

Programme Outcomes and Course Outcomes Diary of Academic Programmes

Based on Metric No. 1.1.1 of Criterion 1 (Curricular Aspects) of Self Study Reports (SSR) for Assessment and Accreditation

by

National Assessment and Accreditation Council

(An Autonomous Institution of the University Grants Commission)

BANGALORE-560072

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Central University of Jharkhand, Ranchi

2024

2



DEPARTMENT OF CHEMISTRY

Programme Outcomes and Course Outcomes

of

M.Sc. in Chemistry

3 Years B.Sc. in Chemistry

Integrated B.Sc. & M.Sc. in Chemistry

M.Sc. in Chemistry

Program outcomes of 2 Year M.Sc. in chemistry are as follow:

[PO.1]. To formulate new ideas/concepts in chemical sciences.

[PO.2]. To analyze and interpretation of chemical phenomena and process.

[PO.3]. To design and develop of new molecules/processes with research, industry and societal applications.

[PO.4]. To acquire the principles and practice of chemical sciences for fundamental research in chemistry and applied chemistry

[PO.5]. To get aware about the issues of environment, health and development from a chemical perspective and hence to address it using chemistry knowledge.

[PO.6]. To allow professional ethics in academics and research and in all sphere of life.

[PO.7]. To develop a leadership quality to work in diverse teams/groups to achieve the goal.

[PO.8]. To become independent thinker and hence to learn chemistry in the context of scientific advancement and career goal.

SEMESTER WISE STRUCTURE

FIRST SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 610010	Quantum Chemistry	3	1	0	4
2.		CHM 610020	Organic reactions and Mechanism	3	1	0	4
3.		CHM 610030	Concepts in coordination Chemistry	3	1	0	4
4.		CHM 610040	Organic Spectroscopy	3	1	0	4
5.		CHM 610050	Organic Chemistry Laboratory I	0	0	2	2
6.		CHM 610060	Inorganic Chemistry Laboratory	0	0	2	2
Total Credits							20

SECOND SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 621010	Kinetics and Thermodynamics	3	1	0	4

2.		CHM 621020	Organic Photochemistry and Pericyclic reactions	3	1	0	4
3.		CHM 621030	Bio-Inorganic Chemistry	3	1	0	4
4.		CHM 621040	Analytical Chemistry	3	1	0	4
5.		CHM 622060	Physical Chemistry Laboratory	0	0	2	2
6.		CHM 623060	Seminar	0	0	2	2
Total Credits							20

TOTAL CREDITS AFTER 1st YEAR=40

THIRD SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 716040	Organometallic Chemistry	3	1	0	4
2.		CHM 716060	Group Theory, Molecular spectroscopy and surface chemistry	3	1	0	4
3.		CHM 716050	Main group Chemistry, actinides, Lanthanides and Nuclear chemistry	3	1	0	4
4.		CHM 717010	MOOCs I (Organic reactions mechanism)	4	0	0	4
5.		CHM 716070	Analytical Chemistry Practical	0	0	2	2
6.		CHM 716080	Minor Project	0	0	4	4
Total Credits							22

FOURTH SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 726010	Major Project	0	0	20	20
2.		CHM 726020	MOOCs II	4	0	0	4
Total Credits							24

Note: During the summer vacation after 4th semester students can do 4-6 weeks Summer Internship at once or in two parts that will be evaluated through presentation/seminar in 5th semester.

Course Outcome

Semester I

Quantum Chemistry

Course Details			
Programme	M.Sc.	Course Code	CHM 610010
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Basic understanding of quantum chemistry, molecular spectroscopy and photochemistry.
- Applying the concepts to some standard systems.
- Draw connection among ideas and solve numerical problems

Organic reactions and Mechanism

Course Details			
Programme	M.Sc.	Course Code	CHM 610020
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Substitution reaction mechanism, elimination reaction, radical reaction and stereochemistry.
- Name reactions
- Substitution reaction mechanism in aromatic systems.
- Radical reaction mechanism in organic chemistry.

Concepts in coordination Chemistry

Course Details			
Programme	M.Sc.	Course Code	CHM 610030
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- the basics of inorganic and coordination chemistry
- analyse inorganic reaction pathways using redox reactions
- analyze structure-property correlation of coordination compounds
- electronic properties of molecules
- specialized and advanced topics in inorganic and coordination chemistry

Organic Spectroscopy

Course Details			
Programme	M.Sc.	Course Code	CHM 610040
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- the basic principles of light-matter interactions and learn quantum mechanical methods to analyze the interactions.
- To elucidate the structure and molecular mass of small organic molecules using UV, IR, NMR, MS.
- Various spectroscopic methods based on the IR, NMR principles
- Calculate the absorption maxima of conjugated molecules using Woodward rules.

