



**Department of Chemistry**  
Suren Das College, Hajo, Kamrup, Assam  
Program Outcome, Program Specific Outcome  
**CBCS Generic-Course under Gauhati University**

**B. Sc. Generic Chemistry (CBCS)**

**Program Outcomes (POs)**

<b>Department of Chemistry</b>	After successfully completion of three years degree program in Chemistry under CBCS, a student should be able to
<b>Program Outcomes (POs)</b>	<p><b>POs-1.</b> To impart knowledge of General Chemistry covering all the aspects viz. inorganic, organic, physical and analytical Chemistry.</p> <p><b>POs-2.</b> Solve the problem and also think methodically, independently and draw a logical conclusion.</p> <p><b>POs-3.</b> Employ critical thinking and the scientific knowledge to design, carry out, record and analyse the results of chemical reactions.</p> <p><b>POs-4.</b> Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.</p> <p><b>POs-5.</b> Find out the green route for chemical reaction for sustainable development.</p> <p><b>POs-6.</b> To inculcate the scientific temperament in the students and outside the scientific community.</p>

**Semester-I**

CHE-RC/HG-1016: CHEMISTRY1 (Credits: Theory-04, Lab-02)

**Semester-II**

CHE-RC/HG-2016: CHEMISTRY2 (Credits: Theory-04, Lab-02)

**Semester-III**

CHE-RC/HG-3016: CHEMISTRY 3 (Credits: Theory-04, Lab-02)

CHE-SE-3034: Basic Analytical Chemistry (Credits: 04)

**Semester-IV**

CHE- RC/HG-4016: CHEMISTRY4 (Credits: Theory-04, Lab-02)

CHE-SE-4024: Green Methods in Chemistry (Credits: 04)

**Semester-V**

CHE-SE-5014: CHEMICAL TECHNOLOGY & SOCIETY (Credits: 04)

CHE-RE-5026: ANALYTICAL METHODS IN CHEMISTRY (Credits: Theory-04, Lab -02)

**Semester-VI**

CHE-SE-6024: PESTICIDE CHEMISTRY (Credits: 04)

CHE-RE-6016: GREEN CHEMISTRY (Credits: Theory-04, Lab -02)

**Programme Specific Outcomes (Chemistry Generic Course, CBCS)**

<b>Programme Specific Outcomes (PSOs)</b>	<p><b>PSOs-1.</b> Gain the knowledge of Chemistry through theory and practicals.</p> <p><b>PSOs-2.</b> To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.</p> <p><b>PSOs-3.</b> Identify chemical formula and solve numerical problems.</p> <p><b>PSOs-4.</b> Use modern chemical tools, Models, UV Spectrophotometer, Chemdraw, Charts and Equipments.</p> <p><b>PSOs-5.</b> Know structure-activity relationship.</p> <p><b>PSOs-6.</b> Understand good laboratory practices and safety.</p> <p><b>PSOs-7.</b> Make aware and handle the sophisticated instruments/equipments.</p>
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**Course Outcomes (Chemistry Generic Course, CBCS)**

<b>Semester-I</b>	
<b>Course</b>	<b>Outcome</b> (After completion of these courses students should be able to)
CHE-RC/HG-1016: CHEMISTRY1	<p><b>CO-1.</b> This course introduces students to two broad parts of chemistry - inorganic and organic chemistry.</p> <p><b>CO-2.</b> The students will learn about the atomic structure through the basic concepts of quantum mechanics.</p> <p><b>CO-3.</b> The students will understand the concepts of chemical bonding through VB and MO approaches.</p> <p><b>CO-4.</b> In the organic part, the students will learn basic ideas used in organic chemistry, stereochemistry, functional groups, alkanes, alkenes, alkynes etc.</p>

	<p><b>CO-5.</b> The experimental part provides knowledge on volumetric analysis of a mixture of inorganic compounds as well as gives idea on the detection of elements present in organic compounds.</p> <p><b>CO-6.</b> The experimental part also introduces students to the chromatographic techniques for separation of organic mixtures.</p>
<b><i>Semester-II</i></b>	
<b>Course</b>	<b>Outcome</b> (After completion of these courses students should be able to)
CHE-RC/HG-2016: CHEMISTRY2	<p><b>CO-1.</b> After completion of this course the students will learn periodic properties in main group elements, transition metals (3d series).</p> <p><b>CO-2.</b> They will also learn the crystal field theory in coordination chemistry unit.</p> <p><b>CO-3.</b> The students are expected to learn about kinetic theory of gases, ideal gas and real gases.</p> <p><b>CO-4.</b> They will also learn about surface tension, viscosity, basic solid state chemistry.</p> <p><b>CO-5.</b> The students are also introduced to chemical kinetics, the different laws and methods for finding the rate constant of reactions.</p> <p><b>CO-6.</b> The laboratory course will help the students to have an exposure to hands-on experience in analysing various properties of liquids such as viscosity and surface tension on the basis of the knowledge gained in the theory course.</p> <p><b>CO-7.</b> The laboratory course will also help the students to learn about Semi-micro qualitative analysis of inorganic compounds.</p>
<b><i>Semester-III</i></b>	
<b>Course</b>	<b>Outcome</b> (After completion of these courses students should be able to)
CHE-RC/HG-3016: CHEMISTRY 3	<p><b>CO-1.</b> After completion of this course the students will be able to understand the chemical system from thermodynamic points of view.</p> <p><b>CO-2.</b> They will also learn two very important topics in chemistry-chemical equilibrium and ionic equilibrium.</p> <p><b>CO-3.</b> In organic chemistry part, the students are expected to learn various classes of organic molecules-alkyl halides, aryl halides, alcohols, phenols, ethers, aldehydes and ketones.</p>

