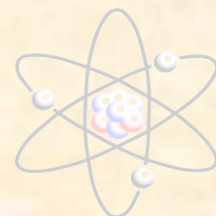


Kavayitri Bahinabai Chaudhari
North Maharashtra University
Jalgaon

Academic Curriculum

B.Sc.

Subject: Chemistry

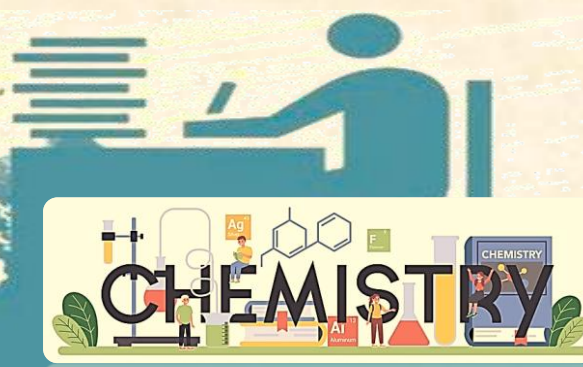
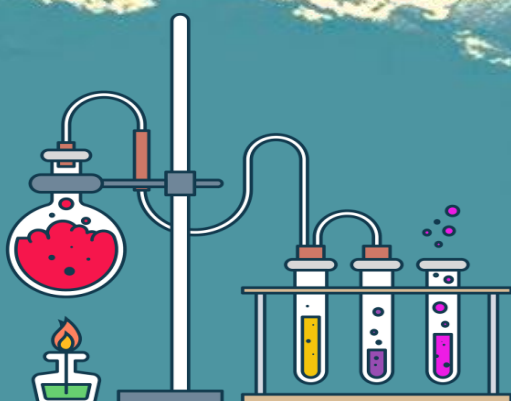


(Semester I and II)
Based on NEP-2020
(Outcome Based Curriculum)

| | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
| H | | | | | | | | | | | | | | | | | He | |
| Li | Be | | | | | | | | | | | B | C | N | O | F | Ne | |
| Na | Mg | | | | | | | | | | | Al | Si | P | S | Cl | Ar | |
| K | Ca | Sc | Ti | V | Cr | Mn | Fe | Co | Ni | Cu | Zn | Ga | Ge | As | Se | Br | Kr | |
| Rb | Sr | Y | Zr | Nb | Mo | Tc | Ru | Rh | Pd | Ag | Cd | In | Sn | Sb | Te | I | Xe | |
| Cs | Ba | Hf | Ta | W | Re | Os | Ir | Pt | Au | Hg | Tl | Pb | Bi | Po | At | Rn | | |
| Fr | Ra | Rf | Db | Sg | Bh | Hs | Mt | Ds | Rg | Cn | Nh | Fl | Mc | Lv | Ts | Og | | |
| | | La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu | | |
| | | Ac | Th | Pa | U | Np | Pu | Am | Cm | Bk | Cf | Es | Fm | Md | No | Lr | | |

Prepared
By
BoS Chairman,
Members of Board of Studies and
The Experienced Teachers in Chemistry,
KBCNMU, Jalgaon

To Be Implemented From
Academic Year 2024-25



**Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon**



**Semester-wise Course Structure, Course Code and
Credit distribution and Syllabus for**

Faculty of Science and Technology

**B. Sc. (Chemistry)
(Honors/Research) Programme**

As per NEP 2020, for Affiliated Colleges

w. e. f. – June 2024

Preamble:

The syllabus of Chemistry for First year has been redesigned for National Education policy under Choice based Credit System (CBCS) to be implemented from 2024-2025. In CBCS pattern semester system has been adopted for FY, SY and TY which includes Discipline Specific Core Course (DSC) at F. Y. level, Ability Enhancement Compulsory Course (AEC), Discipline Specific Elective Course (DSE) and Open Elective Course (OE), Skill Enhancement Course (SEC), Indian Knowledge Science (IKS), Vocational Skill course (VSC) etc.

It imbibes the guidelines of UGC, NEP-2020 and Government of Maharashtra for all its Under Graduate programmes. The Board of Study in Chemistry of the KBCNMU prepared the syllabus for the first year undergraduate of Chemistry. The new curriculum of B. Sc. (Degree) Chemistry and B.Sc. (Honors with Research) Chemistry offer courses in the areas of Physical Chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, Polymer Chemistry, Industrial Chemistry, Green Chemistry, Nanoscience and Nanotechnology etc. All the courses are having defined objectives and learning outcomes, which will help prospective students in choosing the elective courses to broaden their skills in the field of chemistry and interdisciplinary areas. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry. The courses also offer ample skills to pursue research as career in the field of chemistry and allied areas.

Abbreviations:

- **T:** Theory Course
- **P:** Practical course
- **DSC:** Discipline Specific Core Course
- **DSE:** Discipline Specific Elective Course
- **MIN:** Minor subject
- **VSEC:** Vocational skill and Skill enhancement courses
- **VSC:** Vocational Skill Courses
- **SEC:** Skill Enhancement Courses
- **GE/OE:** Generic/open elective
- **CI:** Constitution of India
- **IKS:** Indian Knowledge System
- **CEP:** Community engagement and service
- **OJT:** On Job Training: Internship/ Apprenticeship
- **RP:** Research Project
- **RM:** Research methodology
- **ES:** Environment studies
- **ENG:** English
- **MIL:** Modern Indian language
- **Co-curricular Course (CC)**
 - a) **CC-1: CC-120 (A/B): Sports or Yoga**
 - b) **CC-2: CC-130 (A/B): NSS or NCC**
 - c) **CC-3:**
CC-220 (A): Human Rights and Environment Law
CC-220 (B): Cyber Security
 - d) **CC-4:**
CC-229 (A): Communication Skills and Personality Development
CC-229 (B): Cultural
- **Value Education Courses (VEC)**
 - a) **VEC1: EA-118: Environmental Awareness**
 - b) **VEC2: CI-129: Constitution of India**
- **Indian Knowledge System (IKS):**
 - a) **IK: IK - 119: Ayurvedic Medicine in Ancient India**
- **Ability Enhancement Courses (AEC)**
 - a) **AEC-1: EG: 101 – English -1**
 - b) **AEC-2: EG: 102 – English -2**
 - c) **AEC-3: MR: 201 – Marathi -1**
 - d) **AEC-3: HN: 201 – Hindi -1**
 - e) **AEC-3: MR: 202 – Marathi -2**
 - f) **AEC-3: HN: 202 – Hindi -2**

| Subject Short Name: | | |
|----------------------------|------------------------|-------------------|
| Sr. No. | Name of Subject | Short Name |
| 1 | Physics | PH |
| 2 | Mathematics | MT |
| 3 | Chemistry | CH |
| 4 | Botany | BO |
| 5 | Zoology | ZO |
| 6 | Electronics | EL |
| 7 | Computer Science | CS |
| 8 | Statistics | ST |
| 9 | Microbiology | MB |
| 10 | Biotechnology | BT |
| 11 | Information Technology | IT |
| 12 | Biochemistry | BC |
| 13 | Environmental Science | EV |
| 14 | Geography | GG |
| 15 | Geology | GE |

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon
Syllabus

F.Y.B.Sc. Chemistry (w.e.f. June-2024)

As per NEP-2020

Program Outcomes (PO) for B.Sc. Program: Upon successful completion of the B.Sc. program, student will be able to:

| PO No. | PO |
|--------|--|
| PO1 | Understand the basic concepts and fundamental principles related to various science branches |
| PO2 | Aquaint the skills in handling scientific instruments and performing in laboratory experiments |
| PO 3 | Relate various scientific phenomena and their relevancies in the day-to-day life. |
| PO4 | Analyses experimental data critically and systematically to draw the objective conclusions. |
| PO 5 | Develop various skills such as communication, leadership, teamwork, social, research etc., which will help in expressing ideas and views clearly |
| PO 6 | Demonstrate comprehensive knowledge of the disciplines that form a part of an graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work. |
| PO 7 | Develop interdisciplinary approach for providing better solutions and sustainable developments. |
| PO 8 | Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development. |

Program Specific Outcome PSO (B.Sc. Chemistry):

After completion of this course, students are expected to:

| PSO No. | PSO |
|---------|---|
| PSO1 | Understand the theoretical concepts of organic chemistry such as IUPAC nomenclature, electronic effects, reactive intermediates, organic reagents, types of reactions and their mechanisms etc. Along with this students will also learn practical aspects of organic chemistry such as purification techniques, qualitative analysis, organic synthesis etc. |
| PSO2 | Understand the different concept of inorganic chemistry such as elements and their different periodic properties, chemical bonding, coordination complexes, catalysis etc. Along with this students will also learn practical inorganic techniques such as inorganic qualitative and quantitative analysis, coordination complex synthesis etc. |
| PSO3 | learn various concepts of physical chemistry, namely, as it is through thermodynamics, chemical kinetics, electrochemistry, quantum chemistry, solid state chemistry, colligative properties, nuclear chemistry and radioactivity etc. |
| PSO4 | learn contemporary as well as modern concepts of chemistry such as nano-chemistry, polymer chemistry, green chemistry, environmental chemistry etc. |
| PSO5 | apply their chemistry knowledge and critical thinking to design, perform, record, analyze, to |

Multiple Entry and Multiple Exit options: The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

| Levels | Qualification Title | Credit Requirements | | Semester | Year |
|--------|---|---------------------|---------|----------|------|
| | | Minimum | Maximum | | |
| 4.5 | UG Certificate | 40 | 44 | 2 | 1 |
| 5.0 | UG Diploma | 80 | 88 | 4 | 2 |
| 5.5 | Three Year Bachelor's Degree | 120 | 132 | 6 | 3 |
| 6.0 | Bachelor's Degree- Honours Or Bachelor's Degree- Honours with Research | 160 | 176 | 8 | 4 |

