

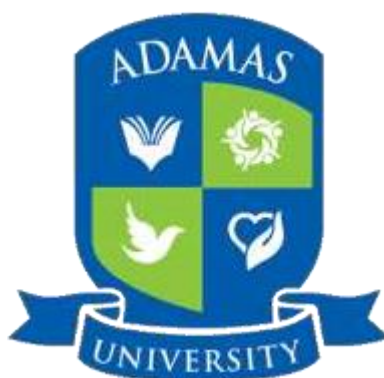
# **Course Curriculum under**

**CHOICE BASED CREDIT SYSTEM**

**COURSE STRUCTURE FOR**

**FOR**

**BACHELOR OF SCIENCE IN CHEMISTRY (HONOURS)**



**ADAMAS UNIVERSITY**

## **VISION OF THE DEPARTMENT**

The Vision of the Department of Chemistry is to generate and disseminate Chemistry education among its pupils such that at individual level, a Chemistry graduate should be inspired with a sense of curiosity and wonder about the fundamental nature of the world around the student; be empowered with the ability to make decisions about their own lives and critically evaluate scientific and technological developments that impact society and lastly be equipped them with the knowledge and skills to pursue further study and rewarding careers in the chemical sciences and a wide range of related fields.

## **MISSION STATEMENTS OF THE DEPARTMENT**

**M.S 01:** To represent a clear framework or narrative that gives a coherent ‘big picture’ of chemistry as a subject, explains why it matters, and shows how different areas of content are connected.

**M.S 02:** To prepare competitive and professional graduates within an innovative and intellectually stimulating environment, support other academic programs at Adamas University by offering quality chemistry learning experiences, conduct basic and applied research of national and international impact.

**M.S 03:** To advance knowledge platform that supports an invent-and-design culture in graduate and undergraduate chemistry education and that empowers students to address and solve challenges of global significance.

**M.S 04:** To reach out to our future thought leaders—students of all backgrounds from pre-college to doctoral candidates—to share the power of chemistry to create new knowledge directed at the major unmet needs of our time.

### **Name of the Programme: Bachelor of Science (Honours) in Chemistry**

#### **PROGRAMME SPECIFIC OBJECTIVES (PSO)**

**PSO 01:** To cultivate a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistries.

**PSO 02:** To appreciate the importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of complexes using theories and instruments.

**PSO 03:** To be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

**PSO 04:** To employ critical thinking and the scientific knowledge to design, carryout, record and analyse the results of chemical reactions.

**PSO 05:** To create an awareness of the impact of chemistry on the environment, society, and

development outside the scientific community

**Name of the Programme: Bachelor of Science (Honours) in Chemistry**

**GRADUATE ATTRIBUTE / PROGRAMME OUTCOME (PO)**

**GA 01 / PO 01: Knowledge Integration:** To apply contextual knowledge and modern tools of chemical research for solving problems

**GA 02 / PO 02: Critical Thinking:** To cultivate a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical, Inorganic, Organic and Physical Chemistries.

**GA 03 / PO 03: Chemistry Knowledge:** To appreciate the importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of complexes using theories and instruments.

**GA 04 / PO 04: Expertise in Basic Chemistry:** Understands the background of organic reaction mechanisms, complex chemical structures, and instrumental method of chemical analysis, molecular rearrangements and separation techniques.

**GA 05 / PO 05: Analytical Skills** To be able to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

**GA 06 / PO 06: Professional Growth:** Upon completion of a BS in Chemistry degree, students are able to understand theoretical concepts of instruments that are commonly used in most chemistry fields as well as interpret and use data generated in instrumental chemical analyses.

**GA 07 / PO 07: Environment and Sustainability:** Find out the green route for chemical reaction for sustainable development.

**GA 08 / PO 08: Modern Tools Usage:** Use modern chemical tools, Models, Chem-draw, Charts and Equipment's.

**GA 09 / PO 09: Ethics:** Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing chemists.

<b>Summary of the B.Sc. Chemistry (Hons.) Programme</b>	
<b>Course Credit</b>	<b>Theory +Practical</b>
<b>Core Course (CC)</b>	
Theory (15 Papers of 4 credits each)	15×4=60
Practical (12 Papers of 2 credits each)	12×2=24
<b>Allied Knowledge Enhancement Course (AKEC)</b>	
Industry-Academia Interaction/Seminar Organization	1×2=2
Biological Chemistry	1×2=2
<b>Discipline Specific Elective Course (DSE)</b>	
Theory (4 Papers of 4 credits each)	4×4=16
Practical (4 Papers of 2 credits each)	4×2=8
<b>Generic Elective (GE)</b>	
Theory (4 Papers of 4 credits each)	4×4=16
Practical (4 Papers of 2 credits each)	4×2=8
<b>Ability Enhancement Compulsory Course (AECC)</b>	
(2 Papers of 2 credits each)	2×2=4
Environmental Science	2
English (Language & Literature)	2
<b>Skill Enhancement Elective Course (SEC)</b>	
(2 Papers of 2 credits each)	2×2=4
<b>Value Added Course (VAC)</b>	
Value added courses in different semester	10
<b>Total credit</b>	<b>154</b>