Organic Chemistry Laboratory I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 610050
Semester	I	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Separation of binary mixtures of organic compounds
- Analysis of elements and common functional groups

Inorganic Chemistry Laboratory

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 610060
Semester	I	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Inorganic salt analysis
- Titrimetric analysis
- Dry and wet test for acid/base radicals

Course Outcome

Semester II

Kinetics and Thermodynamics

Course Details			
Programme	M.Sc.	Course Code	CHM 621010
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about physical chemistry thus creating, evaluating, analyzing, applying, understanding, and remembering of kinetics and thermodynamics.

Organic Photochemistry and Pericyclic reactions

Course Details			
Programme	M.Sc.	Course Code	CHM 621020
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Photochemistry and Pericyclic reactions thus creating, evaluating, analyzing, applying, understanding and remembering of Photochemistry and Pericyclic reactions.

Bio-Inorganic Chemistry

Course Details			
Programme	M.Sc.	Course Code	CHM 621030
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Bioinorganic Chemistry thus creating, evaluating, analyzing, applying, understanding and remembering of Bioinorganic Chemistry.

Analytical Chemistry

Course Details			
Programme	M.Sc.	Course Code	CHM 621040
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Analytical Chemistry thus creating, evaluating, analyzing,

- applying, understanding and remembering of Analytical Chemistry.

Physical Chemistry Laboratory

Course Details			
Programme	M.Sc.	Course Code	CHM 622060
Semester	II	Credits	2
Contact Hours	60	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Physical Chemistry Laboratory thus creating, evaluating
- analyzing, applying, understanding, and remembering of Physical Chemistry laboratory.

Seminar

Course Details			
Programme	M.Sc.	Course Code	CHM 623060
Semester	II	Credits	2
Contact Hours	60	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- To get the exposure of different areas of science and their applications.
- To understand the ongoing trends of research and technology.

Organometallic Chemistry**Course Details**

Programme	M.Sc.	Course Code	CHM 716040
Semester	III	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Organometallic Chemistry
- thus creating, evaluating, analyzing, applying, understanding and remembering of Organometallic Chemistry.

Group Theory, Molecular Spectroscopy and Surface Chemistry**Course Details**

Programme	M.Sc.	Course Code	CHM 716060
Semester	III	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Group Theory, Molecular spectroscopy and surface chemistry thus creating, evaluating, analyzing,
- applying, understanding and remembering of Group Theory, Molecular spectroscopy and surface chemistry.

Main group Chemistry, actinides, Lanthanides and Nuclear chemistry

Course Details			
Programme	M.Sc.	Course Code	CHM 716050
Semester	III	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Development of scientific ideas about Main group Chemistry, actinides, Lanthanides and Nuclear chemistry thus creating, evaluating, analyzing,
- applying, understanding and remembering of Main group Chemistry, actinides, Lanthanides and Nuclear chemistry.

MOOCs I (Organic reactions mechanism)

Course Details			
Programme	M.Sc.	Course Code	CHM 717010
Semester	III	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Linear free energy relationship
- Kinetic isotope effect
- Hammett equation

Analytical Chemistry Practical

Course Details			
Programme	M.Sc.	Course Code	CHM 716070
Semester	III	Credits	2
Contact Hours	60	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Analysis of Bronze with respect to copper and tin
- Determination of organic carbon in soil.

Minor Project

Course Details			
Programme	M.Sc.	Course Code	CHM 716080
Semester	III	Credits	4
Contact Hours		L/T/P	0/0/4
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- To get the exposure of different areas of science and their applications.
- To understand the ongoing trends of research and technology.

Course Outcome

Semester IV

Major Project

Course Details			
Programme	M.Sc.	Course Code	CHM 726010
Semester	IV	Credits	20
Contact Hours		L/T/P	0/0/20
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- To get the exposure of different areas of science and their applications.
- To understand the ongoing trends of research and technology.

MOOCs II

Course Details			
Programme	M.Sc.	Course Code	CHM 726020
Semester	IV	Credits	4
Contact Hours	60	L/T/P	4/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- As per the course the students will learn about fundamentals of respective topics.

Program outcomes of 3 Year B.Sc. in chemistry are as follow:

[PO.1]. Critical thinking in formulation of new concepts in chemical sciences

[PO.2]. To get aware about the issues of environment, health and problem-solving ability using chemical phenomena and process

[PO.3]. To design and to develop new molecule/process with research, industry and societal application.

[PO.4]. To acquire the principles and practice of chemical science for fundamental research

[PO.5]. To develop a leadership quality to work in diverse teams/groups to achieve the goal.