Semester-wise Code structure for B. Sc (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – First Year, SEMESTER – I, Level – 4.5

| Course | Course Type | Course Code | Course Title | Credits | Teaching Hours/Week | | | Marks (Total 100) | | | |
|--------|-------------|--------------|--|---------|---------------------|----|-------|-------------------|----|---------------|----|
| | | | | | T | P | Total | Internal (CA) | | External (UA) | |
| | | | | | | | | T | P | T | P |
| DSC-1 | DSC | CH-111 | Basic Physical and Inorganic Chemistry-I | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-2 | DSC | CH-112 | Basic Organic and Inorganic Chemistry-I | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-3 | DSC | CH-113 | Chemistry Practical-I | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| MIN-1 | MIN | CH-114 | Fundamentals of Chemistry-I | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| MIN-2 | MIN | CH-115 | Chemistry Practical (Based on Minor- 1) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| OE-1 | OE | CH-116 | Food Chemistry, Safety and Adulteration | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| SEC-1 | SEC | CH-117 | Basics of Analytical Chemistry-I | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| VEC-1 | VEC | EA-118 | Environmental Awareness | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| IKS | IKS | IK-119 | Ayurvedic Medicine in Ancient India | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| CC-1 | CC | CC-120 (A/B) | A) Sports or B) Yoga | 2 | 1 | 1 | 2 | 20 | -- | 30 | -- |
| AEC-1 | AEC | EG-101 | English -1 | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |

B. Sc (Honors/Research) – First Year, SEMESTER – II, Level – 4.5

| | | | | | | | | | | | |
|-------|-----|--------------|--|---|----|----|---|----|----|----|----|
| DSC-4 | DSC | CH-121 | Basic Organic and Inorganic Chemistry-II | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-5 | DSC | CH-122 | Ancient Indian Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-6 | DSC | CH-123 | Chemistry Practical-II | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| MIN-3 | MIN | CH-124 | Fundamentals of Chemistry-II | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| MIN-4 | MIN | CH-125 | Chemistry Practical (Based on Minor- 3) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| OE-2 | OE | CH-126 | Chemistry in Every Day Life | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| SEC-2 | SEC | CH-127 | Advanced Analytical Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| SEC-3 | SEC | CH-128 | Analytical Chemistry Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| VEC-2 | VEC | CI-129 | Constitution of India | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| CC-2 | CC | CC-130 (A/B) | A) NSS or B) NCC | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| AEC-2 | AEC | EG-102 | English -2 | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |

Cumulative Credits For First Year – 44

Semester-wise Code structure for B. Sc (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – Second Year, SEMESTER – III, Level – 5.0

| Course | Course Type | Course Code | Course Title | Credits | Teaching Hours/Week | | | Marks (Total 100) | | | |
|--------|-------------|-------------|---|---------|---------------------|----|-------|-------------------|----|---------------|----|
| | | | | | T | P | Total | Internal (CA) | | External (UA) | |
| | | | | | | | | T | P | T | P |
| DSC-7 | DSC | CH-211 | Physical and Inorganic Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-8 | DSC | CH-212 | Organic and Inorganic Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-9 | DSC | CH-213 | Chemistry Practical-III | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-10 | DSC | CH-214 | Chemistry Practical-IV | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| MIN-5 | MIN | CH-215 | Physical and Inorganic Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| MIN-6 | MIN | CH-216 | Chemistry Practical (Based on Minor- 5) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| OE-3 | OE | CH-217 | Waste Management | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| VSC-1 | VSC | CH-218 | Polymer Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| VSC-2 | VSC | CH-219 | Practical based on Industrially Important products | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| CC-3 | CC | CC-220 | A) Human Rights and Environment Law or B) Cyber Security | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| AEC-3 | AEC | MR-201 | Marathi -1 | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| | | HN-201 | Hindi -1 | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |

B. Sc (Honors/Research) – Second Year, SEMESTER – IV, Level – 5.0

| | | | | | | | | | | | |
|--------|-----|--------|--|---|----|----|---|----|----|----|----|
| DSC-11 | DSC | CH-221 | Physical and Inorganic Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-12 | DSC | CH-222 | Organic and Inorganic Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-13 | DSC | CH-223 | Chemistry Practical- V | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-14 | DSC | CH-224 | Chemistry Practical-VI | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| MIN-7 | MIN | CH-225 | Organic and Analytical Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| MIN-8 | MIN | CH-226 | Chemistry Practical (Based on Minor- 8) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| OE-4 | OE | CH-227 | Pollution | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| CEP | CEP | CH-228 | Agriculture and Dairy Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| CC-4 | CC | CC-229 | A) Communication Skills and Personality Development B) Cultural | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| AEC-4 | AEC | MR-202 | Marathi -2 | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| | | HN-202 | Hindi -2 | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |

Cumulative Credits For First Year – 44

Semester-wise Code structure for B. Sc (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – Third Year, SEMESTER – V, Level – 5.5

| Course | Course Type | Course Code | Course Title | Credits | Teaching Hours/Week | | | Marks (Total 100) | | | |
|--------|-------------|-------------|--|---------|---------------------|----|-------|-------------------|----|---------------|----|
| | | | | | T | P | Total | Internal (CA) | | External (UA) | |
| | | | | | | | | T | P | T | P |
| DSC-15 | DSC | CH-311 | Principles of Physical Chemistry-I | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-16 | DSC | CH-312 | Inorganic Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-17 | DSC | CH-313 | Organic Reaction Mechanism | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-18 | DSC | CH-314 | Inorganic Chemistry Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-19 | DSC | CH-315 | Organic Chemistry Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSE-1 | DSE | CH-316 (A) | Agrochemicals and Pesticides | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| | | CH-316 (B) | Biochemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSE-2 | DSE | CH-317 | Instrumentation Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| MIN-9 | MIN | CH-318 | Basics of Reaction Mechanism | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| VSC-3 | VSC | CH-319 | Preparation of Daily Use Products Practical (Hands on Training to prepare candle, soap, shampoo, gel, wound cream) | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| FP | FP | CH-320 | Field Project | 4 | -- | 8 | 8 | -- | 40 | -- | 60 |

B. Sc (Honors/Research) – Third Year, SEMESTER – VI, Level – 5.5

| | | | | | | | | | | | |
|----------|---------|------------|--|---|----|----|---|----|----|----|----|
| DSC-20 | DSC | CH-321 | Principles of Physical Chemistry-II | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-21 | DSC | CH-322 | Chemistry of Inorganic Solids | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-22 | DSC | CH-323 | Spectroscopic Methods of Structure Determination | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSC-23 | DSC | CH-324 | Physical Chemistry Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-24 | DSC | CH-325 | Inorganic Chemistry Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSE-3 | DSE | CH-326 (A) | Industrial Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| | | CH-326 (B) | Drug Chemistry | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| DSE-4 | DSE | CH-327 | Organic Chemistry Practical | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| MIN-10 | MIN | CH-328 | Instrumental Methods of Analysis | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| VSC-4 | VSC | CH-329 | Practical (Hands on training Food adulteration or Beauty Products or Paints or Polymers) | 2 | 2 | -- | 2 | 20 | -- | 30 | -- |
| *OJT/Int | OJT/Int | CH-330 | On Job Training/Internship | 4 | -- | 8 | 8 | -- | 40 | -- | 60 |

* Students need to complete one month on job training (OJT) or internship in any industry related to major subject.

Semester-wise Code structure for B. Sc (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – 4th Year (Honors), SEMESTER – VII, Level – 6.0

| Course | Course Type | Course Code | Course Title | Credits | Teaching Hours/Week | | | Marks (Total 100) | | | |
|--------|-------------|-------------|--|---------|---------------------|----|-------|-------------------|----|---------------|----|
| | | | | | T | P | Total | Internal (CA) | | External (UA) | |
| | | | | | | | | T | P | T | P |
| DSC-25 | DSC | CH-411 | Advanced Physical Chemistry-I | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| DSC-26 | DSC | CH-412 | Chemistry Practical- I (Physical Chemistry) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-27 | DSC | CH-413 | Advanced Organic Chemistry-I | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| DSC-28 | DSC | CH-414 | Chemistry Practical-II (Organic Chemistry) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-29 | DSC | CH-415 | Chemistry Practical-III (Inorganic Chemistry) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSE-5 | DSE | CH-416 (A) | A) Advanced Inorganic Chemistry-I | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| | | CH-416 (B) | B) Advanced Analytical Chemistry-I | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| RM | RM | RH-417 | Research Methodology | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |

B. Sc (Honors/Research) – 4th Year (Honors), SEMESTER – VIII, Level – 6.0

| | | | | | | | | | | | |
|--------------|---------|-----------|--|---|----|----|---|----|----|----|----|
| DSC-30 | DSC | CH-421 | Advanced Physical Chemistry-II | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| DSC-31 | DSC | CH-422 | Chemistry Practical-IV (Physical Chemistry) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-32 | DSC | CH-423 | Advanced Organic Chemistry-II | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| DSC-33 | DSC | CH-424 | Chemistry Practical-V (Organic Chemistry) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSC-34 | DSC | CH-425 | Chemistry Practical-VI (Inorganic Chemistry) | 2 | -- | 4 | 4 | -- | 20 | -- | 30 |
| DSE-6 | DSE | CH-426(A) | A) Advanced Inorganic Chemistry-II | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| | | CH-426(B) | B) Industrial Safety and Good laboratory Practices | 4 | 4 | -- | 4 | 40 | -- | 60 | -- |
| *OJT/ Int | OJT/Int | CH-427 | On Job Training or Internship | 4 | -- | 8 | 8 | -- | 40 | -- | 60 |

* Students need to complete one month on job training (OJT) or internship in any industry related to major subject.

