

SVA Government College, Srikalahasti
Dept. of Chemistry
Mapping of Program Outcomes (POs), Program Specific
Outcomes (PSOs) & Course Outcomes (COs)

Program Outcomes (POs) – B.Sc

PO Code	Program Outcome Description
PO1	Critical thinking and scientific reasoning
PO2	In-depth knowledge of Scientific principles and laboratory techniques
PO3	Analytical and problem-solving skills
PO4	Ethical, environmental, and safety consciousness in labs and industry
PO5	Communication and teamwork skills in scientific contexts
PO6	Preparation for competitive exams, higher education, or employment

Program Specific Outcomes (PSOs) – B.Sc. Chemistry

PSO Code	Program Specific Outcome Description
PSO1	Apply knowledge of organic, inorganic, physical and analytical chemistry to solve problems
PSO2	Perform accurate quantitative and qualitative chemical analysis
PSO3	Develop, validate, and conduct chemistry experiments using modern techniques
PSO4	Demonstrate skills in interpreting data, writing reports, and using scientific literature

B.Sc Chemistry Courses Mapping with COs, POs, PSOs and Assessment

Semester: I

Course-1: Essentials and Applications of Mathematical, Physical and Chemical Sciences

CO Code	Course Outcome Description	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1	Apply critical thinking to solve problems using complex numbers, trigonometric ratios, vectors, and statistical measures.	PO1, PO2, PO3	PSO1, PSO2	Assignments, Problem-solving tests, Numerical quizzes, Tutorial worksheets
CO2	Explain fundamental concepts of physics and relate them to real-world scenarios such as motion, energy, waves, and particles.	PO1, PO2, PO4	PSO1, PSO3	Concept mapping, Classroom seminars, Internal exams, Lab-based activities
CO3	Demonstrate understanding of basic chemistry concepts (e.g., periodic table, chemical changes, biomolecules) and apply them in daily life.	PO2, PO4, PO5	PSO1, PSO4	Experiments, Group presentations, MCQ-based tests, Chemistry in daily life projects
CO4	Integrate knowledge from mathematics, physics, and chemistry for solving real-world interdisciplinary problems.	PO1, PO3	PSO2, PSO5	Interdisciplinary case studies, Group projects, Practical evaluations, Viva voce
CO5	Understand the basics of computer networks, internet evolution, cyber security, and their relevance in scientific contexts.	PO6	PSO5	Report writing, Digital skill tests, Cybersecurity quizzes, Class discussions

Course 2: Advances in Mathematical, Physical, and Chemical Sciences

CO Code	Course Outcome Description	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1	Explore mathematical tools (limits, differentiation, integration, matrices) and apply them to scientific contexts and modeling.	PO1, PO2, PO3	PSO1, PSO2	Problem-solving tasks, numerical assignments, quizzes, analytical exercises
CO2	Understand recent developments in physics, including renewable energy, nanotechnology, and medical physics, and explain their scientific and social implications.	PO1, PO4, PO5	PSO1, PSO3, PSO4	Group discussion, debates, experimental design reports, internal assessment
CO3	Demonstrate understanding of modern advances in chemistry such as drug design, catalysis, and nano sensors, and their impact on health and environment.	PO2, PO4, PO6	PSO1, PSO4	Case study analysis, simulation reports, mini-projects, peer reviews
CO4	Apply interdisciplinary knowledge in modeling and technological applications related to renewable energy, nanomedicine, water treatment, and environmental management.	PO1, PO3	PSO2, PSO5	Interdisciplinary projects, mathematical modeling reports, viva, project presentations
CO5	Understand digital logic, number systems, transmission media, and networking devices relevant to scientific data and communication.	PO6	PSO5	Written tests, practical exercises, digital tools demo, network device identification assignments

Semester II

Course Code 3: *General & Inorganic Chemistry (Theory)*

Course Outcome (CO)	POs	PSOs	Assessment & Evaluation Methods
CO1: Understand atomic structure and periodic trends	PO1, PO2	PSO1	Unit tests, MCQs, written exams
CO2: Explain nature and properties of ionic and covalent compounds	PO1, PO2, PO4	PSO1, PSO2	Diagrams, assignments, viva
CO3: Interpret molecular geometry using VSEPR and MO theories	PO2, PO3	PSO1	Group discussion, worksheets
CO4: Describe metallic bonds and weak interactions	PO1, PO4	PSO1	Seminar, quiz
CO5: Explain acid-base theories and predict salt hydrolysis	PO2, PO4	PSO1, PSO2	Quiz, conceptual questions, semester-end examination