[PO.6]. To Digitally Literate for competency development

[PO.7]. Professional Ethical Awareness in academics and research in all sphere of life

SEMESTER WISE STRUCTURE

FIRST SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		ENG 110040	Communicative English	3	1	0	4
2.		CHM 111110	Inorganic Chemistry I	3	1	0	4
3.		CHM 112010	Inorganic Chemistry Practical	0	0	2	2
4.		CHM 111120	Organic Chemistry-I	3	1	0	4
5.		CHM 112020	Organic Chemistry Practical	0	0	2	2
6.		PHY 111110	Physics-I	3	1	0	4
7.		PHY 112010	Physics I (Practical)	0	0	2	2
Total Credits							22

SECOND SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 121010	Physical Chemistry-II	3	1	0	4
2.		CHM 121020	Organic Chemistry -II	3	1	0	4
3.		CHM 121030	Fundamentals of Mathematics	3	1	0	4
4.		ENV 120060	Environmental Studies	3	1	0	4

5.		CHM122070	Organic Chemistry Practical -II	0	0	2	2
6.		CHM 122080	Physical Chemistry Practical-II	0	0	2	2
7.		KOR 125060	Basic Korean Language	0	0	2	2
Total Credits							22

THIRD SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 211010	Inorganic Chemistry-II	3	0	0	3
2.		CHM 211020	Physical Chemistry-III	3	0	0	3
3.		PHY 211030	Physics II	3	0	0	3
4.		DGI 210100	Disaster Management	2	0	0	2
5.		PIR 215010	Introduction to Indian Constitution	2	0	0	2
6.		CHM 215010	Skill Enhancement Course: Dyes, Paints and Pigments	3	0	0	3
4.		CHM 212010	Inorganic Chemistry Practical-II	0	0	2	2
5.		CHM 212020	Physical Chemistry-III Practical	0	0	2	2
6.		PHY 212020	Physics II Practical	0	0	2	2
Total Credits							22

FOURTH SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 221010	Physical Chemistry – IV	3	0	0	3
2.		CHM 221020	Analytical Chemistry	3	0	0	3
3.		CHM 221030	Transition Metals and Coordination Chemistry	3	0	0	3
4.		CHM 221040	Stereochemistry and Molecular Rearrangement	3	0	0	3
5.		CHM 221050	Intellectual Property Rights	3	0	0	3
6.		CHM 221060	Advance Mathematics	3	0	0	3
7.		CHM 221070	Organic Chemistry Practical III	0	0	2	2

8.		CHM 221080	Analytical Chemistry Practical	0	0	2	2
Total Credits							22
Note: During the summer vacation after 4th semester students can do 4-6 weeks Summer Internship at once or in two parts that will be evaluated through presentation/seminar in 5 th semester.							

FIFTH SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 311040	Chemistry of Biomolecules	3	1	0	4
2.		CHM 311010	Quantum Chemistry	3	1	0	4
3.		CHM 311020	Heterocyclic Chemistry-I	3	1	0	4
4.		CHM 311030	Chemistry in Everyday Life	3	1	0	4
5.		CHM 312010	Adv Inorganic Chemistry Practical	0	0	2	2
Total Credits							18

SIXTH SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.		CHM 321010	Heterocyclic Chemistry-II	3	1	0	4
2.		CHM 321020	Advanced Physical Chemistry	3	1	0	4
3.		CHM 321030	Organic Spectroscopy	3	1	0	4
4.		CHM 321040	Advanced inorganic Chemistry	3	1	0	4
5.		CHM 322010	Biomolecule Chemistry Practical	0	0	2	2
6.		CHM 323010	Minor Project	0	0	6	6
Total Credits							24

Course Outcome

Semester I

Communicative English

Course Details			
Programme	B.Sc.	Course Code	ENG 110040
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Inorganic Chemistry I

Course Details			
Programme	B.Sc.	Course Code	CHM 111110
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Atomic theory of matter, composition of atom
- Identity of given element, relative size, charges of subatomic particles
- Defining isotopes, isobar and isotone
- Physical and chemical characteristics of elements in periodic table

Inorganic Chemistry Practical

Course Details			
Programme	B.Sc.	Course Code	CHM 112010
Semester	I	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Titrimetric analysis
- Acid base titration
- Redox titrimetric reaction

Organic Chemistry I

Course Details			
Programme	B.Sc.	Course Code	CHM 111120
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Hybridization and geometry of atoms
- 3 d structure of organic molecules
- Identifying chiral center
- Reactivity and stability of organic compounds
- Electrophile, nucleophiles free radicals

Organic Chemistry Practical

Course Details			
Programme	B.Sc.	Course Code	CHM 112020
Semester	I	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Calibration of thermometers
- Purification of organic compounds by crystallization
- Determination of melting points of compounds

Physics I

Course Details			
Programme	B.Sc.	Course Code	PHY 111110
Semester	I	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Physics I (Practical)

Course Details			
Programme	B.Sc.	Course Code	PHY 112010
Semester	I	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Course Outcome

Semester II

Physical Chemistry-II

Course Details			
Programme	B.Sc.	Course Code	CHM 121010
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Kinetic model of gas and its properties
- Maxwell's distribution and mean free path, Kinetic energy
- Behavior of real gases, its deviation from ideal behavior
- Solids lattice parameters

Organic Chemistry-II

Course Details			
Programme	B.Sc.	Course Code	CHM 121020
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Preparation and uses of various classes of organic compounds
- Organometallic compounds and their uses
- Organic chemistry reactions and mechanism