	<p><b>CO-4.</b> The laboratory course will help the students to learn about preparation and purification of different organic compounds.</p> <p><b>CO-5.</b> The laboratory course will also help the students to learn about determination of different thermodynamic properties such as heat capacity, enthalpy of neutralization, enthalpy of ionization etc.</p>
<b><i>Semester-IV</i></b>	
<b>Course</b>	<b>Outcome</b> (After completion of these courses students should be able to)
CHE-RC/HG 4016: CHEMISTRY4	<p><b>CO-1.</b> After completion of this course the students learn solutions, phase rule and its application in specific cases</p> <p><b>CO-2.</b> Students will learn about the basics of conductance and electrochemistry.</p> <p><b>CO-3.</b> Students will also learn some important topics of organic and biochemistry- carboxylic acids, amines, amino acids, peptides, proteins and carbohydrates.</p> <p><b>CO-4.</b> The laboratory course will boost the students' knowledge on potentiometric and conductometric titrations.</p> <p><b>CO-5.</b> The laboratory course will boost the students' knowledge on constructing the phase diagrams for different types of reactions.</p>

***Course Outcomes (Skill Enhancement Courses (SEC))***

<b><i>SEC for Semester-III</i></b>	
<b>Course</b>	<b>Outcome</b> (After completion of these courses students should be able to)
CHE-SE-3034: BASIC ANALYTICAL CHEMISTRY (Credits: 04)	<p><b>CO-1.</b> The students will gain knowledge on different micro and semimicro analytical techniques and help develop the ability to use modern instrumental methods.</p> <p><b>CO-2.</b> Students are able to explain the basic principles of chemical analysis.</p> <p><b>CO-3.</b> Students are able to design/implement microscale and semimicro experiments, record, interpret and analyze data following scientific methodology.</p>

	<b>CO-4.</b> The instrumental demonstrations included in the course helps the students to get hands-on-exposure to the supplement the theoretical knowledge.
<b><i>Must Read</i></b>	
<ol style="list-style-type: none"> <li>1. Willard, H. H. Instrumental Methods of Analysis, CBS Publishers.</li> <li>2. Skoog &amp; Lerry. Instrumental Methods of Analysis, Saunders College Publications, New York.</li> <li>3. Skoog, D.A.; West, D.M. &amp; Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort Worth (1992).</li> <li>4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.</li> <li>5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.</li> <li>6. Day, R. A. &amp; Underwood, A. L. Quantitative Analysis, Prentice Hall of India.</li> <li>7. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y. USA (1982).</li> <li>8. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16 (1977).</li> <li>9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.</li> <li>10. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.</li> <li>11. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc., New York (1995).</li> </ol>	
<b><i>SEC for Semester-IV</i></b>	
CHE-SE-4024: GREEN METHODS IN CHEMISTRY (Credits: 04)	<p><b>CO-1.</b> Students shall be able to describe and evaluate chemical products and processes from environmental perspective</p> <p><b>CO-2.</b> Students will learn about the tools of Green chemistry and twelve principles of Green Chemistry</p> <p><b>CO-3.</b> Students will learn to define and propose sustainable solutions and critically assess the methods for waste reduction and recycling.</p> <p><b>CO-4.</b> The course introduces the students to the real-world cases in green chemistry</p>
<b><i>Must Read</i></b>	
<ol style="list-style-type: none"> <li>1. Manahan S.E. (2005) Environmental Chemistry, CRC Press</li> <li>2. Miller, G.T. (2006) Environmental Science 11th edition. Brooks/Cole</li> <li>3. Mishra, A. (2005) Environmental Studies. Selective and Scientific Books</li> </ol>	
<b><i>SEC for Semester-V</i></b>	