### Structure of Chemistry Undergraduate Courses

<b>Semester</b>	<b>Number of Courses</b>						
	<b>Core Course</b>	<b>SEC</b>	<b>DSE</b>	<b>GE</b>	<b>AKEC</b>	<b>AECC</b>	<b>Value Added Course</b>
1st	4			2		1	1
2nd	4			2		1	1
3rd	6	1		2			2
4th	6	1		2	1		1
5th	5		2				
6th	2		2		1		

**CORE COURSES OFFERED FOR  
B. SC. HONOURS (CHEMISTRY)**

<b>SEMESTER</b>	<b>COURSE NAME</b>
<b>1</b>	Physical-I and Organic -IA
	Physical Lab -I
	Inorganic-I and Organic -IB
	Inorganic Lab I
<b>2</b>	Organic -II and Physical IIA
	Organic Lab - I
	Inorganic -II and Physical IIB
	Physical Lab - II
<b>3</b>	Physical-III
	Physical Lab -III
	Inorganic -III
	Inorganic Lab -II
	Organic -III
	Organic Lab - II
<b>4</b>	Organic - IV
	Organic Lab - III
	Physical - IV
	Physical Lab - IV
	Inorganic -IV
	Inorganic Lab -III
<b>5</b>	Physical -V
	Inorganic -V
	Inorganic Lab -IV
	Organic -V
	Organic Lab -V
<b>6</b>	Analytical Chemistry
	Organic VI

## SKILL ENHANCEMENT COURSES (SEC)

### SEC-A For Semester 3 [Any one]

- SEC 1: Fuel Chemistry
- SEC 2: Intellectual Property Rights
- SEC 3: Chemistry of Cosmetics & Perfumes
- SEC 4: Any UGC MOOC Courses

### SEC-B For Semester 4 [Any one]

- SEC 5: Pharmaceuticals Chemistry
- SEC 6: Green Methods in Chemistry
- SEC 7: Cheminformatics
- SEC 8: Any UGC MOOC Courses

## Discipline Specific Courses (DSE)

### **Semester 5**

(Any One from the following)

- DSE-I: Advanced Spectroscopy and its application and Corresponding Lab Course
- DSE-I: Inorganic Material for Industrial Importance and Corresponding Lab Course

(Any One from the following)

- DSE-II: Theoretical Chemistry and corresponding Lab course
- DSE-II: Polymer Chemistry and Corresponding Lab

### **Semester 6**

(Any one from the following)

- DSE-III: Dissertation
  - DSE-III: Environmental Chemistry and Corresponding Lab Course
- (Any one from the following)
- DSE-IV: Chemistry of Nanomaterials and Corresponding Lab Course
  - DSE-IV: Green Chemistry and Chemistry of Natural Products and Corresponding Lab Course

## **Generic Elective Courses (GE)**

Semester 1&2 [Any one]

- GE 1 – Mathematics
- GE 2 – Zoology

Semester 3&4 [Any one]