Fundamentals of Mathematics

Course Details			
Programme	B.Sc.	Course Code	CHM 121030
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Environmental Studies

Course Details			
Programme	B.Sc.	Course Code	ENV 120060
Semester	II	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Organic Chemistry Practical -II

Course Details			
Programme	B.Sc.	Course Code	CHM 122070
Semester	II	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Functional group test for phenols, alcohol, carbonyl, and carboxylic acid
- Preparation of acetanilide, benzylation of aniline

Physical Chemistry Practical-II

Course Details			
Programme	B.Sc.	Course Code	CHM 122080
Semester	II	Credits	2
Contact Hours	30	L/T/P	0/0/2

Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.
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Expected Learning Outcomes

After completion of the course the student will be able to understand

- Determination of surface tension by drop no. and drop wet method
- pH metry, viscometer

Basic Korean Language

Course Details			
Programme	B.Sc.	Course Code	KOR 125060
Semester	II	Credits	2
Contact Hours	30	L/T/P	2/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Course Outcome

Semester III

Inorganic Chemistry-II

Course Details			
Programme	B.Sc.	Course Code	CHM 211010
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Redox reaction in hydrometallurgy process
- Structure bonding of s, p- blocks elements
- Chemistry of novel gases

Physical Chemistry-III

Course Details			
Programme	B.Sc.	Course Code	CHM 211020
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Concept of system variables heat, work and laws of thermodynamics
- Heat of reaction and use of equation for bond energy, enthalpy etc
- Concept of entropy, reversible irreversible process

Physics-II

Course Details			
Programme	B.Sc.	Course Code	PHY 211030
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Disaster Management

Course Details			
Programme	B.Sc.	Course Code	DGI 210100
Semester	III	Credits	2
Contact Hours	30	L/T/P	2/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Introduction to Indian Constitution

Course Details			
Programme	B.Sc.	Course Code	PIR 215010
Semester	III	Credits	2
Contact Hours	30	L/T/P	2/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Dyes, Paints and Pigments

Course Details			
Programme	B.Sc.	Course Code	CHM 215010
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- About different organic dyes
- Synthetic and Natural Pigments

Inorganic Chemistry Practical-II

Course Details			
Programme	B.Sc.	Course Code	CHM 212010
Semester	III	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Iodo-iodimetric titration
- Preparation of cuprous chloride, Potash alum

Physical Chemistry Practical-III

Course Details			
Programme	B.Sc.	Course Code	CHM 212020
Semester	III	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Determination of critical solution temperature and composition of the phenol water system
- To study the effect of impurities in solvents
- Kinetics of the acid hydrolysis of methyl acetate with HCl
- Saponification of ethyl acetate

Physics Practical-II

Course Details			
Programme	B.Sc.	Course Code	PHY 212020
Semester	III	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

Course Outcome

Semester IV

Physical Chemistry-IV

Course Details			
Programme	B.Sc.	Course Code	CHM 221010
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Carnot cycle and Joule Thomson effect and their applications
- Impact of Carnot cycle and Thomson effect on design and performance of thermal system

Analytical Chemistry

Course Details			
Programme	B.Sc.	Course Code	CHM 221020
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Errors statistics and sampling
- Chromatographic method of analysis
- Spectroscopic method of analysis

Transition Metals and Co-ordination Chemistry

Course Details			
Programme	B.Sc.	Course Code	CHM 221030
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Study of organometallic compounds
- Basic organometallic reaction mechanism
- Metal carbonyls

Stereochemistry and Molecular rearrangement

Course Details			
Programme	B.Sc.	Course Code	CHM 221040
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Stereochemistry of carbon compound
- Named reactions
- Hoffman rearrangement and related reactions

Intellectual Property Rights

Course Details			
Programme	B.Sc.	Course Code	CHM 221050
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Fabrication falsification and plagiarism
- Creative common license
- Copyrights
- Patents

Advanced Mathematics

Course Details			
Programme	B.Sc.	Course Code	CHM 221060
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Fundamentals of calculus, differentiation, and Integration
- Polynomial functions

Organic Chemistry Practical-III

Course Details			
Programme	B.Sc.	Course Code	CHM 221070
Semester	IV	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Laboratory, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Special element detection
- Functional group identification
- Derivative preparation of common organic compounds

Analytical Chemistry Practical

Course Details			
Programme	B.Sc.	Course Code	CHM 221080
Semester	IV	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Laboratory, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- UV spectroscopic analysis of chemical compounds
- Gas chromatographic analysis
- FTIR analysis

Course Outcome

Semester V

Chemistry of Bio-Molecules

Course Details			
Programme	B.Sc.	Course Code	CHM 311040
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Amino acids peptides and propenes
- Hoffman exhaustive methylation
- Carbohydrates
- Vitamins

Quantum Chemistry

Course Details			
Programme	B.Sc.	Course Code	CHM 311010
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Black body radiation and old quantum theory
- Particle in one dimensional box and its solution
- Spherical polar coordinates rigid rotor model