<p>CHE-SE-5014: CHEMICAL TECHNOLOGY &amp; SOCIETY (Credits: 04)</p>	<p><b>CO-1.</b> The students will have a first-hand understanding of different types of equipments needed in chemical technology and offer them concepts regarding some important parameters.</p> <p><b>CO-2.</b> Students shall be familiarized with processes and terminologies in chemical industry, like mass balance, energy balance etc.</p> <p><b>CO-3.</b> Students will be able to use chemical and scientific literacy as a means to better understand the topics related to the society.</p>
<p><b><i>Must Read</i></b></p>	
<ol style="list-style-type: none"> <li>1. John W. Hill, Terry W. McCreary &amp; Doris K. Kolb, <i>Chemistry for changing times</i> 13th Ed.</li> <li>2. E.J. Hackett, O. Amsterdamska, M. Lynch and J. Wajcman (eds.), <i>The Handbook of Science and Technology Studies</i>, The MIT Press, 2008.</li> <li>3. D. MacKenzie and J. Wajcman (eds.), <i>The Social Shaping of Technology</i>, The Open University Press, 1999.</li> </ol>	
<p><b><i>SEC for Semester-VI</i></b></p>	
<p>CHE-SE-6024: PESTICIDE CHEMISTRY (Credits: 04)</p>	<p><b>CO-1.</b> Students will be introduced to the course on pesticides.</p> <p><b>CO-2.</b> Students will be able to explain or describe and critically examine different types of pesticides.</p> <p><b>CO-3.</b> Students will learn about the activity/toxicity of pesticides</p> <p><b>CO-4.</b> Students will learn about the applications and the need for the search of an alternative based on natural products.</p> <p><b>CO-5.</b> The experiments included in the course will help the students to learn how to calculate the acidity/alkalinity of a given sample of pesticides formulations as per BIS specifications.</p> <p><b>CO-6.</b> The experiments included in the course will also help the students to prepare simple pesticides.</p>
<p><b><i>Must Read</i></b></p>	
<ol style="list-style-type: none"> <li>1. R. Cremlyn: <i>Pesticides, Preparation and Mode of Action</i>, John Wiley &amp; Sons, New York, 1978.</li> <li>2. R P Bateman, <i>Pesticide Applications</i>, AAB Press, 2004</li> <li>3. <i>Principles of Pesticide chemistry</i>: S K Handa, Ed. by Agrobios (India), 2008</li> <li>4. <i>Pesticide Science &amp; Biotechnology</i>: R Greenhalgh and T R Robers, IUPAC, Blackwell Scientific Publications, 1987</li> <li>5. <i>The Chemical Process Industries</i>: D N Shreve</li> </ol>	

**Course Outcomes (Discipline Specific Elective Papers)**

<b>DSE for Semester-V</b>	
<b>Course</b>	<b>Outcome</b> (After completion of these courses students should be able to)
CHE-RE-5026: ANALYTICAL METHODS IN CHEMISTRY	<p><b>CO-1.</b> The course will enable students to have knowledge on the qualitative and quantitative aspects of analysis</p> <p><b>CO-2.</b> This course will help students develop a theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples.</p> <p><b>CO-3.</b> The experiments included in the course will help students to gain hands on experience of the techniques discussed in the theoretical section.</p> <p><b>CO-4.</b> Students will be enabled to take judicious decisions while analyzing different samples.</p> <p><b>CO-5.</b> The instrumental demonstrations included in the course helps the students to get hands-on-exposure to the supplement the theoretical knowledge.</p>
<b>Must Read</b>	
<ol style="list-style-type: none"> <li>1. Mendham, J. et al.: Vogel's Text Book of Quantitative Chemical Analysis; 6th Ed. Pearson Education, 2009.</li> <li>2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. CBS Publishers &amp; Distributors, 2004.</li> <li>3. Christian, Gary D: Analytical Chemistry, 6th Ed. Wiley India (P) Ltd., 2004.</li> <li>4. Harris, Daniel C: Exploring Chemical Analysis, 4th Ed. W. H. Freeman, 2008. 45</li> <li>5. Khopkar, S.M.: Basic Concepts of Analytical Chemistry, 3rd Ed. New Age, International Publisher, 2009.</li> </ol>	

6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, 6th Ed. Thomson Asia Pvt. Ltd. Singapore
7. Mikes, O. and Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Ltd. London.1979
8. Ditts, R.V. *Analytical Chemistry: Methods of separation.* Van Nostrand, New York, 1974.

***DSE for Semester-VI***

CHE-RE-6016:  
GREEN  
CHEMISTRY

- CO-1.** The course will introduce learners to the principles of green chemistry.
- CO-2.** This course will make them conversant with applications of green chemistry to organic synthesis.
- CO-3.** Students will be prepared for taking up entry level jobs in the chemical industry.
- CO-4.** They also will have the option of studying further in the area of green chemistry and will learn about the future perspectives.
- CO-5.** The experiments included in the course will help the students to learn how to avoid waste and select green chemicals for their synthesis.

***Must Read***

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
3. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).
4. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).
5. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).
6. Pavia, D. L. Lampman, G. H. & Kriz, G.S. W B Introduction to Organic Laboratory Techniques: A Microscale Approach, 4th Ed., Brooks/Cole; 2007.