- GE 3 – Physics
- GE 4 – Computer Science

### Detailed Course Structure for the B.Sc. (H) Chemistry

<b>ADAMAS UNIVERSITY</b>								
<b>SCHOOL OF BASIC AND APPLIED SCIENCES</b>								
<b>Department of Chemistry – B. Sc. Programme</b>								
<b>Semester - I</b>								
Type of the Paper	Paper Code	Subject	Brief Contents	Contact Hour Per Week	L	T	P	Credit
<b>Core</b>	<b>CHM11052</b>	Physical-I and Organic -IA <b>(Theory)</b>	Kinetic theory of gases, Liquid state , Thermodynamics-I, General Introduction and Bonding Features in Organic Molecules, General treatment of reaction mechanism, Reaction thermodynamics	<b>4</b>	3	1	0	<b>4</b>
<b>Core</b>	<b>CHM11053</b>	Inorganic-I and Organic -IB <b>(Theory)</b>	Extra nuclear structure of atom, Chemical periodicity, Acids and bases, Radioactivity & Stereochemistry-I	<b>4</b>	3	1	0	<b>4</b>
<b>Core</b>	<b>CHM12054</b>	Physical Lab-I <b>(Practical)</b>	List of experiments will be provided separately	<b>3</b>	0	0	3	<b>2</b>
<b>Core</b>	<b>CHM12055</b>	Inorganic Lab-I <b>(Practical)</b>	List of experiments will be provided separately	<b>3</b>	0	0	3	<b>2</b>
<b>Generic Elective</b>	<b>MTH11508</b>	Elective Mathematics-I	Details will be provided later	<b>6</b>	4	2	0	<b>6</b>
<b>Or</b>								
<b>Generic Elective</b>	<b>ZOL11001</b>	Elective Zoology-I	Details will be provided later	<b>4</b>	3	1	0	<b>4</b>
<b>Generic Elective</b>	<b>ZOL12002</b>	Elective Zoology-I Laboratory	Details will be provided later	<b>0</b>	0	0	3	<b>2</b>
<b>Value Added Course</b>	<b>DGS11001</b>	Design Thinking	Too basic as a philosophy of user-centric interactive disciplined collaborative innovation.	<b>2</b>	2	0	0	<b>2</b>
<b>Ability Enhancement Course (Compulsory)</b>	<b>ENG11057</b>	English (Language & Literature)	Details will be provided later	<b>2</b>	2	0	0	<b>2</b>
<b>Total Credit</b>				<b>22</b>				



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**Department of Chemistry – B. Sc. Programme Semester - II**

Type of the Paper	Paper Code	Subject	Brief Contents	Contact Hour Per Week	L	T	P	Credit
Core	CHM11056	Organic -II and Physical IIA (Theory)	Carbon-Carbon sigma bonds, Nucleophilic Substitution Reactions, Carbon-carbon pi bonds, Electrophilic addition to C=C bond & Chemical Kinetics I	4	3	1	0	4
Core	CHM11057	Inorganic -II and Physical IIB (Theory)	Chemical bonding, Noble gases & Thermodynamics II, Real gas	4	3	1	0	4
Core	CHM12063	Physical Lab-II (Practical)	List of experiments will be provided later	3	0	0	3	2
Core	CHM12059	Organic Lab-I (Practical)	List of experiments will be provided later	3	0	0	3	2
Generic Elective	MTH11509	Elective Mathematics-II	Details will be provided later	6	4	2	0	6
Or								
Generic Elective	ZOL11003	Elective Zoology-II	Details will be provided later	4	3	1	0	4
Generic Elective	ZOL12004	Elective Zoology-II Laboratory	Details will be provided later	3	0	0	3	2
Value Added Course	EIC11001	Venture Ideation	Still students will have 2 years to ideate and proceed to next level (Implementation).	2	1	1	0	2
Ability Enhancement Course (Compulsory)	EVS11105	Environmental Science and Energy Resources	Details will be provided later	2	2	0	0	2
<b>Total Credit</b>				<b>22</b>				

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Department of Chemistry – B. Sc. Programme Semester - III								
Type of the Paper	Paper Code	Subject	Brief Contents	Contact Hour Per Week	L	T	P	Credit
Core	CHM11060	Physical-III (Theory)	Chemical equilibrium and Ionic equilibrium, Chemical Kinetics-II, Conductance, Colloid and Surface Science	4	3	1	0	4
Core	CHM11061	Inorganic-III (Theory)	Chemistry of s and p block elements, Redox reactions and precipitation equilibria in solution.	4	3	1	0	4
Core	CHM11062	Organic-III (Theory)	Electrophilic aromatic substitution, Introduction to Alcohol, Synthesis of carbonyl compounds & Nucleophilic addition to C=O, Carboxylic acids and their derivatives	4	3	1	0	4
Core	CHM12069	Physical Lab- III (Practical)	List of experiments will be provided later	3	0	0	3	2
Core	CHM12064	Organic Lab-II (Practical)	List of experiments will be provided later	3	0	0	3	2
Core	CHM12058	Inorganic Lab- II (Practical)	List of experiments will be provided later	3	0	0	3	2
Generic Elective	PHY11015	Elective Physics-I	Details will be provided later	4	3	1	0	4
Generic Elective	PHY12016	Elective Physics-I Laboratory	Details will be provided later	3	0	0	3	2
		<b>Or</b>						
Generic Elective	CSE21641	Elective Computer Science-I	Details will be provided later	6	4	2	0	6
Generic Elective	CSE22642	Elective Computer Science Lab -I	Details will be provided later					
SEC	CHM11015	Intellectual Property Rights	IPR theory, Copyright, Trademarks, Patents, Geographical indications, Industrial designs, layout designs of integrated circuits, trade secrets.	2	2	0	0	2
		<b>Or</b>						
SEC	CHM11025	Chemistry of Cosmetics & Perfumes	Drugs and Pharmaceuticals, Fermentation	2	2	0	0	2
		<b>Or</b>						
SEC	CHM11017	Fuel Chemistry	Classification of fuels and their calorific value, Coal, Petroleum and	2	2	0	0	2