Heterocyclic Chemistry-I

Course Details			
Programme	B.Sc.	Course Code	CHM 311020
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Three membered ring with one hetero atom
- Four membered Heterocycles
- Five membered aromatic heterocycles

Chemistry in Everyday Life

Course Details			
Programme	B.Sc.	Course Code	CHM 311030
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Respiration and energy production

- Chemical aspects of some common health hazard
- Vitamins and minerals

Advanced Inorganic Chemistry Practical

Course Details			
Programme	B.Sc.	Course Code	CHM 312010
Semester	V	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Standardization of sodium thiosulphate solution and volumetric estimation of Cu(II) iodometrically.
- Volumetric estimation of Zn(II), Ca(II) and Mg(II) by EDTA titration, using Eriochrome black – T indicator
- Gravimetric estimation of Nickel(II), using dimethylglyoxime.
- Estimation of: (a) total manganese content in manganese ore (pyrolusite); (b) total iron content in Fe₂O₃ (haematite).
- To study the composition of ferric-sulfosalicylic acid complex by Job's method of continuous variation, and to determine the stability of the complex, spectrophotometrically.

Course Outcome

Semester VI

Heterocyclic Chemistry-II

Course Details			
Programme	B.Sc.	Course Code	CHM 321010
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Six membered heterocycles with one two or three atoms
- Oxitanes, azatidanes and thietanes

Advanced Physical Chemistry

Course Details			
Programme	B.Sc.	Course Code	CHM 321020
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Theories of reactions rates
- Catalysts: Mechanism of catalytic reactions
- Enzyme catalysis

Organic Spectroscopy

Course Details			
Programme	B.Sc.	Course Code	CHM 321030
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- NMR, Proton and ¹³C
- Basic principles of IR spectroscopy
- Mass spectrometry
- UV spectroscopy

Advanced Inorganic Chemistry

Course Details			
Programme	B.Sc.	Course Code	CHM 321040
Semester	V	Credits	4
Contact Hours	60	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Chemistry of main group elements
- Boranes, diboranes and silicone chemistry
- Organometallic chemistry and its application

Biomolecules Chemistry Practical

Course Details			
Programme	B.Sc.	Course Code	CHM 322010
Semester	V	Credits	2
Contact Hours	30	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Systematic identification of organic compounds
- Preparation of sulphanilic acid, dibenzyl acetone
- Estimation of phenol, bromide bromate method

Minor Project

Course Details			
Programme	B.Sc.	Course Code	CHM 323010
Semester	V	Credits	6
Contact Hours	90	L/T/P	0/0/6
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will be able to understand

- Different research area with practical applications
- Presentation and seminar skills
- Literature review
- Drafting report

Int B.Sc./M.Sc. Chemistry Program Structure

FIRST SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.	Major-1	CHM 011010	Organic Chemistry-I	3	0	0	3
2.	Major-2	CHM 011030	Organic Chemistry Practical-I	0	0	2	2
3.	Minor-1	CHM 021010*	Principles of Chemistry-I	3	0	0	3
4.	Minor-2	CHM 021030*	Principles of Chemistry Lab-I	0	0	1	1
5.	MDC-1	CHM 031010	Chemistry for Everyday Life	3	0	0	3
6.	AEC-1			2	0	0	2
7.	SEC-1	CHM 051010	Renewable Energy	3	0	0	3
8.	VAC-1						3
Total Credits							20
SECOND SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.	Major-3	CHM 011020	Inorganic Chemistry-I	3	0	0	3
2.	Major-4	CHM 011040	Inorganic Chemistry Practical-I	0	0	2	2
3.		CHM 031020^	Chemistry-I	3	0	0	3
4.		CHM 031040^	Chemistry-I Lab	0	0	2	1
5.	Minor-3	CHM 021020*	Principles of Chemistry-II	3	0	0	3
6.	Minor-4	CHM 021020*	Principles of Chemistry Practical-II	0	0	2	1
7.	MDC			3	0	0	3
8.	AEC			2	0	0	2
9.	SEC-2	CHM 051020	Industrial Chemistry	3	0	0	3
10.	SEC-3	CHM051040	Water Conversation	3	0	0	3
11.	VAC-2			3	0	0	3
Total Credits							27
THIRD SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.	Major-5	CHM 012010	Organic Chemistry-II	3	0	0	3

2.	Major-6	CHM 012030	Physical Chemistry-I	3	0	0	3
3.	Major-7	CHM 012050	Organic Chemistry Practical-II	0	0	1	1
4.	Major-8	CHM 012070	Physical Chemistry Practical-I	0	0	1	1
5.	Minor-5	CHM 022010*	Principles of Chemistry-III	3	0	0	3
6.	Minor-6	CHM 022030*	Principles of Chemistry Practical-III	0	0	1	1
4.	MDC-2	CHM 032010	Science for Everyday Life	3	0	0	3
5.	AEC			2	0	0	2
6.	SEC-4	CHM 052010	Chemical Analysis of Water	2	0	1	3
Total Credits							20