Important Notes:

1. One credit is equivalent to 15 hour of teaching (lecture or tutorial) or 30 hours of practical or field work or community engagement and service per semester. Each lecture is of one hour duration.
2. Each theory paper has two lectures per week and each practical course has four lectures per week.
3. Each theory course prescribed for B. Sc. should be covered in number of lectures equivalent to the credit (2 hours for 2 Credit course, total 30 hours and 4 hours for 4 credit course, 60 hours), each per week per course including lectures, tutorials, seminars, class room discussions etc.
4. Each practical course will require 04 hours of laboratory work per week for each semesters (Total 60 hours/practical course of 2 credit)
5. In the 30 lectures of theory course about 05 lectures will include tutorials, student seminars, classroom discussions and tests.
6. There should not be more than 15 students in a batch for F.Y. B. Sc. Practical course.
7. For theory course, the question paper (Internal/External) should include numerical, short answer, long answer, MCQ questions, and problem solving approach to test understanding of the subject.
8. The marks for each paper are distributed as external examination 30 marks (1.5 Hrs) and internal examination 20 marks. For internal assessment of each theory and practical course, 2 written tests will be taken.
9. The external evaluation of practical course should be done by Internal and External examiner jointly at the end of each semester
10. The minimum marks required for passing the theory and practical course are 12 in External examination (out of 30) and 08 in internal examination (out of 20).
11. The 75% attendance of students is compulsory.
12. Students should visit at least one chemical industry in the first year of M. Sc. And submit the observations/report to the Department.
13. Exit Option: UG Certificate after one Year of UG Programme with minimum 40 Credits.
14. A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination, certified by the Head of the Department/Institute that the candidate has completed the practical course of DSC/MIN/Vocational skill course of that semester of F.Y.B.Sc. Chemistry as per the minimum requirement.
15. The duration of the practical examination will be Three hours.

Semester I

CH-111 Basic Physical and Inorganic Chemistry-I

| | |
|---|--|
| Course Code: CH-111 | Course Category: Core Course DSC-01 |
| Course Title: Basic Physical and Inorganic Chemistry-I | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none">• To study the properties of liquid state• To study the kinetic theory of gases and its significance• To study compressibility factor and its applications in liquification of gases• To study second law of thermodynamics, significance of entropy and third law of thermodynamics• To correlate the periodic properties of elements with the chemical behavior | |

Chapter 1: Liquid State

(L:06, M:06)

- Introduction, Intermolecular forces in liquid state and their types.
- Surface tension of liquid, units of surface tension, factors affecting surface tension, Unit of Surface tension, determination of surface tension of liquids by single capillary rise method and Drop formation method.
- Viscosity of liquid, units of viscosity, measurement of viscosity of liquid by Ostwald's method, related numerical.

Chapter 2: The Gaseous State

(L:08, M:08)

- Molar gas constant R, its values in different units and its significance, the kinetic theory of ideal gases. Assumptions of kinetic theory of gases. Kinetic gas equation and its Significance (Derivation not expected), Deductions of Avogadro's principle, Graham's law, kinetic energy of translation.
- Deviation of real gases from ideal behaviour. Reasons for deviation, compressibility factor, Van der Waal's equation, its applications. Andrew's isotherms of CO₂, related numerical.

Chapter 3: Second and Third Law of Thermodynamics**(L:08, M:08)**

- a) Introduction, Limitations of first law of thermodynamics, spontaneous and non-spontaneous process with examples, Statements of second law of thermodynamics,
- b) Entropy, Units of entropy, Physical Significance of entropy, entropy changes in isolated systems, entropy changes for systems only, entropy of mixing of gases, entropy changes in ideal gases and physical transformation.
- c) Statement of third law of thermodynamics, list its applications, Numerical.

Chapter: 4 Periodic properties**(L:08, M:08)**

Periodicity in the following properties right through the periodic table:

- a) **Atomic and ionic size:** Definition and explanation of atomic radius, ionic radius, covalent radius and Van der Waals radius, Variation of atomic size along a period and a group.
- b) **Ionisation energy:** Definition and explanation, factors affecting ionisation energy, Variation of ionisation energy along a period and a group. Applications of I. E. to chemical behavior of an element.
- c) **Electron affinity:** Definition and explanation, factors affecting electron affinity, Variation of electron affinity along a period and a group.
- d) **Electronegativity:** Definition and explanation, factors affecting electronegativity, Variation of electronegativity along a period and a group, Pauling's electronegativity scale, Mullikan's approach of electro negativity, electro negativity and percent ionic character.
- e) **Metallic character:** Variation of metallic character along a period and a group.

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|--|-----------------|
| 1 | Students will be able to understand spontaneity and non-spontaneity and Calculations and significance of entropy. | 3 |
| 2 | To understand periodic properties and their general trends in groups and periods.(Atomic size, Ionization energy, Electron affinity, Electro negativity, Metallic properties). | 3 |

| | | |
|---|--|---|
| 3 | Understand the Compressibility, liquification and related critical constants of a system | 4 |
| 4 | Students will be able to determine surface tension and viscosity of liquids and understand the relation between them | 5 |

References :

1. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, M.S. Pathaniya
2. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand & Co Ltd.)
3. Mathematical Preparation for Physical Chemistry, Farrington Daniels, Mc Graw-Hill Publication.
4. Physical Chemistry, Barrow, G.M. Tata McGraw-Hill (2007)
5. Physical Chemistry, Atkins', 10th edition (2014), Oxford University Press
6. Physical Chemistry, Thomas Engel, Philip Reid, Pearson Education (2006)
7. Advanced Physical Chemistry. J N. Gurtu, A. Gurtu, , Pragati Edition
8. Principles of Physical Chemistry 4th edition Samuel Maron, Carl F. Prutton, Oxford & IBH Publishing.
9. Principles of Physical Chemistry, S. H. Maron and C. F. Prutton (4th edition).
10. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand and Co Ltd.) (25th edition).
11. Elements of Physical Chemistry, S. Glasstone and D. Lewis (The Macmillan Press Ltd. (2nd edition).
12. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand and Co Ltd.)
13. Principles of Inorganic Chemistry – Puri, Sharma, Kalia.
14. Advanced Inorganic Chemistry (Vol I) (Satyaprakash, G. D. Tuli, S. K. Basu, R. D. Madan) (S. Chand and Co Ltd.) Page Nos. 364-376.
15. Inorganic Qualitative Analysis—A I Vogel
16. Practical Chemistry (for B.Sc. I, II and III year students) – O P Pandey, D. N. Bajpai and S. Giri (S Chand and company Ltd)
17. Theoretical Principles of Inorganic Chemistry – G S Manku.
18. Analytical Chemistry – G. D. Christian (6th Edition).
19. A new guide to Modern Valency Theory –G. I. Brown.

Semester- I

CH-112 Basic Organic and Inorganic Chemistry-I

| | |
|--|--|
| Course Code: CH-112 | Course Category: Core Course DSC-02 |
| Course Title: Basic Organic and Inorganic Chemistry-I | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none">• To study fundamentals of organic chemistry• To learn the different types of bonds and structures of organic compounds• To study the fundamentals of organic reaction mechanism, structural isomerism.• To study the chemistry of hydrocarbons• To understand different type of bonds, overlaps, theories of chemical bonding• To study the concept of hybridization, steps involved in hybridization, characteristics and types of hybridization.• To study Valence Shell Electron Pair Repulsion (VSEPR) Theory and its applications to explain geometry of irregular molecules | |

Chapter 1: Basic Principles of Organic Chemistry

(L:08, M:08)

- Introduction, general properties of organic compounds, applications of organic compounds in everyday life.
- Covalent bond, Sigma bond and Pi bond double and triple bond, structural formulae of organic compounds
- Structure of benzene, stability of benzene (heat of hydrogenation), Huckel's rule of aromaticity, derivatives of benzene and their nomenclature (mono & di substituted benzene only)
- Structural effects: Inductive effect, resonance, hyper conjugation, steric effect, electrometric effect and their effect on the strength of acids and bases.
- Fundamentals of organic reaction mechanism: Fission of covalent bond: homolytic and heterolytic fission, reactive intermediates: Carbocations, Carbanions and Carbon free radicals, Carbenes, Nitrenes, Arynes, types of reagents: electrophiles and nucleophiles, types of organic reactions: addition,

elimination, substitution and rearrangement reactions.

f) Isomerism, types of isomerism, structural isomerism

Ref. 1,2,3,4,5 (relevant pages)

Chapter 2: Hydrocarbons

(L:08, M:08)

- a) Alkanes: Introduction to alkanes and cycloalkanes, sp^3 hybridization in ethane molecule, nomenclature (common and IUPAC system), isomerism in alkanes
- b) Preparation of alkanes: by Wurtz reaction, by hydrogenation of alkenes. Reactions of alkanes: halogenation, nitration, combustion.
- c) Alkenes: Introduction, sp^2 hybridization in ethylene molecule, nomenclature (common and IUPAC system), geometrical isomerism in alkenes
- d) Preparation of alkenes: by dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides and partial reduction of alkynes by Lindlar catalyst. Reactions of alkenes: Addition of halogen, hydrogen halide, Sulphuric acid and hydration.
- e) Alkynes: Introduction, sp hybridization in acetylene molecule, nomenclature (common and IUPAC system), acidity of acetylene and terminal alkynes.
- f) Preparation of alkynes: by Double Dehydrohalogenation of vicinal and germinal dihalides, by alkylation of acetylene.
- g) Reactions: Addition of halogens, hydrogen halides, hydration, hydrogenation, Ozonolysis.

Ref. 1,2,3,4 (relevant pages)

Chapter: 3 Chemical Bonding and Structure

(L:06, M:06)

- a) Attainment of stable configuration, Types of bonds-
 1. Ionic bond- NaCl, $CaCl_2$
 2. Covalent bond (Lewis concept)- H_2 , Cl_2 , HF, NH_3 , H_2O , O_2 and N_2 molecules.
 3. Coordinate bond (Dative bond) - NH_4^+ , H_3O^+
 4. Metallic bond.
- b) Types of overlaps: s-s, s-p and p-p overlaps with examples of H_2 , HF, F_2 , O_2 , and N_2 molecules.
- c) Theories of bonding: Valence Bond Theory, Heitler-London theory and Pauling-Slater theory.

Ref: 8, 9, 10 (Relevant pages)

Chapter:4 Hybridization and Shapes of Covalent Molecules

(L: 08, M:08)

- Hybridization: Definition, need for the concept of hybridization, steps involved in hybridization, characteristics of hybridization. Types of hybridizations involving s, p and d orbitals: sp^3d , sp^3d^2 , sp^3d^3 and dsp^2 hybridizations.
- Applications of hybridization concept: geometries of molecules like PCl_5 , SF_6 , IF_7 and $[Ni(CN)_4]^{2-}$ ions.
- Valence Shell Electron Pair Repulsion (VSEPR) Theory: assumptions, need of theory, Applications of the theory to explain geometry of irregular molecules like $SnCl_2$, NH_3 , H_2O , ClF_3 , SF_4 , BrF_5 , ICl_2^- , ICl_4^- . Limitations of VSEPR theory.