			petrochemical industry, Lubricants					
		<b>Or</b>						
<b>SEC</b>	<b>CHM11018</b>	Any Suitable UGC-MOOCs Course <sup>1</sup>	Details will be provided later	<b>2</b>	2	0	0	<b>2</b>
<b>Value Added Course</b>	<b>SOC14100</b>	Community Service	Various community service as chosen by student	<b>3</b>	0	0	3	<b>1</b>
<b>Value Added Course</b>	<b>IDP14001</b>	Inter-disciplinary Project	Basics of discipline are a prerequisite for inter- disciplinary knowledge.	<b>3</b>	1	0	2	<b>3</b>
<b>Total Credit</b>				<b>30</b>				

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**Department of Chemistry – B. Sc. Programme Semester - IV**

Type of the Paper	Paper Code	Subject	Brief Contents	Contact Hour Per Week	L	T	P	Credit
Core	CHM11066	Physical IV (Theory)	Quantum Mechanics I, Colligative properties, Phase rule, Thermodynamics Application in Electrochemistry,	4	3	1	0	4
Core	CHM11067	Inorganic IV (Theory)	Coordination Chemistry I & II, Chemistry of d and f block elements.	4	3	1	0	4
Core	CHM11068	Organic IV (Theory)	Nitrogen compounds and Organometallics, Rearrangements, Carbocycles and heterocycles	4	3	1	0	4
Core	CHM12075	Physical Lab IV (Practical)	List of experiments will be provided later	3	0	0	3	2
Core	CHM12070	Organic Lab III (Practical)	List of experiments will be provided later	3	0	0	3	2
Core	CHM12065	Inorganic Lab III (Practical)	List of experiments will be provided later	3	0	0	3	2
Generic Elective	CSE21643	Elective Computer Science-II	Details will be provided later	4	4	2	0	4
Generic Elective	CSE22644	Elective Computer Science Lab-II	Details will be provided later	3	0	0	3	2
Or								
Generic Elective	PHY11024	Elective Physics-II	Details will be provided later	4	3	1	0	4
Generic Elective	PHY12025	Elective Physics Lab- II	Details will be provided later	3	0	0	3	2
SEC	CHM11016	Pharmaceutical Chemistry	Preparation and uses of the following: Hair dye, hair spray, shampoo etc. antiperspirants and artificial flavors. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol etc.	2	2	0	0	2
Or								
SEC	CHM11026	Green Methods in Chemistry	Principles of Green Chemistry and Designing a Chemical synthesis, Examples of Green Synthesis	2	2	0	0	2
Or								
SEC	CHM11027	Chemoinformatics	Introduction to Chemoinformatics, Representation of molecules and chemical reactions, Searching	2	2	0	0	2

			chemical structures, Applications					
Or								
<b>SEC</b>	<b>CHM11028</b>	Any Suitable UGC-MOOCs Course <sup>1</sup>	Details will be provided later	<b>2</b>	2	0	0	<b>2</b>
<b>Value Added Course</b>	<b>PSG11021</b>	Human Values and Professional Ethics	Appreciation of professional ethical dilemmas needs basic grounding in profession.	<b>2</b>	1	1	0	<b>2</b>
<b>Allied Knowledge Enhancement Course</b>	<b>CHM14078</b>	Industry Academia Interactions/Organi zation of Seminar	Details will be provided later	<b>2</b>	0	0	2	<b>2</b>
<b>Total Credit</b>								<b>30</b>

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**Department of Chemistry – B. Sc. Programme**