FOURTH SEMESTER

Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.	Major-9	CHM 012020	Physical Chemistry – II	3	0	0	3
2.	Major-10	CHM 012040	Inorganic Chemistry – II	3	0	0	3
3.	Major-11	CHM 012060	Organic Chemistry-III	3	1	0	4
4.	Major-12	CHM 012080	Physical Chemistry Lab-II	0	0	1	1
5.	Major-13	CHM 012100*	Inorganic Chemistry Lab-II	0	0	1	1
6.	Major-14	CHM012120	Organic Chemistry Lab-III	0	0	1	1
7.	Major-15	CHM012140	Seminar			2	2
8.	Minor-7	CHM022020	Environmental Chemistry	4	0	0	4
9.	AEC						2
Total Credits							21

Note: During the summer vacation after 4th semester students can do 4-6 weeks Summer Internship at once or in two parts that will be evaluated through presentation/seminar in 5th semester.

FIFTH SEMESTER

Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.	Major-16	CHM 013030	Physical Chemistry-III	3	0	0	3
2.	Major-17	CHM 013030	Inorganic Chemistry-III	3	0	0	3
3.	Major-18	CHM 013050	Heterocyclic Chemistry-I	3	0	0	3
4.	Major-19	CHM 013070	Inorganic Chemistry Practical-III	0	0	2	2
5.	Major-20	CHM 013090	Heterocyclic Chemistry Practical-I	0	0	2	2
6.	Major-21	CHM 013110	Seminar	0	0	1	1

7.	Minor-8	CHM 023010*	Material Chemistry	3	0	1	4
8.	SEC-5	CHM 053010	Internship/Field Visit	0	0	2	2
Total Credits							20
SIXTH SEMESTER							
Sl. No.	Category	Course Code	Course Title	Periods Per Week			Credit
				L	T	P	
1.	Major-22	CHM 013020	Physical Chemistry-IV	3	0	0	3
2.	Major-23	CHM 013040	Inorganic Chemistry-IV	3	0	0	3
3.	Major-24	CHM 013060	Organic Spectroscopy	3	0	0	3
4.	Major-25	CHM 013080	Organic Chemistry Lab-IV	0	0	2	2
5.	Major-26	CHM 013100	Physical Chemistry Lab-IV	0	0	2	2
6.	Major-27: Elective-II	CHM 013120	MOOCs courses	4	0	0	4
7.	Minor-9	CHM 023020*	Polymer Chemistry	3	0	0	3
Total Credits							20

TOTAL CREDITS AFTER 3rd YEAR=128

Programme Learning Outcome:

PO-1: To formulate new ideas/concepts in chemical sciences.

PO-2: To Analysis and interpretation of chemical phenomena and process.

PO-3: To Design and develop of new molecules/processes with research, industry and societal applications.

PO-4: To acquire the principles and practice of chemical sciences for fundamental research in chemistry and applied chemistry.

PO-5: To get aware about issues of environment, health and development from a chemical perspective and hence to address it using chemistry knowledge.

PO-6: To follow professional ethics in academics and research and in all sphere of life.

PO-7: To develop a leadership quality to work in diverse teams/groups to achieve the goal.

PO-8: To become independent thinker and hence to learn chemistry in the context of scientific advancement and career goal.

Course Outcome

Semester I

Organic Chemistry-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 011010
Semester	I	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will be able to

- an understanding of the development of scientific ideas about organic chemistry
- creating, evaluating, analyzing, applying, understanding, and remembering concepts of basic organic chemistry, stereochemistry, aliphatic and aromatics compounds

Organic Chemistry Practical-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 011030
Semester	I	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will be able to

- develop practical skills in organic laboratory.
- an understanding of the development of scientific ideas about organic chemistry laboratory.

Principles of Chemistry-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021010
Semester	I	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, workshop, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- understanding of the development of scientific ideas about principles of chemistry
- understanding and remembering atomic structure, chemical periodicity, chemical bonding, basic organic chemistry, acid base and material chemistry.

Principles of Chemistry Lab-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021030
Semester	I	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- develop practical skills in chemistry laboratory.
- an understanding of the development of scientific ideas about chemistry laboratory.

Chemistry for Everyday Life-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 031010
Semester	I	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, workshop, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- the use of chemistry in daily life
- understanding of the development of scientific ideas about chemistry in societal use.

Renewable Energy

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 051010
Semester	I	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, workshop, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- fundamental understanding of renewable energy
- idea about the characteristics of radiation their distribution
- understanding of solar mapping using solar satellite
- composition of different biomasses as a alternative sources of energy.

Course Outcome

Semester II

Inorganic Chemistry-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 011020
Semester	II	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course

- Student could be able to understand the atomic structure and chemical periodicity.
- Students will be able to explore the nature of chemical bonds and know theories of chemical bonding including forces that influence molecular shapes.
- After the fundamental insight, student could be able to explain the basic reaction mechanism concept and applying the same with examples.
- Student could understand acid/base and pH concept.
- Students can explore the polymeric materials and their properties for Engineering applications.