Ref: 8, 9, 10 (relevant pages)

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|--|-----------------|
| 1 | Students will be able to understand fundamentals of organic reaction mechanism, structural isomerism, methods of purification of organic compounds. | 5 |
| 2 | To understand different methods of preparation and chemical properties of alkanes, alkenes and alkynes | 4 |
| 3 | Understand the applications of hybridization, concept to understand geometries of different molecules | 4 |
| 4 | Students will be able to understand Valence Shell Electron Pair Repulsion (VSEPR) Theory and its applications to explain geometry of irregular molecules | 3 |

Reference Books

- Organic chemistry - Francis A Carey (6th Edition)
- Organic chemistry - Morrison and Boyd (6th Edition)
- Organic chemistry - Stanley H pine (5th Edition)
- A Text book of Organic chemistry- Arun Bahl and B S Bahl, S Chand publication.
- Guide book to mechanism in organic chemistry -Peter Sykes (6th Edition)
- Undergraduate organic chemistry volume I – Jagdamba Singh and LDS Yadav

- 7) Organic Chemistry (Volume 1) – I L Finar
- 8) Concise inorganic chemistry – J. D. Lee (5th edition).
- 9) Principles of Inorganic Chemistry – Puri, Sharma, Kalia.
- 10) Advanced Inorganic Chemistry (Vol I) (Satyaprakash, G. D. Tuli, S. K. Basu, R. D. Madan) (S. Chand and Co Ltd.) Page Nos. 364-376.
- 11) Inorganic Qualitative Analysis—A I Vogel
- 12) Practical Chemistry (for B.Sc. I, II and III year students) – O P Pandey, D. N. Bajpai and S. Giri (S Chand and company Ltd)
- 13) Theoretical Principles of Inorganic Chemistry – G S Manku.
- 14) Analytical Chemistry – G. D. Christian (6th Edition).
- 15) A new guide to Modern Valency Theory –G. I. Brown.

| Semester-I | |
|--|--|
| CH-113 Chemistry Practical-I | |
| Course Code: CH-113 | Course Category: Core Course DSC-03 |
| Course Title: Chemistry Practical-I | Type: Practical |
| Total Contact Hours: 60 Hrs. (4 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none"> • To understand basic principles involved in quantitative and qualitative analysis. • To understand the preparation and standardization procedures. • To analyze the cation and anions in various inorganic compounds. • To know about primary standard and secondary standard. • To study calculations related to concentration of solutions. | |

A) Laboratory equipments and Safety

B) Physical Chemistry Experiments (Any 3)

1. Calibration of volumetric apparatus Pipette / Volumetric flask.
2. Determination of relative viscosity of liquid A and B by viscometer.
3. Determination of percentage composition (v/v) of given mixture of ethyl alcohol and water by viscometer.
4. To determine the equivalent weight of Mg metal by Eudiometer method.
5. Determination of integral enthalpy of solution of salts (KNO₃, NH₄Cl)
6. Determination of surface tension of given liquid by drop number method using stalagmeter.
7. Determination of surface tension of given liquid by drop weight method using stalagmeter.

C) Analytical Chemistry Experiments (Any 2)

1. Determination of loss per gram and percentage purity of Zinc Carbonate gravimetrically.
2. Preparation of std. 0.1N K₂Cr₂O₇ solution and standardization of ferrous ammonium sulphate solution.
3. Preparation of std. 0.1N oxalic acid solution and standardization of NaOH solution.
4. Preparation of std. 0.1N ZnSO₄ solution and standardization of EDTA solution.

(Instruction: Prepare standard solutions preferably by using 50 ml volumetric flask)

D) Inorganic Qualitative Analysis (Any 5 compounds)

Analysis of inorganic compound containing one cation and anion

Course Outcomes (CO):

After successful completion of the course students are expected to

| N o. | CO | Cognitive Level |
|-----------------|--|----------------------------|
| 1 | Students will be able to understand determine of relative viscosity of liquid by viscometer. | 5 |
| 2 | To determine pH, dissociation constant, solubility of Sparingly soluble salt | 4 |
| 3 | Understand the preparation and standardization procedures. | 3 |
| 4 | Students will be able to a analyze cation and anion of unknown inorganic compound | 4 |
| 5 | Understand the calibration of volumetric apparatus pipette / volumetric flask. | 4 |

Internal Examination Pattern

Chemistry Practical Semester I/ II (CH-113 /CH-123)

| Time: 3 Hrs. | Marks 20 |
|---|-----------------|
| Q. 1. Physical Chemistry/ Analytical Chemistry experiment | 15 Marks |
| OR | |
| Inorganic/ Organic Qualitative analysis | |
| Q. 2. Oral | 02 Marks |
| Q. 3. Attendance and Behavior | 03 Marks |
| <hr/> | |
| Total: 20 Marks | |

External Examination Pattern

Chemistry Practical Semester I/ II (CH-113 /CH-123)

| Time: 3 Hrs. | Marks : 30 |
|--|-------------------|
| Q. 1. Physical Chemistry / Analytical Chemistry experiment | 20 Marks |
| OR | |
| Inorganic/ Organic Qualitative analysis | |
| Q. 2. Oral | 05 Marks |
| Q. 3. Journal | 05 Marks |
| <hr/> | |
| Total: 30 Marks | |

Note: Distribution of Experiments – One fourth of the total students in a batch will be given physical chemistry experiment, one fourth will be given an analytical chemistry experiment and one half of the students will be given an Inorganic / Organic qualitative analysis.

Semester I

CH-114 Fundamentals of Chemistry-I

| | |
|--|--|
| Course Code: CH-114 | Course Category: Minor Course MIN-1 |
| Course Title: Fundamentals of Chemistry-I | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (CA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none"> • To study the basic concepts of chemistry • To understand modern periodic table • To understand the basic concepts of Inorganic & Organic chemistry • To understand the structure and distinctiveness of carbon atom and hydrocarbon chemistry. • To draw the shapes of orbital's and shapes of hybridizations • To understand the concept and types of hybridizations | |

| Unit | Content | |
|-----------|--|-----------------|
| 1. | Basic Concept of Chemistry 1.1 Meaning of Chemistry, Definition of Matter, State of Matter, Solid, Liquid and Gaseous state of matter, Physical Properties of Matter, Crystalline and Amorphous solid. 1.2 Pure Substance and its Classification: Elements, Compounds 1.3 Mixture Definition and Classification of Mixtures: Homogeneous, Heterogeneous 1.4 Physical quantities and name of S.I. units with symbols. Atomic mass and atomic mass unit (amu) | L-6 M-8 |
| 2. | Basics of Inorganic Chemistry & Periodic Properties 2.1 Definition of Inorganic Chemistry, Concept of Acids and Bases (Arrhenius theory, Lowry-Bronsted, Lewis Concepts) 2.2 Classification of Inorganic compounds, oxides, carbonates, sulphates and Halides with example. 2.3 Introduction of periodic table, Mendeleev's Modern Periodic Law, Modern | L-8 M-14 |

| | | |
|-----------|---|-------------|
| | Periodic law, Long Form of Periodic Table, Feature of Modern Periodic Table, Four Blocks of Modern periodic table, Periodic properties and its trends. | |
| 3. | Basic Concepts of Organic Chemistry 3.1 Introduction of Organic Chemistry, Definition of Organic Chemistry, Importance of Organic Chemistry in everyday life, Elements of Organic Compounds. 3.2 Chemistry of the Carbon Atom: Atomic Structure of Carbon, The Uniqueness of Carbon, Geometry, Allotropes. Types of orbital, shape of S, P and D orbitals, Covalence Number. | L-8 M-14 |
| 4 | Hydrocarbons 4.1 Definition of hydrocarbons, Types of hydrocarbons: Saturated and Unsaturated Hydrocarbons, Alicyclic and Aromatic Hydrocarbons 4.2 Alkanes, Alkenes and Alkynes and their Nomenclature 4.3 Hybridization: sp^3 Hybridization (Alkanes i.e. Saturated), sp^2 and sp Hybridization (Alkene & Alkynes i.e. Unsaturated). 4.4 Formation of Methane, Ethene and Acetylene Molecules on the basis of hybridization. | L-8 M-14 |

- **Course Outcomes (CO):**

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|--|-----------------|
| 1 | To know the basic concepts of chemistry | 5 |
| 2 | To understand modern periodic table and periodic properties | 4 |
| 3 | To know the structure and distinctiveness of carbon atom | 4 |
| 4 | To draw the shapes of orbitals and shapes of hybridizations and understand the concept and types of hydrocarbons | 3 |
| 5 | To understand the nature, functional groups of organic compounds | 3 |

References:

- 1) Fundamentals Handbook Chemistry Volume 1 of 2, National Technical Information Services, U.S. Department of Commerce, 5285 Port Royal., Springfield, VA 22161
- 2) <https://ncert.nic.in/textbook.php?lech1=an-9>
- 3) ABC of Chemistry, CBSE Board, Jauhar Publication
- 4) Fundamentals of Organic Chemistry, Seventh Edition John McMurry, Printed in the United States of America
- 5) Principles Of Inorganic Chemistry, Brian W. Pfennig, John Wiley & Sons, Inc., Hoboken, New Jersey
- 6) Introductory Organic Chemistry and Hydrocarbons - A Physical Chemistry Approach, By CaioFirme, First edition, Publisher: CRC Press/Taylor&Francis Group, ISBN: 9780815383574
- 7) Hydrocarbon Chemistry, George A. Olah and Arpad Molnar, Second Edition, Published by John Wiley & Sons, Inc., Hoboken, New Jersey

| Semester-I | |
|---|--|
| CH-115 Chemistry Practical-I | |
| Course Code: CH-115 | Course Category: Minor Course MIN-2 |
| Course Title: Chemistry Practical | Type: Practical |
| Total Contact Hours: 60 Hrs. (4 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none"> • To understand the importance of calibration of apparatus, • To determine p^H of soil and water and buffer solution, • To know various purification methods of organic compounds, criteria of purity, types of organic compounds, • To develops the qualitative techniques. | |

Section A - Physical chemistry experiments (Any 3)

1. Calibration of volumetric apparatus pipette / volumetric flask.
2. Determination of pH of soil and water (two samples) by pH meter.
3. Preparation of buffer solution and measurement of pH of buffer solution and comparison of pH values of buffer solution with theoretical values.
4. Measurement of pH of different solution like aerated drinks, fruit juice, shampoos and Soap and detergent using pH meter.

