study, work, or professional practice.
PO5:	The graduates should be able to demonstrate the willingness and ability to: • Embrace and practice constitutional, humanistic, ethical, and moral values in one's life. • Adopt objective and unbiased actions in all aspects of work related to the chosen fields/subfields of study and professional practice. • Participate in actions to address environmental protection and sustainable development issues. • Support relevant ethical and moral issues by formulating and presenting coherent arguments. • Follow ethical principles and practices in all aspects of research and unethical practices such as fabrication, falsification or misrepresentation of data or committing plagiarism.
PO6:	The graduates should be able to demonstrate the acquisition of knowledge and skill sets required for: • adapting to the future of work and responding to the demands of the fast pace of technological developments and innovations that drive the shift in employers' demands for skills, particularly with respect to t h e transition towards more technology-assisted work involving the creation of new forms of work and rapidly changing work and production processes. • Exercising full personal responsibility for the output of own work as well as for group/team outputs and for managing work that is complex and unpredictable requiring new strategic approaches.
PSO1:	Chemistry graduates will be prepared to contribute effectively in the areas of organic chemistry and able to apply the concept of advanced studies for the understanding of underlining principles, proposing mechanisms, problem solving, identification of chemical species, and arriving at a logical conclusion by developing skills in synthesis and characterization of specific organic compounds using documented laboratory procedures.
PSO2:	GU Chemistry graduates will be able to integrate knowledge learned in different courses of Inorganic and Environmental Chemistry. This learning will help students to meet the demands of various Industries based on chemicals as well as environmental science. And students will also utilize this knowledge to handle all types of hazardous and toxic chemicals along with all necessary required precautions.
PSO3:	GU Chemistry graduates will be able to acquire firm knowledge of various fundamental theories related to Physical and Analytical Chemistry. By using concepts, tools, and techniques related to these topics, they can acquire knowledge and utilize its application in interpretation and explanation of the limits and accuracy of experimental data in terms of significance.

Curriculum Structure

(Flexible Credit System)

Minimum Credit Requirements to Award Degree Under Each Category

Duration & Name of the Programme				S.No	Course Category		Minimum Credit Requirement		
Programme	Eligibility	Programme	Eligibility				2 Year PG (2nd year- Course Work alone)	2 Year PG (2nd year - Course Work and Research)	2 Year PG (2nd year - Research alone)
2-year PG Degree (with exit option at the end of first year)	3-year UG Degree	1 year & PG Diploma	3-year UG Degree	1	Programme Core Courses & Labs	PC	28	28	28
				2	Programme Electives Courses	PE	8	8	8
				3	Research Methodology	FC	4	4	4
				4	Seminar	FC	1	1	1
				5	Term Paper	FC	1	1	1
				6	Internship	FC	4	4	4
				Total (At the end of I Year)			46	46	46
		1 year & PG Degree	4-year UG Degree	7	Programme Core Courses	PC	40	20	0
				8	Programme Electives Courses	PE			
				9	Research Project	FC	0	20	0
				10	Research Dissertation	FC	0	0	40
				Total (At the end of II Year)			86	86	86

2 Year PG programme:

Semester I and II: Common Structure for Course Work, Course Work & Research and Research Alone

Course Code	Category	Level	Course Title	L	T	P	S	J	C
Semester - I									
25CHEM6001	PC	600	Advances in Inorganic Chemistry-I	4	0	0	0	0	4
25CHEM6011	PC	600	Principles of Organic Chemistry-I	4	0	0	0	0	4
25CHEM6021	PC	600	Quantum Chemistry and Spectroscopy	4	0	0	0	0	4
25CHEM6031	PC	600	Organic Chemistry Laboratory	0	0	4	0	0	2
25CHEM6041	PC	600	Physical Chemistry Laboratory	0	0	4	0	0	2
Choose any one of the following electives:									
25CHEM6051	PE	600	Advanced Spectroscopy and Dynamics	4	0	0	0	0	4
25CHEM6061	PE	600	Concepts of Analytical Chemistry-I	4	0	0	0	0	4
25CHEM6071	PE	600	Organic Reactive Intermediates, Concept of Mechanism and Reagents	4	0	0	0	0	4
			Total Credits						**20**
Semester - II									
25CHEM6081	PC	600	Advances in Inorganic Chemistry-II	4	0	0	0	0	4
25CHEM6091	PC	600	Chemical Kinetics and Thermodynamics	4	0	0	0	0	4
25CHEM6101	PC	600	Computational Chemistry Laboratory	0	0	4	0	0	2
25CHEM6111	PC	600	Inorganic Chemistry Laboratory	0	0	4	0	0	2
25CHEM6444	FC	600	Research Methodology	4	0	0	0	0	4
25CHEM6777	FC	600	Term Paper	0	0	0	0	2	1
25CHEM6666	FC	600	Seminar	0	0	0	0	2	1
25CHEM6333	FC	600	Internship	0	0	0	0	8	4
Choose any one of the following electives:									
25CHEM6121	PE	600	Advances in Computational Chemistry	4	0	0	0	0	4
25CHEM6131	PE	600	Concepts of Analytical Chemistry-II	4	0	0	0	0	4
25CHEM6141	PE	600	Principles of Organic Chemistry-II	4	0	0	0	0	4
			Total Credits						**26**

2nd Year - Research alone of Organic Chemistry/Analytical Chemistry specialization:

Course Code	Category	Level	Course Title	L	T	P	S	J	C
Semester - III									
25CHEM7888	FC	700	Research Dissertation - I	0	0	0	0	40	20
			Total Credits						**20**
Semester – IV									
25CHEM7999	FC	700	Research Dissertation - II	0	0	0	0	40	20
			Total Credits						**20**

Organic Chemistry specialization

2nd Year – 'Course Work alone' & 'Coursework and Research':

Semester – III (Common Structure for 'Course Work alone' & 'Course Work and Research')									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25CHEM7001	PC	700	Advances in Organic Spectroscopy	4	0	0	0	0	4
25CHEM7011	PC	700	Organic Synthesis - I	4	0	0	0	0	4
25CHEM7021	PC	700	Microscale Multistep Organic Synthesis Laboratory	0	0	4	0	0	2
25CHEM7031	PC	700	Organic Separations and Spectroscopy Laboratory	0	0	4	0	0	2
Choose any one of the following electives:									
25CHEM7041	PE	700	Advances in Green Chemistry	4	0	0	0	0	4
25CHEM7051	PE	700	Advances in Medicinal Chemistry	4	0	0	0	0	4
25CHEM7061	PE	700	Chemistry of Natural Products	4	0	0	0	0	4
Choose any one of the following electives:									
25CHEM7071	PE	700	Computer-Aided Drug Discovery and Development	4	0	0	0	0	4
25CHEM7081	PE	700	Separation Techniques for Organic Compounds	4	0	0	0	0	4
25CHEM7091	PE	700	Bioorganic Chemistry	4	0	0	0	0	4
			Total Credits						**20**

Course Work alone

Semester - IV									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25CHEM7101	PC	700	Organic Synthesis-II	4	0	0	0	0	4
25CHEM7111	PC	700	Pericyclic Reactions and Photochemistry	4	0	0	0	0	4
25CHEM7121	PC	700	Organic Qualitative and Quantitative Analysis Laboratory	0	0	4	0	0	2
25CHEM7131	PC	700	Organic Computational Laboratory	0	0	4	0	0	2
Choose any one of the following electives:									
25CHEM7141	PE	700	Essentials of Astrochemistry	4	0	0	0	0	4
25CHEM7151	PE	700	Advanced Heterocyclic Chemistry	4	0	0	0	0	4
25CHEM7161	PE	700	Forensic Chemistry	4	0	0	0	0	4
Choose any one of the following electives:									
25CHEM7171	PE	700	Organometallic Chemistry	4	0	0	0	0	4
25CHEM7181	PE	700	Chemistry of Nanomaterials	4	0	0	0	0	4
25CHEM7191	PE	700	Pharmaceutical Process Chemistry	4	0	0	0	0	4
			Total Credits						**20**

Coursework and Research

Semester – IV									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25CHEM7555	FC	700	Research Project	0	0	0	0	40	20
			Total Credits						**20**

Analytical Chemistry specialization

2nd Year – 'Course Work alone' & 'Coursework and Research':

Semester – III (Common Structure for Course Work alone, Course Work & Research)									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25CHEM7201	PC	700	Quality Control and Quality Assurance	4	0	0	0	0	4
25CHEM7211	PC	700	Instrumental Methods of Analysis-I	4	0	0	0	0	4
25CHEM7221	PC	700	Classical Quantitative Analysis Laboratory-I	0	0	4	0	0	2
25CHEM7231	PC	700	Instrumental Methods of Analysis Laboratory-I	0	0	4	0	0	2
Choose any one of the following electives:									
25CHEM7241	PE	700	Applied Analysis-I	4	0	0	0	0	4
25CHEM7251	PE	700	Pharmaceutical Analysis	4	0	0	0	0	4
25CHEM7261	PE	700	Analysis of Agrochemicals	4	0	0	0	0	4
Choose any one of the following electives:									
25CHEM7271	PE	700	Separation Methods and Modern Techniques of Analysis	4	0	0	0	0	4
25CHEM7001	PE	700	Advances in Organic Spectroscopy	4	0	0	0	0	4
25CHEM7161	PE	700	Forensic Chemistry	4	0	0	0	0	4
			Total Credits						**20**

Course Work alone

Semester - IV									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25CHEM7281	PC	700	Applied Analysis-II	4	0	0	0	0	4
25CHEM7291	PC	700	Instrumental Methods of Analysis-II	4	0	0	0	0	4
25CHEM7301	PC	700	Classical Quantitative Analysis Laboratory-II	0	0	4	0	0	2
25CHEM7311	PC	700	Instrumental Methods of Analysis Laboratory-II	0	0	4	0	0	2
Choose any one of the following electives:									
25CHEM7321	PE	700	Concepts of Environmental Analysis	4	0	0	0	0	4
25CHEM7331	PE	700	Drug Formulation and Pharmacokinetics	4	0	0	0	0	4
25CHEM7341	PE	700	Analytical Techniques for Biomolecules	4	0	0	0	0	4
Choose any one of the following electives:									
25CHEM7351	PE	700	Equipment Qualification and Method Validation	4	0	0	0	0	4
25CHEM7041	PE	700	Advances in Green Chemistry	4	0	0	0	0	4
25CHEM7141	PE	700	Essentials of Astrochemistry	4	0	0	0	0	4
			Total Credits						**20**

Coursework and Research

Semester – IV									
Course Code	**Category**	**Level**	**Course Title**	**L**	**T**	**P**	**S**	**J**	**C**
25CHEM7555	FC	700	Research Project	0	0	0	0	40	20
			Total Credits						**20**

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