Inorganic Chemistry Practical-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 011040
Semester	II	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course

- Upon Successful learning Students could be able to understand the complexometric titrations and estimate the concentration of elements present in compound.

Chemistry -I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 031020
Semester	II	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course student will have the comprehensive knowledge about

- Theory of gases
- Fundamentals of organic chemistry and reaction mechanism
- Periodic Properties of elements

Chemistry Lab-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 031040
Semester	II	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course student will have the comprehensive knowledge about

- develop practical skills in chemistry laboratory.
- an understanding of the development of scientific ideas about chemistry laboratory.

Principles of Chemistry-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021020
Semester	II	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course student could be able to

- understand the fundamentals of different principles and theory of chemistry
- evaluate, analyze, apply, and understand gaseous state, chemical kinetics, chemical bonding, crystal structure in solids and reaction mechanism in organic chemistry.

Principles of Chemistry Lab-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021040
Semester	II	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- develop practical skills in chemistry laboratory.
- an understanding of the development of scientific ideas about chemistry laboratory.

Industrial Chemistry

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 051020
Semester	II	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student could be able to

- Identify the importance of different surface coatings.
- Acquire a critical knowledge on manufacture of ceramics and cement.
- Understand various steps in the manufacture of cane sugar.
- Explain the manufacture of pulp and paper.

Water Conservation

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 051040
Semester	II	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student could be able to

- Identify different processes and assess factors contributing to water conservation
- Design and analyze water conservation structures and techniques considering site-specific conditions and requirements.
- Evaluate the effectiveness and performance of soil and water conservation structures. *PO5*

Course Outcome

Semester III

Organic Chemistry-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021010
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive knowledge about

- Preparation and uses of various classes of organic compounds.
- Organometallic compounds and their uses.
- Organic chemistry reactions and reaction mechanisms.
- Use of reagents in various organic transformation reactions.

Physical Chemistry-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021030
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive knowledge about

- Understanding Kinetic model of gas and its properties.
- Maxwell distribution, mean-free path, kinetic energies.
- Behavior of real gases, its deviation from ideal behavior, equation of state, isotherm, and law of corresponding states.
- Liquid state and its physical properties related to temperature and pressure variation.

Organic Chemistry Practical-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021050
Semester	III	Credits	1
Contact Hours	15	L/T/P	0/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Presentation, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive knowledge about

- develop practical skills in organic laboratory.
- an understanding of the development of scientific ideas about organic chemistry laboratory.

Physical Chemistry Practical-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 021070
Semester	III	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive knowledge about

- Development of scientific ideas about principles of physical chemistry laboratory
- Preparation of different solutions with respect to molarity, normality
- Titrimetric analysis
- equivalent conductance, degree of dissociation and dissociation constant

Principles of Chemistry-III

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 022010
Semester	III	Credits	3
Contact Hours	45	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive knowledge about

- understanding of the development of scientific ideas about principles of chemistry

- understanding and remembering gaseous state, chemical kinetics, chemical bonding, crystal structure in solids and reaction mechanism in organic chemistry.

Principles of Chemistry Practical-III

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 022030
Semester	III	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive knowledge about

- practical skills in chemistry laboratory.
- an understanding of the development of scientific ideas about chemistry laboratory.

Science for Everyday Life

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 032010
Semester	III	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- the use of chemistry in daily life
- understanding of the development of scientific ideas about chemistry in societal use.

Chemical Analysis of Water

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 052010
Semester	III	Credits	3
Contact Hours	45	L/T/P	2/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- Hardness of water: disadvantages, removal by internal and external treatment by various softening methods used in industry CO₂
- Knowledge about various types fuels (solid, liquid, and gaseous) like coal, coke, diesel, natural gas etc., their manufacturing, refinement and uses

Course Outcome

Semester IV

Physical Chemistry-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012020
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will have a comprehensive

- Understanding the concept of system, variables, heat, work, and laws of thermodynamics.
- Understanding the concept of heat of reactions and use of equations in calculations of bond energy, enthalpy, etc.

- Understanding the concept of entropy; reversible, irreversible processes. Calculation of entropy using 3rd law of thermodynamics.
- Understanding the application of thermodynamics: Joule Thompson effects, partial molar quantities.
- Understanding phase diagrams

Inorganic Chemistry-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012040
Semester	IV	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will have a comprehensive

- Understanding d-and f-block elements.
- Understanding transition metal complexes and their spectral and magnetic properties.
- Understanding organometallic compounds like Li, Mg, Hg, etc. – their bonding and properties.

Organic Chemistry-III

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012060
Semester	IV	Credits	4
Contact Hours	45	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will have a comprehensive

- Understanding of reaction intermediate and isotopic labeling
- Different types of electrophilic and nucleophilic aromatic substitution reaction

Physical Chemistry Lab-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012080
Semester	IV	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will have a comprehensive

- Understanding of kinetics of reactions
- Understanding of critical solution temperature and composition of the phenol-water system
- Freundlich and Langmuir isotherms for adsorption of acetic acid and selected organic dye(s) on activated charcoal

Inorganic Chemistry Lab-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012100
Semester	IV	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course

- Upon Successful learning Students could be able to understand the complexometric titrations and estimate the concentration of elements present in compound.