Section B - Organic chemistry experiments (Any 3)

1. Purification of organic compounds by crystallization and sublimation.
2. Purification of organic liquid by distillation.
3. Criteria of purity determination of melting and boiling points.(Any two organic compounds)
4. Determination of types of organic compounds. (Acids, Base, Phenol and Neutral)

Section C - Inorganic chemistry experiments (Any 4 compounds)

1. Inorganic qualitative analysis: Analysis of inorganic compound containing one cations and one anions (excluding phosphate and borate).

- **Course Outcomes (CO):**

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | To understand calibration of volumetric apparatus/glassware. | 5 |
| 2 | To study the p ^H values of various solutions. | 5 |
| 3 | To understand the various purification methods. | 4 |
| 4 | To understand the nature, functional groups of organic compounds and to identify the mono functional groups | 4 |
| 5 | To analysis of in-organic compounds | 3 |

Semester-I

CH-116 Food Chemistry, Food Safety and Adulteration

| | |
|---|---|
| Course Code: CH-116 | Course Category: Open Elective Course OE-1 (To be chosen compulsory from faculty other than that of major) |
| Course Title: Food Chemistry, Food Safety and Adulteration | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none">• To understand and analyse the nutrients and role played by the nutrients in the development of a health.• To study different types of detection (quick tests) of household food adulterants discuss the effect of food additives on human body• To understand the importance of Balance Diet and Nutrition• To study the importance of food preservation and conserving nutrient in food.• To know the use of basic food groups in meal planning to get nutritionally adequate diet and good eating habits. | |

Chapter 1: Basic Concept of Food Chemistry

(L: 08, M: 08)

- Introduction: Definition of food, Classification.
- Functions of Food: Social Function, Physiological Function.
- Nutrients: Definition and Classification.
- Carbohydrates: Function of Carbohydrates, Food Sources of Carbohydrates.
- Protein: Food Sources of Proteins, Function of Protein
- Fats and Oils: Food Sources and Functions of Fats and Oils.
- Micronutrients: Vitamins- types and functions, Minerals-types and functions.

(Ref: 1, 2, & 6 (Relevant Pages))

Chapter 2: Food Adulteration

(L: 08, M: 08)

- Introduction: Definition and Types.
- Adulteration Through food Additives.
- Adulteration in Milk, Oil, Grains, Sugars, Spices and Condiments, Fruits Vegetables and Honey.
- Detection of Adulteration Using Rapid Test (DART): Testing Methods for Milk, Oil, Grains, Sugars, Spices and Condiments, Fruits Vegetables and Honey.

e) Impact of Adulteration on Human Health.

f) Food Safety and Standard Authority of India (FSSAI): Functions of FSSAI

Ref: 1, 2 (Relevant Pages) and Web Link: www.fssai.gov.in

Chapter 3: Food Preservatives

(L: 08, M: 08)

a) Introduction: Definition and Types.

b) Natural food preservatives

c) Traditional food preservation methods

d) Chemical food Preservatives: Conventional Preservatives, Parabens, Sulphur dioxide, sulphites and Vinegar.

e) Artificial preservative agents.

f) Modern food preservation techniques.

g) Safety concerns of food preservatives.

Ref: 1, 2 (Relevant Pages)

Chapter 4: Balance Diet and Nutrition

(L: 06, M: 06)

a) Introduction: Definition of Balance diet and malnutrition

b) Benefits of a balanced diet

c) Basic food groups, Anti-oxidants, Dietary Fibers.

d) Diseases due to Deficiency or excess of Calcium, Iron and Iodine.

e) Junk Food: Hazardous Chemicals in junk food-. Monosodium Glutamate (MSG), Caramels, Butylated Hydroxy Anisole (BHA), Butylated Hydroxy Toluene (B.H.T.)

f) Effect of Junk food on health.

Ref: 1, 2 & 6 (Relevant Pages)

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | Students will be able to understand analyse the nutrients and role played by the nutrients in the development of a health. | 5 |
| 2 | Different types of detection (quick tests) of household food adulterants discuss the effect of food additives on human body | 4 |

| | | |
|----------|--|----------|
| 3 | Understand the Importance of food preservation and conserving nutrient in food. | 3 |
| 4 | Students will be able to know the use of basic food groups in meal planning to get nutritionally adequate diet and good eating habits. | 5 |

References:

1. Handbook of Food Chemistry; Springer Reference; Peter C.K. Cheung, Bhavbhuti M. Mehta
 2. Fundamentals of Foods and Nutrition, 4th Edition, Sumati R. Mudambi and M.V. RajaGopal, New Age International (P) Limited, Publisher.
 3. Food: Its Preservatives, Additives and Applications, Hamid, A., Abdumumeen, Ahmed, N., Risikat & Agboola, R., Sururah, 2011:
 4. The Chemistry of Food Additives and Preservatives, Titus, A. M., & Msagati., 2012: John Wiley & Sons, New York City.
 5. Pioneer in Food Science and Quality, In a Century of Food Science Chicago: Institute of Food Technologist, F.J., Francis. 2000: pp. 13-14
 6. Nutrition- A Diet Therapy, 9e, Saunders USA, 2003.
 7. Food Safety and Standard Authority of India. Manual on Essential of Food Hygiene.
- Web links: www.fssai.gov.in

| Semester-I | |
|---|--|
| CH-117 Basics of Analytical Chemistry | |
| Course Code: CH-117 | Course Category: Skill Enhancement Course SCE-1 |
| Course Title: Basics of Analytical Chemistry | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none"> • To understand the fundamentals of analytical chemistry and steps of a characteristic analysis. • To know different types of qualitative and quantitative analyses • To know the use of titrimetric analysis methods, selection and role of indicators • Able to express the terms such as standard solution, titration, back titration, equivalence point, end point, primary and secondary standard. • To understand the principle of various chromatographic technique. | |

Chapter1: Introduction to Analytical Chemistry

(L-08, M-08)

- a) Introduction: Analytical chemistry, its interdisciplinary nature, importance of analytical chemistry, types of analysis: qualitative and quantitative analysis
- b) Concept of sampling, definition, procedure of sampling, types of sampling
- c) Accuracy, precision, significant figures, significance of zero, rounding off
- d) Errors: Definition, types and sources of errors, minimization of errors.
- e) Good laboratory practices: Material safety data sheet (MSDS), fire safety, Handling of chemicals

Ref.1,2,3,4,5 (Relevant pages)

Chapter 2: Volumetric Analysis

(L-08, M-08)

- a) Introduction to volumetric analysis, principle, types of titration, apparatus used for volumetric analysis.
- b) Methods of expressing concentration of solutions: Equivalent weight-normality, Moles - molarity, molality and weight percent of solution.
- c) Standard solutions, Primary and secondary standard, preparation of standard solution.

- d) Procedure for volumetric analysis, end point of titration, indicators

Ref.1,2,3,4,5(Relevant pages)

Chapter 3: Acid Base Titrations

(L-08,M-08)

- a. Principle, Acid–base Titration, Henderson-Hasselbalch equation, Indicator, transition range of indicators.
- b. Study of following acid base titrations with respect to: neutralization curve, selection of indicators and calculation of P^H
 - i. Strong acid versus strong base
 - ii. Weak acid versus strong base
- c. Applications of acid base titrations.

Ref.1,2,3,4,5(Relevant pages)

Chapter 4: Precipitation Titrations

(L-06, M-06)

- a) Principle, precipitation titration curve, use of indicators in detection of end point.
- b) Preparation of $AgNO_3$ solution, its standardization by Mohr's method.
- c) Estimation of halides by Fajan's method
- d) Applications of precipitation titrations.

Ref.1,2,3,4,5 (Relevant pages)

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | Students will be able to understand the fundamentals of analytical chemistry and steps of a characteristic analysis. | 5 |
| 2 | Different types of qualitative and quantitative analyses | 4 |
| 3 | Expresses the terms such as standard solution, titration, back titration, equivalence point, end point, primary and secondary standard. | 4 |
| 4 | Students will be able to know the use of titrimetric analysis methods and to chromatographic technique. | 3 |

| | | |
|---|---|---|
| 5 | will be able to assess the quality of your own work in order to be certain your analysis is correct | 3 |
|---|---|---|

Reference Books

- 1) Analytical Chemistry, G. D. Christian(5thEdition) 2006
- 2) Quantitative Chemical Analysis, J Mendham, RC Denny, Barnes, Thomas, 2009
- 3) Analytical Chemistry, D A Skoog, D M West, FJHoller, 1992
- 4) Vogel's Textbook of Quantitative Inorganic Analysis, Bassett, Denney, Jeffrery,1989
- 5) Basic Concepts of Analytical Chemistry, S M Khopkar, 2008

Semester- II

| CH-121 Basic Organic and Inorganic Chemistry-II | |
|--|--|
| Course Code: CH-121 | Course Category: Core Course DSC-4 |
| Course Title: Basic Organic and Inorganic Chemistry-II | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: Student should able to <ul style="list-style-type: none">• Classify Haloalkanes, its nomenclature and different methods of preparation of mono halogen and dihalogen derivatives.• To classify, give nomenclature and methods of preparation of alcohols, ethers and phenols• To understand the methods of preparation and reactions of aliphatic and aromatic aldehydes and ketones.• To understand different type of bonds, overlaps, theories of chemical bonding• To understand the basic principles involved in separation, extraction and refining times of metals. | |

Chapter 1: Haloalkanes and haloarenes

(L:08, M:08)

- a) Haloalkanes: Introduction, classification and nomenclature of haloalkanes (common and IUPAC system)
- b) Mono halogen derivatives: Classification, methods of preparation: from alcohols (using HX, PX₃, PX₅, SOCl₂). Reactions: with aqueous alkali, sodium alkoxide, alc. KCN, silver salt of acid, alc. ammonia, NaSH/ KSH, dehydrohalogenation, formation of Grignard's reagent.
- c) Di halogen derivatives: preparation of vicinal and geminal dihalides, reactions: hydrolysis with aq. NaOH.
- d) Haloarenes: Introduction, nomenclature, reactions of haloarenes: nucleophilic substitution reactions with NaNH₂/ KNH₂, NaOH, NH₃, CuCN, Ullman reaction.