**Semester – V**

Type of the Paper	Paper Code	Subject	Brief Contents	Contact Hour Per Week	L	T	P	Credit
Core	CHM11072	Physical -V (Theory)	Quantum Mechanics-II, Basics of Atomic and Molecular Spectroscopy, Photochemistry Statistical thermodynamics	4	3	1	0	4
Core	CHM11073	Inorganic V (Theory)	Bioinorganic Chemistry, Organometallic compounds, Reaction kinetics and mechanism	4	3	1	0	4
Core	CHM11074	Organic V (Theory)	NMR, IR, UV and Mass spectra, Dynamic stereochemistry, Pericyclic reactions, Synthetic Methodology	4	3	1	0	4
Core	CHM12076	Organic Lab IV (Practical)	List of experiments will be provided later	3	0	0	3	2
Core	CHM12071	Inorganic Lab IV (Practical)	List of experiments will be provided later	3	0	0	0	2
Discipline Specific Elective-I	CHM11033	Advanced Spectroscopy and its application (Theory)	Rotational-vibrational spectroscopy, Raman spectroscopy, Electronic spectroscopy, Magnetic resonance spectroscopy	4	3	1	0	4
Discipline Specific Elective-I Lab	CHM12034	Advanced Spectroscopy and its application Lab (Practical)	Lists of experiments will be provided later	3	0	0	3	2
Or								
Discipline Specific Elective-I	CHM11035	Inorganic Material for Industrial Importance	Silicate industries, Glass, Fertilizers. Surface coatings, Batteries, Alloys, Chemical explosives	4	3	1	0	4
Discipline Specific Elective-I Lab	CHM12036	Inorganic Material for Industrial Importance Lab	Lists of experiments will be provided later	3	0	0	3	2
Discipline Specific Elective-II	CHM11130	Theoretical Chemistry	Introduction, Force fields, Energy Minimization and Computer Simulation, Molecular Dynamics & Monte Carlo Simulation.	4	3	1	0	4
Discipline Specific Elective-II Lab	CHM12131	Theoretical Chemistry Lab	List of experiments will be provided later	3	0	0	3	2

OR

<b>Discipline Specific Elective-II</b>	<b>CHM11050</b>	Polymer Chemistry	Functionality and its importance, kinetics of polymerization, crystallization and crystallinity, structure and nature of polymer, polymer solution, properties of polymers	<b>4</b>	3	1	0	<b>4</b>
<b>Discipline Specific Elective-II Lab</b>	<b>CHM12051</b>	Polymer Chemistry Lab	List of experiments will be provided later	<b>3</b>	0	0	3	<b>2</b>
<b>Total Credit</b>								<b>28</b>

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**SCHOOL OF BASIC AND APPLIED SCIENCES**

**Department of Chemistry – B. Sc. Programme Semester - VI**

Type of the Paper	Paper Code	Subject	Brief Contents	Contact Hour Per Week	L	T	P	Credit
Core	CHM11078	Analytical Chemistry	Quantitative and qualitative aspects of analysis, optical method, thermal method, electroanalytical method, Separation techniques, Spectrophotometry	4	3	1	0	4
Core	CHM11079	Organic VI	Synthetic Strategy, Retrosynthetic and Asymmetric analysis	4	3	1	0	4
Allied Knowledge Enhancement Course	CHM11044	Biological Chemistry	Carbohydrates, Amino acids and peptides, Lipids, Enzymes	2	2	0	0	2
Discipline Specific Elective-III	CHM15045	Dissertation	As per choice of research topics by concerned students	8	0	1	7	6
<b>OR</b>								
Discipline Specific Elective-III	CHM11037	Environmental Chemistry	Environment and its segments, Water pollution, Energy and environment resources	4	3	1	0	4
Discipline Specific Elective-III Lab	CHM12038	Environmental Chemistry Lab	Lists of experiments will be provided later	3	0	0	3	2
Discipline Specific Elective-IV	CHM11046	Chemistry of Nanomaterials	Solid state materials, Nanomaterials, applications of nanotechnology, applications in biomedical and food industry	4	3	1	0	4
Discipline Specific Elective-IV Lab	CHM12047	Chemistry of Nanomaterials Lab	List of experiments will be provided later	3	0	0	3	2
		Or						
Discipline Specific Elective-IV	CHM11048	Green chemistry and chemistry of natural products	Introduction, principles of green chemistry and designing a chemical synthesis, Examples of green synthesis, future in green chemistry	4	3	1	0	4
Discipline Specific Elective-IV	CHM12049	Green chemistry and chemistry of natural products	List of experiments will be provided later	3	0	0	3	2



<b>Lab</b>		Lab						
			<b>Total Credit</b>					<b>22</b>

1 N.B.: Students are highly encouraged to enrol their names for the suitable courses offered having minimum credit point 2 by UGC-MOOCs. A Vertical of SWAYAM courses as one of the skill enhancements courses. The number/grade obtained by the students following the completion of this type of courses will carry equivalent weightage/ credit for the fulfilment of their courses. The name of the courses opted by the students will be reflected in the mark sheet as reported by Head of the Department or Programme In Charge (empowered by the Dean, SOBAS) to the examination section of the university.

\*\* N.B. Offer of a particular elective paper is subjected to the availability of the expertise as well as required resources at the point of time of teaching