Organic Chemistry Lab-II

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012120
Semester	IV	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will be able to

- develop practical skills in organic laboratory.
- an understanding of the development of scientific ideas about organic chemistry laboratory.

Seminar

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 012140
Semester	IV	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will be able to

- get the exposure of different areas of science and their applications
- understand the on-going trends of research and technology

Environmental Chemistry

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 022020
Semester	IV	Credits	4
Contact Hours	45	L/T/P	3/1/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student will have a comprehensive

- composition of atmosphere
- terrestrial and aquatic pollution
- DO/BOD/COD in water
- Waste water treatment process

Course Outcome

Semester V

Physical Chemistry-III

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013010
Semester	V	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive

- Basic understanding of quantum chemistry, molecular spectroscopy, and photochemistry.
- Applying the concepts to some standard systems.
- Draw connection among ideas and solve numerical problems

Inorganic Chemistry-III

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013030
Semester	V	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive

- Understanding classification of nuclides, nuclear stability and nuclear models.

- Understanding radio-active decay and decay kinetics.
- Understanding quantum radio-active isotopes separation and analysis.

Heterocyclic Chemistry-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013050
Semester	V	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive

- understanding of the development of scientific ideas about heterocyclic chemistry
- creating, evaluating, analyzing, applying, understanding and remembering three, four, five and six member rings.

Inorganic Chemistry Practical-III

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013070
Semester	V	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

After completion of the course the student could be able to

- describe and compare the distinct properties of different elements
- Understand the thermodynamic and kinetic properties of reactions of different complexes
- understand the fundamental and applied aspects of different inorganic species

Heterocyclic Chemistry-I

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013090
Semester	V	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

After completion of the course the student could be able to understand

- development of scientific ideas about heterocyclic chemistry laboratory
- Synthesis of Pyrazole, imidazole, pyrimidine, derivatives
- Synthesis of Benzimidazole, benzthiazole, Indole derivatives
- Some reactions of isatin

Seminar

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013110
Semester	V	Credits	1
Contact Hours	15	L/T/P	0/0/1
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will be able to

- *get the exposure of different areas of science and their applications*
- *understand the on-going trends of research and technology*

Material Chemistry

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 023010
Semester	V	Credits	4
Contact Hours	45	L/T/P	3/0/1

Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.
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After completion of the course the student could be able to

- To explain the fundamentals, manipulation of materials
- To explain the growth and formation of materials through theories and techniques.
- To explain the methods involved in the synthesis of nanomaterials
- To introduce the magnetic behavior of materials and their structural relevance
- To demonstrate the application of materials

Internship/Field Visit

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013110
Semester	V	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

Expected Learning Outcomes

After completion of the course the student-teachers will be able to

- *get the exposure of different areas of science and their applications*
- *understand the on-going trends of research and technology*

Course Outcome

Semester VI

Physical Chemistry-IV

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013020
Semester	VI	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- the development of scientific ideas about physical chemistry
- Physical Chemistry with emphasis of chemical kinetics, thermodynamics of solution and electrochemistry

Inorganic Chemistry-IV

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013040
Semester	VI	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- Chemistry of main group elements
- Boranes, diborane and silicone chemistry
- Organometallic chemistry and its application

Organic Spectroscopy-IV

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013060
Semester	VI	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- Basic principle of UV spectroscopy
- IR spectroscopy
- Mass spectroscopy
- NMR

Organic Chemistry Lab-IV

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013080
Semester	VI	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- Qualitative analysis of organic compounds containing functional groups
- Identification of functional groups by IR and NMR spectroscopy
- Preparation of methyl orange
- Extraction of caffeine from tea leaves
- Analysis of carbohydrates

Physical Chemistry Lab-IV

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013110
Semester	VI	Credits	2
Contact Hours	15	L/T/P	0/0/2
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Laboratory, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- Acid hydrolysis of methyl acetate with hydrochloric acid.
- Saponification of ethyl acetate.
- Determination of cell constant.
- Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- Perform the following conductometric titrations:

MOOCs Course

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 013110
Semester	VI	Credits	4
Contact Hours	60	L/T/P	4/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- Related topic of MOOCs course

Polymer Chemistry

Course Details			
Programme	Int B.Sc./M.Sc.	Course Code	CHM 023020
Semester	VI	Credits	3
Contact Hours	45	L/T/P	3/0/0
Transaction Style	Lecture, Lecture-cum-Demonstration, Questioning, Discussion, Project, Seminar, Assignment, etc.		

After completion of the course the student will have a comprehensive understanding of

- Fundamentals of polymer chemistry
- Polymer structure and relation
- Methods of polymerization
- Polymer characterization