Semester II – Course Code 3: *General & Inorganic Chemistry (Practical)*

Course Outcome (CO)	POs	PSOs	Assessment & Evaluation Methods
CO1: Understand qualitative analysis of inorganic salts	PO1, PO2	PSO2	Lab performance, practical records
CO2: Use laboratory apparatus and chemicals properly	PO3, PO5	PSO3	Observation, skill-based tests
CO3: Apply concepts like common ion effect and solubility product	PO2, PO3	PSO2, PSO4	Viva, internal practical test

Semester II – Course Code 4: Inorganic Chemistry – I (Theory)

Course Outcome (CO)	POs	PSOs	Assessment & Evaluation Methods
CO1: Understand concepts of p-block elements and their compounds	PO1, PO2	PSO1	Written exams, assignments
CO2: Explain d- and f-block element properties and applications	PO1, PO3	PSO1, PSO2	Diagram analysis, group work
CO3: Distinguish lanthanides and actinides based on their chemistry	PO2, PO4	PSO1, PSO4	Flow charts, presentations
CO4: Describe basics of radioactivity and its applications	PO2, PO6	PSO1	MCQ, end-semester theory examination

Semester II – Course Code 4: *Inorganic Chemistry – I (Practical)*

Course Outcome (CO)	POs	PSOs	Assessment & Evaluation Methods
CO1: Understand inorganic synthesis methods (e.g., alum, ferrous salts)	PO2, PO3	PSO2, PSO3	Experimental performance, accuracy of product
CO2: Use appropriate procedures and safety measures in labs	PO4, PO5	PSO3	Skill-based rubric assessment
CO3: Correlate theory with practical results	PO1, PO3, PO6	PSO1, PSO4	Oral viva, practical notebook, observation-based evaluation

Assessment and Evaluation – Semester II (General)

Type of Assessment	Methodology
Continuous Internal Evaluation	Class tests, quizzes, worksheets
Practical Assessment	Weekly performance in lab, record submission, viva voce
Presentations & Assignments	Encourages communication skills and knowledge integration
Group Discussion & Projects	Enhances peer learning and conceptual clarity
Semester-End Examination	University-conducted final theory and practical exams to assess holistic understanding

PO–PSO–CO Mapping Table for Semester III

Course Code 5: *Fundamentals in Organic Chemistry (Theory)*

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Understand the differential behaviour of organic compounds	PO1, PO2	PSO1	Written tests, assignments, quizzes
CO2: Formulate mechanisms of organic reactions	PO1, PO3	PSO1, PSO4	Mechanism-based questions, group tasks
CO3: Identify common organic reaction mechanisms	PO2, PO3	PSO1	MCQ, written exams
CO4: Describe stereochemical properties of organic reactions	PO1, PO4	PSO1, PSO4	Diagram-based explanations, seminars

Course Code 6: *Organic Chemistry – Halogen and Oxygen Compounds (Theory)*

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Explain SN1, SN2, and SNi mechanisms	PO1, PO3	PSO1	Mechanism writing, reaction analysis
CO2: Describe properties of alcohols and phenols	PO1, PO2	PSO1	Structured questions, group presentations
CO3: Propose mechanisms for reactions of oxygen-containing compounds	PO2, PO3	PSO1, PSO4	Conceptual questions, peer-reviewed assignments
CO4: Interconvert monosaccharides	PO1, PO3	PSO1, PSO2	Class discussions, quizzes

Course Code 7: Physical Chemistry – I: Solutions & Electrochemistry (Theory)

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Understand ideal and non-ideal behaviour of solutions	PO1, PO2	PSO1, PSO2	Numerical problems, written exams
CO2: Determine molecular mass using colligative properties	PO2, PO3	PSO2	Lab-based problem solving
CO3: Explain photochemical principles	PO1, PO4	PSO1	Concept test, oral viva
CO4: Apply electrochemical principles	PO2, PO3	PSO2, PSO3	Conductivity experiments, reports
CO5: Describe EMF and fuel cells	PO2, PO6	PSO4	Diagrams, quizzes, end-semester exam

Corresponding Practicals (Codes 5, 6, 7)

Practical Course Outcome	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
Use laboratory glassware and follow safety procedures	PO4, PO5	PSO3	Lab observation, practical notebooks
Perform qualitative and quantitative organic analysis	PO2, PO3	PSO2, PSO4	Functional group tests, melting/boiling point estimation
Conduct CST, conductometric, potentiometric titrations	PO2, PO3	PSO2, PSO3	Practical performance, viva, record submission