Ref. 1,2,3,4 (relevant pages)

Chapter 2: Alcohols, phenols and ethers**(L:08, M:08)**

- a) Alcohols: Introduction, classification, nomenclature (common and IUPAC system), methods of preparation of monohydric alcohols: from Grignard's reagent (using aldehydes and Ketones), by reduction of aldehydes and ketones, by hydroboration, by oxymercuration-demercuration. Preparation of dihydric alcohols by hydroxylation of alkenes, toxicity of alcohols.
- b) Physical properties of alcohols. Reactions of alcohols: reaction with active metals, dehydration, oxidation and ester formation, toxicity of alcohols.
- c) Phenols: Introduction, nomenclature, acidity of phenols, Preparation of phenol from benzene sulphonic acid, benzene diazonium chloride and from chlorobenzene.
- d) Reactions of phenols: ester formation (acylation), formation of aryl ethers, Kolbe reaction, catalytic hydrogenation.
- e) Ethers: Introduction, classification, nomenclature (common and IUPAC system), methods of preparation: by Williamson's synthesis, by dehydration of alcohols and from diazomethane. Reactions of ethers: reaction with hot and cold HI, hydrolysis with dil. H_2SO_4 . Crown ethers (Introduction only)

Ref. 1,2,3,4 (relevant pages)**Chapter 3: Aldehydes and Ketones****(L:08, M:08)**

- a) Introduction, structure of carbonyl group, nomenclature of aldehydes and ketones (common and IUPAC system)
- b) Aldehydes: Preparation of aldehydes: by reduction of acid chlorides, from Grignard's reagent and HCN, from terminal geminal dihalides and from calcium salt of acids. Preparation of benzaldehyde: by Gattermann Kotch reaction, by oxidation of toluene, by side chain chlorination of toluene.
- c) Ketones: Preparation from Grignard's reagent and R-CN, from nonterminal geminal dihalides, from calcium salt of acids. Preparation of acetophenone: by oxidation of ethyl benzene, by F C acylation.
- d) Reactions of aldehydes & Ketones: Distinguishing test between aldehydes and ketones : reaction with Tollen's reagent, Fehling's solution and Schiff's reagent, Reducing properties of aldehydes : Clemmenson reduction, Wolff Kishner reduction, Aldol condensation, Cannizzaro reaction, addition of HCN, NaHSO_3 ,

addition of derivatives of ammonia (hydroxyl amine, phenyl hydrazine, 2,4 DNP, semicarbazide), hydration, addition of alcohols, benzoin condensation of benzaldehyde.

Ref. 1,2,3,4 (relevant pages)

Chapter: 4 Metals and Metallurgy

(L: 06, M: 06)

Occurrence of metals, various steps involved in metallurgical processes, concentration of Ore, Hand picking, gravity separation, Magnetic separation, froth floatation, calcinations,roasting, reduction to free metals, Flux, Types of fluxes, Slag, electrometallurgy, hydrometallurgy, refining of metals. Ores and its applications

Ref: 9, 13 (Relevant pages)

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|--|-----------------|
| 1 | Classify Haloalkanes, its nomenclature and different methods of preparation of mono halogen and dihalogen derivatives. | 5 |
| 2 | To classify, give nomenclature and methods of preparation of alcohols, ethers and phenols | 4 |
| 3 | To understand the methods of preparation and reactions of aliphatic and aromatic aldehydes and ketones. | 4 |
| 4 | To understand the basic principles involved in separation, extraction and refining techniques of metals. | 3 |

Reference Books

- 1) Organic chemistry - Francis A Carey (6th Edition)
- 2) Organic chemistry - Morrison and Boyd (6th Edition)
- 3) Organic chemistry - Stanley H pine (5th Edition)
- 4) A Text book of Organic chemistry- Arun Bahl and B S Bahl, S Chand publication.
- 5) Guide book to mechanism in organic chemistry -Peter Sykes (6th Edition)
- 6) Undergraduate organic chemistry volume I – Jagdamba Singh and LDS Yadav
- 7) Organic Chemistry (Volume 1) – I L Finar
- 8) Concise inorganic chemistry – J. D. Lee (5th edition).

- 9) Principles of Inorganic Chemistry – Puri, Sharma, Kalia.
- 10) Advanced Inorganic Chemistry (Vol I) (Satyaprakash, G. D. Tuli, S. K. Basu, R. D. Madan) (S. Chand and Co Ltd.) Page Nos. 364-376.
- 11) Inorganic Qualitative Analysis—A I Vogel
- 12) Practical Chemistry (for B.Sc. I, II and III year students) – O P Pandey, D. N. Bajpai and S. Giri (S Chand and company Ltd)
- 13) Theoretical Principles of Inorganic Chemistry – G S Manku.
- 14) Analytical Chemistry – G. D. Christian (6th Edition).
- 15) A new guide to Modern Valency Theory –G. I. Brown.

Semester-II

CH-122 Ancient Indian Chemistry

| | |
|---|--|
| Course Code: CH-122 | Course Category: Major Specific IKS DSC-5 |
| Course Title: Ancient Indian Chemistry | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |

Course Objectives:

India has a very prosperous adaptable knowledge system and cultural heritage. A comprehensive development in Indian knowledge system during the Vedic period, the Saraswatī-Sindhu Civilization, in this basic course, a special attention is given to the rasayanas in the ancient chemical laboratories, and explorations of chemicals in the science of colors, drugs and medicines, metals and metallurgical processes, agriculture, health and hygiene etc.

Given the nature of course and diversity of the learner's fields, the course is designed to provide a broad spectrum of the Indian knowledge system from the perspectives of ancient Indian chemistry.

The main objectives of this course are as follows:

- Creating consciousness amongst the youths about the appropriate history and prosperous culture of the Indian knowledge system,
- Understanding the scientific value of the Indian knowledge system,
- Promoting the youths to do research in the various fields of Indian knowledge system, and
- To motivate the youths to take up a detailed study of some of these topics and explore their application potential.

| Unit | Content | Hrs./ Marks |
|-------------|--|------------------------|
| 1. | Chemistry laboratory in Ancient India. 1.1 Introduction to Ayurveda, Rasaratna Samucchaya, Composition of Rasaratna Samucchaya, 1.2 Various descriptions mentioned in Rasaratna Samucchaya such as Location of Chemistry lab and layout of the Chemistry Laboratory (Rasashala), different types of equipment required to carry out chemistry experiments such as Koshti Apparatus, Koshti Yantra, Tiryak Patana Yantra, Dheki Yantram, 1.3 Qualification required by Staff working in a Chemical laboratory: Qualities of Lab attendant, Qualities of storekeeper/accountant, Qualities of Rasayan Vaidya | L-07 M-07 |

| | | |
|-----------|--|---------------------------------------|
| | (Drug maker), Qualities of alchemist, Quality of Drug Collector, Qualities of Best Sadhaka/Chemistry Students/Researcher. | |
| 2. | <p>Medicinal Chemistry of Ayurvedic Formulations</p> <p>2.1 Introduction of pioneer of Ayurveda.</p> <p>2.2 Study of some important Ayurvedic herbal plant since used from Ancient time such as a) Amla, b) Neem, c) Ashwagandha, d) Turmeric, e) Ginger, f) Garlic, g) Basil, h) Clove, i) Cumin, j) Aloe-vera, k) Peppermint, l) Triphala, j) Shankhpushpi, k) Arjuna, l) Shatavari</p> | <p>L-07</p> <p>M-07</p> |
| 3. | <p>Indian Perspectives in Colour Chemistry</p> <p>3.1 Introduction, colour, dyes and pigments – historical perspectives, origins of colour</p> <p>3.2 The Art of Painting in Ancient India – Chitrasutra, Wall painting of AJANTA and ELLORA caves and Sithannvasal, printing and embroidering of clothes</p> <p>3.3 India’s contribution in colour chemistry – Asikni (Indigo), Manjistha (Madder) and Haridra (Turmeric) etc.</p> <p>3.4 Indian scientist contribution in colour chemistry: Krishnasamy Venkataraman – The Father of dyestuff research in India</p> <p>3.5 Baker Venkataraman rearrangement for flavonoid synthesis</p> <p>3.6 Significance of colour such as turmeric, henna, natural dyes in Indian tradition</p> | <p>L-08</p> <p>M-08</p> |
| 4. | <p>Ancient Indian Metallurgy</p> <p>4.1 Introduction, Metallurgy, Metallurgical Operation</p> <p>4.2 Indian Metallurgical History, Archaeological Sources of Metallurgy, Indian metallurgist and alchemist – Nagarjuna</p> <p>4.3 Harappan Civilization or Bronze Age civilization, Metal Technologies of Indus Valley</p> <p>4.4 Iron Smelting in Ancient India, Indian Wootz steel and sponge iron blocks</p> <p>4.5 List of metals in ancient India and their uses – Gold, Silver, Zinc, Iron, Mercury, Lead, Copper, Alloys – Pewter, Steel and Bronze</p> <p>4.6 Coinage of Ancient India – Vedic Period and Janapadas, Punch-marked Coins.</p> | <p>L-08</p> <p>M-08</p> |

Course Outcomes (CO):

After successful completion of the course students are expected to

| Sr. No. | Course Outcomes | Cognitive Level |
|----------------|---|------------------------|
| 1 | Familiar with the Ayurveda and Ancient Indian Chemistry in detail. | 3 |
| 2 | Learn how to explore natural resources as medicine for absolutely negligible side effects. | 4 |
| 3 | Understand how to advance a science of colors and coloring agents with the help of natural coloring agents. | 5 |
| 4 | Explore Ancient Indian Knowledge for the handling and purification of metals. | 5 |

Semester II

CH-123 Chemistry Practical-II

| | |
|---|---------------------------------------|
| Course Code: CH-123 | Course Category: Core Course DSC-6 |
| Course Title: Chemistry Practical-II | Type: Practical |
| Total Contact Hours: 60 Hrs. (4 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none">To understand basic principles involved in determination of surface tension.To understand the preparation and standardization procedures.To analyze the nature, functional groups and physical constant of organic compoundsTo understand the role of primary standard and secondary standard.To understand basic principles involved in qualitative and quantitative analysis. | |

A) Physical Chemistry Experiments (Any 3)

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH-meter. (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode)
2. Determination of heat of solution of KNO_3 / NH_4Cl by water equivalent method.
3. Determination of normality and strength in g/L of acid (HCl or CH_3COOH) conductometrically.
4. To standardize commercial sample of HCl using Borax and to write material safety data of the chemicals involved.
5. Determination of dissociation constant of weak monobasic acid (CH_3COOH) by conductance measurement.
6. Determination of conductance of soil and irrigation water.