Semester III – General Assessment Methods

Assessment Type	Tools/Strategies
Continuous Evaluation	Class tests, weekly assignments, worksheets
Practical Evaluation	Lab performance, records, viva, skill-based tasks
Seminar/Group Work	Presentations, collaborative problem-solving
Semester-End Exam	Theory and lab exams evaluating understanding and analytical abilities

PO–PSO–CO Mapping Table for Semester IV

Course Code 9: *Physical Chemistry – II (States of Matter, Phase Rule & Surface Chemistry)*

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Explain solid, liquid, and gas states based on intermolecular interactions	PO1, PO2	PSO1	Assignments, oral quiz, written exam
CO2: Differentiate ideal and real gases; derive related equations	PO1, PO3	PSO1, PSO4	Numerical worksheets, tutorial discussions
CO3: Discuss phase diagrams and their applications	PO2, PO4	PSO1	Group presentation, diagram-based assignments
CO4: Apply adsorption theories and models	PO2, PO3	PSO2	Lab-based experiments, quiz
CO5: Explain the principles of crystallography	PO1, PO4	PSO1	Visual learning tools, written explanation

Course Code 10: General & Physical Chemistry

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Correlate and describe stereochemical properties	PO1, PO2	PSO1	Stereo models, structure-based worksheets
CO2: Explain biological role of elements in human body	PO1, PO4	PSO1	Case studies, theory quiz
CO3: Apply ionic equilibrium for analysis	PO2, PO3	PSO2, PSO4	Lab application, pH buffer preparation
CO4: Determine order of chemical reactions	PO2, PO3	PSO2	Reaction rate experiments, lab notebook
CO5: Describe enzyme catalysis and kinetics	PO1, PO3	PSO1, PSO4	Enzyme activity calculations, viva voce

Course Code 11: Nitrogen Containing Organic Compounds & Spectroscopy

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Distinguish and analyze amines and their reactions	PO1, PO2	PSO1	Reaction mechanism test, Hinsberg method demo
CO2: Explain properties and synthesis of amino acids	PO1, PO3	PSO1, PSO2	Assignments, diagrams, oral exam
CO3: Describe reactivity of nitro hydrocarbons	PO2, PO4	PSO1	Mechanistic explanations, comparative tables
CO4: Discuss structure and properties of heterocyclic compounds	PO1, PO3	PSO1	Presentation on drug-based heterocycles
CO5: Apply IR and UV spectroscopy for compound analysis	PO2, PO6	PSO4	Spectral interpretation tasks, practice questions

Semester IV – Practical Components (Course Codes 9, 10, 11)

Practical Course Outcome	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
Use lab equipment correctly; follow procedures	PO3, PO5	PSO3	Skill check, lab records, viva
Apply concepts of viscosity, surface tension, adsorption	PO2, PO3	PSO2	Experiments: drop count, viscometer, Freundlich isotherm
Perform volumetric analysis based on acid–base and redox reactions	PO2, PO3	PSO2, PSO4	Titration: Mohr's salt, KMnO_4 , NaOH estimation
Carry out organic synthesis and analyze IR spectra	PO3, PO5	PSO3, PSO4	Recrystallization, distillation, IR functional group identification

Assessment & Evaluation – Semester IV

Assessment Type	Tools/Strategies
Continuous Evaluation	Quizzes, internal exams, problem-solving worksheets
Practical Evaluation	Lab notebook, viva, real-time skill demonstration
Group Activities	Assignments, collaborative tasks on bioinorganic or kinetic analysis
Semester-End Exams	Theory and practical exams by the university

PO–PSO–CO Mapping Table for Semester V

Course Code 12A: *Analytical Methods in Chemistry – Quantitative Analysis*

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Explain the importance of solvent extraction and ion exchange methods	PO1, PO2	PSO1, PSO2	Assignment, quiz, unit test
CO2: Understand principles of volumetric and gravimetric analysis	PO2, PO3	PSO2, PSO4	Practical demo, lab performance
CO3: Use common laboratory apparatus effectively	PO3, PO5	PSO3	Skill-based tasks, checklist observation
CO4: Describe acid–base, redox, complexometric titrations	PO1, PO3	PSO1, PSO2	Viva, experiment-based report
CO5: Evaluate analytical errors and data accuracy	PO3, PO6	PSO4	Worksheet, data handling, error calculation

Course Code 13A: *Chromatography and Instrumental Methods of Analysis*

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Perform separation using TLC, paper, and column chromatography	PO2, PO3	PSO2, PSO3	Lab experiment, accuracy score, peer assessment
CO2: Understand theory and application of chromatography	PO1, PO2	PSO1	Diagram-based questions, explanation
CO3: Use colorimetry for concentration measurement	PO2, PO5	PSO3	Lab work, Beer-Lambert verification

Course Code 14A: *Synthetic Organic Chemistry*

Course Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Understand key reactions used in organic synthesis	PO1, PO3	PSO1	Mechanism drawing, retrosynthesis practice
CO2: Explore reagents like PCC, SeO ₂ , LiAlH ₄	PO2, PO4	PSO1, PSO2	Reaction analysis task, reagent identification
CO3: Apply retrosynthetic and selective synthetic strategies	PO1, PO3	PSO1, PSO4	Case-based retrosynthesis, assignments

Course Code 15A: *Analysis of Organic Compounds – Practical*

Practical Outcome (CO)	Mapped POs	Mapped PSOs	Assessment & Evaluation Methods
CO1: Prepare acetanilide using green synthesis	PO2, PO4	PSO2, PSO3	Yield, purity, lab record
CO2: Separate organic compounds by solvent extraction	PO3, PO5	PSO2, PSO4	Separation efficiency, spot tests
CO3: Carry out green oxidation and rearrangement reactions	PO2, PO3	PSO1, PSO3	Reaction observations, mechanism-based viva

Assessment & Evaluation Methods – Semester V

Component	Tools/Methods
Continuous Internal Evaluation	Unit tests, quizzes, assignments, viva
Laboratory Skill Assessment	Observation checklists, practical reports, record books
Industry Exposure/Field Work	Field visit report, oral presentation
Semester-End Examination	Descriptive theory papers, performance-based practical exams

Course Attainments

Course Attainments refer to the measurable achievements of students at the end of a course, in terms of the **Course Outcomes (COs)** that were intended when the course was designed. They help assess how well students have learned the skills and knowledge defined for a course.

Key Points about Course Attainments:

1. CO-Based Measurement:

- Each course has specific **Course Outcomes (COs)**.
- Attainment shows how well students have achieved each CO.

2. Based on Assessment Results:

- Attainments are calculated using internal assessments (like tests, assignments), final exams, practicals, and other evaluation methods.
- Typically, a **target level** (like 60% of students scoring above 60%) is predefined.

3. Mapped to Program Outcomes (POs) and PSOs:

- Course attainments help track how individual courses contribute to broader **Program Outcomes (POs)** and **Program Specific Outcomes (PSOs)**.

4. Used for Continuous Improvement:

- If attainment is below target, teaching methods or assessments are reviewed and improved.

Assessment Tools:

- Internal exams, assignments, quizzes
- End-semester examinations
- Lab work or practicals
- Projects or presentations

Attainment Levels:

- **3** = Strong Contribution
- **2** = Moderate Contribution
- **1** = Low Contribution
- *(Blank)* = No direct contribution

CO Attainment Calculation

CO	Assessment Tools	% of Students $\geq 40\%$	Attainment Level
CO1	Mid + End Sem	70%	3 (Above target)
CO2	Mid + End Sem	55%	2 (Meets target)
CO3	Assignments + Exam	45%	2 (Meets target)
CO4	Quiz + Exam	35%	1 (Below target)

Use 3-level scale:

- 3 = >60% students
- 2 = 50–60% students
- 1 = <50% students

CO Attainment

CO	Assessment Tools	% Students $\geq 40\%$	Attainment Level (1–3)
CO1	Mid + End Sem	70%	3 (Above target)
CO2	Mid + End Sem	55%	2 (Meets target)
CO3	Assignments + Exam	45%	2 (Meets target)
CO4	Quiz + Exam	35%	1 (Below target)

Mapping of Pos, PSOs, Cos and attainments

Semester II : Physical & General Chemistry

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	3	3	2	2
CO2	2	3	2	2	1	2	3	3	3
CO3	2	2	2	2	1	2	2	3	2
CO4	3	2	2	2	2	3	3	2	2
CO5	3	2	3	2	2	2	2	3	3

Semester III: Inorganic & Organic Chemistry

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	3	3	3	3
CO2	2	3	2	1	2	3	2	3	2
CO3	3	2	3	2	2	3	3	3	3
CO4	2	3	2	2	2	2	3	3	2
CO5	3	3	3	2	2	2	3	3	3

Semester IV: Physical & General Chemistry

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	3	3	2	3
CO2	2	3	2	2	2	2	2	3	2
CO3	3	3	2	2	2	2	3	3	3
CO4	3	3	3	2	2	2	3	3	3
CO5	2	2	3	2	2	3	3	3	3

Semester V: Organic Chemistry

COs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	3	3	3
CO2	3	3	2	2	2	2	3	3	3
CO3	3	3	2	2	2	3	3	3	3
CO4	3	3	3	2	2	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3