B) Analytical Chemistry Experiments (Any 2)

1. Determination of total hardness of water.
2. Preparation of standard 0.1N Na_2CO_3 solution and standardization of HCl solution.
3. Preparation of 0.1 N oxalic acid solution and standardization of KMnO_4 solution.
4. Preparation of 0.1 N $\text{Na}_2\text{S}_2\text{O}_3$ solution and estimation of Cu (II) ions iodometrically.

(Instruction: Prepare standard solutions preferably by using 50 ml volumetric flask)

C) Organic Qualitative Analysis (Any 5 compounds)

- 1) Type determination
- 2) Preliminary test
- 3) Physical constant
- 4) Functional group test

(Structural formula not expected)

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | To determine heat of solution of salt, surface tension of liquids by various methods. | 5 |
| 2 | Students will be able to understand the fundamentals of analytical chemistry and steps of a characteristic analysis. | 4 |
| 3 | Different types of qualitative and quantitative analyses | 4 |
| 4 | Expresses the terms such as standard solution, titration, back titration, equivalence point, end point, primary and secondary standard. | 3 |
| 5 | Determine the nature, functional groups and physical constant of organic compounds | 3 |
| 6 | Determine the pH, conductance of fruit juices, and irrigation water | 3 |

Internal Examination Pattern
Chemistry Practical Semester I/ II (CH-113 /CH-123)

| Time: 3 Hrs. | Marks 20 |
|---|-----------------|
| Q. 1. Physical Chemistry/ Analytical Chemistry experiment | 15 Marks |
| OR | |
| Inorganic/ Organic Qualitative analysis | |
| Q. 2. Oral | 02 Marks |
| Q. 3. Attendance and Behavior | 03 Marks |
| Total: 20 Marks | |

External Examination Pattern
Chemistry Practical Semester I/ II (CH-113 /CH-123)

| Time: 3 Hrs. | Marks : 30 |
|--|-------------------|
| Q. 1. Physical Chemistry / Analytical Chemistry experiment | 20 Marks |
| OR | |
| Inorganic/ Organic Qualitative analysis | |
| Q. 2. Oral | 05 Marks |
| Q. 3. Journal | 05 Marks |
| Total: 30 Marks | |

Note: Distribution of Experiments – One fourth of the total students in a batch will be given physical chemistry experiment, one fourth will be given an analytical chemistry experiment and one half of the students will be given an Inorganic / Organic qualitative analysis.

Semester II

CH-124 Fundamentals of Chemistry-II

| | |
|--|--|
| Course Code: CH-124 | Course Category: Minor Course MIN-3 |
| Course Title: Fundamentals of Chemistry-II | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: <ul style="list-style-type: none"> • To study the basic concepts of atomic structure • To understand the concept of atom and subatomic particles. • To understand the categorization of inorganic compounds as well as the production of ionic compounds. • Recognize the definition of metal as well as the significance of alloys. • To comprehend the significance of metals and metal alloys. • Capable of acquiring knowledge of the nomenclature of alkanes, alkenes, and alkynes • Proficient of illustrating the chemical structures of alcohol, aldehydes, and ketones | |

| Unit | Content | |
|-----------|--|--------------------------------|
| 1. | Atomic Structure 1.1 Definition of Atom, Sub-atomic particles of an atom, atomic number, and mass number, Isotopes and isobars 1.2 Postulates and drawbacks of Thomson, Rutherford and Bohr's atomic model. 1.3 Determination the Subatomic Structure of Atoms and Ions, Atomic and Ionic Radius | L-06 M-08 |
| 2. | Chemistry of Inorganic Compound 2.1 Definition of Ionic Bond and Metallic Bond, Formation of ions such as Na ⁺ , Mg ⁺⁺ , Al ⁺⁺⁺ , Cl ⁻ , O ²⁻ , Formation of Ionic Compounds like NaCl and MgCl ₂ with atomic diagram. | L-08 M-06 |
| 3. | Metal and Alloys 3.1 Definition of metal, Occurrence of metal: Native and Combined state, Properties of metals 3.2 Definition of Alloy, Properties, Composition and Uses of Brass, Bronze, Steel, Bell Metal and Solder alloy. | L-08 M-08 |

| | | |
|--|---|---------------------------------------|
| 4 | <p>Nomenclature of Hydrocarbons and Functional Groups</p> <p>4.1 Word root and trivial system of carbon C₁ to C₁₀, Nomenclature of Alkanes, Alkenes and Alkynes of maximum five carbon atoms in the open chain. Closed chain like four, five and six membered rings of alkane and alkenes.</p> <p>4.2 Definition of Functional Group, Types of Functional Groups with Examples.</p> <p>4.3 Nomenclature of Hydrocarbons with substituents including methyl, ethyl, chloro, bromo and functional groups alcohol, aldehyde, ketone only.</p> | <p>L-08</p> <p>M-08</p> |
| <p>References:</p> <ol style="list-style-type: none"> 1) Barrett, J., & Malati, M. (1997), Fundamentals of Inorganic Chemistry. Elsevier Science 2) https://ncert.nic.in/textbook.php?lech1=an-9 3) Smithells Metals Reference Book, Seventh Edition, Butterworth-Heinemann Linacre House, Jordan Hill, Oxford OX2 8DP 225 Wildwood Avenue, Woburn, MA 01801-2041 A division of Reed Educational and Professional Publishing Ltd 4) https://ncert.nic.in/textbook/pdf/kech104.pdf 5) A Reference Book of Engineering Chemistry, DhanpatRai Publication New Delhi. 6) https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch105-consumer-chemistry/ch105-chapter-8/ 7) https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch105-consumer-chemistry/chapter-3-ionic-covalent-bonding/ 8) Abozenadah, H., Bishop, A., Bittner, S., Lopez, O., Wiley, C., and Flatt, P.M. (2017) Consumer Chemistry: How Organic Chemistry Impacts Our Lives. CC BY-NC-SA. | | |

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | Understand the basic concepts of atomic structure, the concept of atom and subatomic particles. | 5 |
| 2 | Classify the inorganic compounds as Acids, Bases, Salts, Oxides and their examples | 4 |
| 3 | To understand the significance of metals and metal alloys. | 4 |
| 4 | Be Proficient in illustrating the chemical structures of alcohol, aldehydes, and ketones | 4 |

| Semester-II | |
|--|--|
| CH-125 Chemistry Practical-II | |
| Course Code: CH-125 | Course Category: Minor Course MIN-4 |
| Course Title: Chemistry Practical | Type: Practical |
| Total Contact Hours: 60 Hrs. (4 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: | |
| <ul style="list-style-type: none"> • To understanding laboratory safety, handling of chemicals and preparation of solutions • To know the conductance measurement usefulness in analysis. • To understand the preparation and standardization of solution • To understand organic qualitative analysis, • To determine hardness of water, preparation of complex & properties of complex. | |

Section A - Physical Chemistry Experiments. (Any 3)

1. Chemical handling-

1.1 Laboratory safety.

1.2 Handling of acids and bases.

1.3 Preparation of solutions based on different units of concentration.

2. Determination of end point of acid base titration

3. Determination of dissociation constant of weak acid (CH_3COOH) by conductance measurement

4. Measurement the conductance of given soil and water samples.

5. Compare the conductance of M/100 and M/1000 solution of NaCl and MgCl_2

Section B - Organic Chemistry Experiments (4 compounds)

1. Organic qualitative analysis (any four compounds)

i) Type determination. ii) Physical constant.

iii) Preliminary test. iv) Functional group

Section C - Inorganic Chemistry Experiments (Any 3)

1. Estimation of hardness of water sample by Complexometric titration.

2. Preparation of any two Complex and Measurement its conductance.

a) Tetraamminecarbonatecobalt (III) nitrate.

b) Tetramminecopper (II) second sulphate.

c) Potassiumoxalatoferate (III) thirhydrate.

4. Preparation of standard $0.1\text{N Na}_2\text{CO}_3$ solution and standardization of HCl solution.

- **Course Outcomes (CO):**

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | To understands end point and equivalence point of titrations. | 5 |
| 2 | To understand Chemical handling in laboratory & Industries. | 5 |
| 3 | To understand conductivity of various concentrations solutions of same electrolyte. | 4 |
| 4 | To understand the nature, functional groups of organic compounds and to identify the mono functional groups | 4 |
| 5 | To understand the primary and secondary valence of complex by conductance measurement. | 3 |

Semester-II

CH-126 Chemistry in Every Day Life

| | |
|--|--|
| Course Code: CH-126 | Course Category: Open Elective OE-2 (To be chosen compulsory from faculty other than that of major) |
| Course Title: Chemistry in Every Day Life | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |

Chemistry plays an indispensable role in everyday life, permeating numerous aspects of our existence and shaping the modern world. Chemistry is a fundamental aspect of the production and development of various everyday products that play a crucial role in our lives. From the food we eat to the medicines we take; chemistry provides us with a deeper understanding and control over our surroundings. As professionals, we appreciate how chemical reactions govern the production of materials ranging from plastics to textiles. From food preservation to fertilizer formulation, first aid treatment, household cleaning agents, and beauty and health hygiene products, chemistry lies at the heart of these essential items. Through careful chemical formulations and processes, scientists can create safe and effective additives for food, enabling longer shelf life while maintaining nutritional value and taste. Fertilizers are manufactured by combining different elements to provide plants with the necessary nutrients they need for optimal growth. First aid treatments such as antiseptics and bandages are developed by utilizing chemical compounds that promote healing, prevent infections, and protect wounds from external factors. Household cleaners employ various chemicals to disinfect surfaces, remove stains, and eliminate pesky germs. Additionally, chemistry-based beauty and health hygiene products like shampoos, soaps, lotions use specific chemical compositions to cleanse effectively while being gentle on skin or hair. These examples highlight how chemistry serves as a crucial pillar in providing us with essential products that contribute to our overall well-being. In everyday life, our knowledge of chemistry allows us to make informed decisions about what products are safe for consumption and what common household substances can be combined without harmful consequences.

The presence of elements in the human body is an awe-inspiring testament to the intricacy and wonder of life itself. The topic of the presence of elements in the human body in this course is an essential aspect that is often overlooked or taken. By appreciating the impact of chemistry on a professional level, we can actively contribute to solving global challenges while simultaneously improving the quality of our daily lives. The course is intended to offer a wide range of use or application of chemistry in daily life from the viewpoints of chemistry, given the nature of the subject

matter and the variety of the learner's disciplines.

Course objectives:

The primary objectives of this course are as follows;

- To help students, visualize the importance of chemistry in daily life.
- To know about artificial food preservatives.
- To know about kind of fertilizers and its uses.
- Make students more aware of the chemicals found in all aspect of daily life.

| Unit | Content | Hrs/Marks |
|------|---|-----------|
| 1. | <p>Domestic and Agricultural Products</p> <p>1.1 Chemistry in our daily activities, 1.1.1 Basic Household Chemicals used in daily life: Caustic soda, Vinegar, NaCl, Calcium carbonate, Baking soda etc.</p> <p>1.2 Domestic Products: 1.2.1 Milk, Types of Milk: Liquid and Milk Powder, Pasteurized milk 1.2.2 Edible Oils, Types of Edible Oils used for cooking purpose 1.2.3 Food Adulterants, Common Adulterants like water, flour, starch, sugar, or dyes. Effect of food adulteration, FSSAI. 1.2.4 Food Preservatives like sugar, salt, sodium nitrite, spices, vinegar, sodium benzoate, and glutamates. Health Implication of Food Preservatives</p> <p>1.3 Agricultural Products: 1.3.1 Manure: Composting, Vermicomposting 1.3.2 Fertilizers: Introduction to Urea, Slurry, Macronutrients N, P, K, Ca, S and Mg. Micronutrients used in fertilizers: B, Zn, Mn, Fe, Cu, Mo and Cl. 1.3.3 Agrochemicals: Pesticide, Insecticides, Herbicide, Weedicide, Rodenticides, Uses of some common pesticide used in India: DDT, BHC, Endosulfan etc. 1.3.4 Symbols on Agricultural Products and their indication</p> | L-08/M-08 |
| 2. | <p>General Medicines and First Aid Treatment</p> <p>2.1 Medicinal products used in daily life: 2.1.1 Properties and Applications of Paracetamol, Antacid, Benadryl Syrup. 2.1.2 Antiseptic Lotion and Cream, hydrogen peroxide, Antiulcer gel, Pain</p> | L-08/M-08 |

| | | |
|----|--|-----------|
| | <p>relief Balms and Oils, Inhalers.</p> <p>2.2 First Aid Treatment:</p> <p>2.2.1 Accidental wound or cut injury, Burning injury,</p> <p>2.2.2 Animal Bite (Pet, Wild, Snake, Scorpion etc)</p> <p>2.2.3 Sudden unconscious like heart attack, sun-stroke, Fits (mirgie) etc</p> | |
| 3. | <p>Household Cleaning, Cosmetics, Health and Hygiene Products</p> <p>3.1 Household Cleaning Products:</p> <p>3.1.1 Floor Cleaning, Detergent Powder and Bars, Utensil Cleaning Liquid, Bar and Powder,</p> <p>3.1.2 Air Fresheners, Mosquito Repellants, Naphthalene</p> <p>3.2 Cosmetics:</p> <p>3.2.1 Talcum Powder, Cold and Sun Cream, Body Lotion</p> <p>3.2.2 Perfumes and Body Spray</p> <p>3.3 Health and Hygiene Products:</p> <p>3.3.1 Principal chemical ingredients and uses of Tooth Paste, Soap, Hand-wash, Sanitizer, Shampoo, Hair remover</p> <p>3.3.2 Properties and uses of Hair oil</p> | L-08/M-08 |
| 4. | <p>Metals and Non-metals Used in Daily Life</p> <p>4.1 Definition of Metals and Non-Metals with examples, Properties of Metal and Non-Metals.</p> <p>4.2 Domestic Applications of Metals: Iron, Copper, Aluminium, Gold, Silver, Lead</p> <p>4.3 The presence of metals and non-metals in the human body. Role and percentage of some major elements like Fe, Ca, O and P in the human body.</p> | L-06/M-06 |

References:

- 1) Chemistry in Everyday Life, G.D. Gem Mathew, Vishal Publishing Co., 1st Edition, ISBN-13:978-9382956075, 2013
- 2) Chemistry in Daily Life: 3rd Edition by Singh K, Prentice Hall India Learning Private Limited, ISBN-13: 978-8120346178, 2012
- 3) <https://ncert.nic.in/textbook.php?lech2=7-7>
- 4) Food Adulteration and its Detection, Jesse Park Battershall, Hansebooks, ISBN-13:978-3337201005, 2017
- 5) Hand Book on Pesticides, Un Nabi, Sajad & Akbar, Shahid. (2018)..
- 6) <https://ncert.nic.in/ncerts/l/jesc103.pdf>

- 7) Hygienic Cleaning Products used in the kitchen; Exposure and risks, MCH, Weerdesteijn & HJ, Bremmer & Zeilmaker, Marco & Veen, M.P., (1999).
- 8) WHO guidelines on hand hygiene in health care, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland, ISBN: 978 92 41597906, 2009
- 9) INDIAN FIRST AID MANUAL, 2016 (7th edition), St. John Ambulance Association (India) – Indian Red Cross Society National Headquarters, 1, Red Cross Road, New Delhi – 11001
- 10) Basic First Aid and Manual, Meghalaya, State Disaster *Management* Authority, Shillong, India

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|---|-----------------|
| 1 | Exhibit knowledge of chemicals in cosmetics. | 5 |
| 2 | Students will be able to understand the uses of medicine and cosmetics safely | 4 |
| 3 | Develop an appreciation for the importance of role of chemistry in everyday life. | 4 |
| 4 | Understand the role of metals and nonmetals in daily life. | 3 |
| 5 | To understand the uses of pesticides and fertilizers and their impact on the environment. | 3 |

| Semester-II | |
|--|--|
| CH-127 Advanced Analytical Chemistry | |
| Course Code: CH-127 | Course Category: Skill Enhancement Course SEC-2 |
| Course Title: Advanced Analytical Chemistry | Type: Theory |
| Total Contact Hours: 30 Hrs. (2 Hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |
| Course Objectives: Students should be able to <ul style="list-style-type: none"> • Understand the different quantitative and qualitative methods of analysis • To understand difference between Iodimetry and Iodometry • Able to Interpret the Complexometric titrations and redox titrations | |

Chapter 1: Redox Titrations

(L-08, M-08)

- a) Oxidation, reduction, redox reaction, oxidizing agents, reducing agents, redox titrations.
- b) Titration of Ce(IV) versus Fe(II), nature of titration curve, calculation of emf during titration.
- c) Detection of end point-redox indicators, self indicator and starch indicator.
- d) Titrations involving iodine: Iodimetry and Iodometry.
- e) Applications of redox titrations.

Ref.1,2,3,4,5 (Relevant pages)

Chapter 2: Complexometric Titrations

(L-08, M-08)

- a) Complexes, ligands, types of ligands, chelates, chelating agents.
- b) Formation of complex, formation constant.
- c) Chelating agent EDTA, EDTA equilibria, EDTA titration curve.
- d) Detection of end point use of indicators, principle involved in colour change of indicator, characteristics of metal ion indicators.
- e) Applications of Complexometric titration.

Ref.1,2,3,4,5 (Relevant pages)

Chapter 3: Gravimetric Analysis

(L-08, M-08)

- a) Introduction, advantages of gravimetric analysis
- b) Solubility product (with problems), conditions for precipitation.

- c) Steps of gravimetric analysis: Preparation of solution, precipitation, digestion.
 Impurities in the precipitate: co-precipitation and post precipitation. Filtration, washing, drying or ignition, weighing
- d) Applications–estimation of Ba as BaSO₄, Ni as Ni-DMG, Pb as PbCrO₄

Ref.1,2,3,4,5 (Relevant pages)

Chapter 4: Chromatography

(L-06, M-06)

- a) Definition, Introduction, advantages and disadvantages of chromatography.
- b) Principle of chromatography, classification of chromatography-partition and adsorption chromatography.
- c) Paper chromatography: principle, technique, R_f- value, ascending and descending techniques, paper chromatographic separation of metal ions, applications.
- d) Thin layer chromatography (TLC): Principle, technique and applications.

Reference Books

1. Analytical Chemistry, G. D. Christian(5thEdition) 2006
2. Quantitative Chemical Analysis, J Mendham, RC Denny, Barnes, Thomas, 2009
3. Analytical Chemistry, D A Skoog, D M West, FJ Holler, 1992
4. Vogel's Textbook of Quantitative Inorganic Analysis, Bassett, Denney, Jeffrery,1989
5. Basic Concepts of Analytical Chemistry, S M Khopkar, 2008

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|--|-----------------|
| 1 | Exhibit knowledge of chemicals in cosmetics. | 5 |
| 2 | Students will be able to understand the different quantitative and qualitative methods of analysis | 4 |
| 3 | Understand the difference between Iodimetry and Iodometry titration | 4 |
| 4 | Interpret the Complexometric titrations and redox titrations | 3 |
| 5 | Assess the quality of your own work in order to be certain your analysis is correct. | 3 |

Semester-II

CH-128 Analytical Chemistry Practical

| | |
|---|--|
| Course Code: CH-128 | Course Category: Skill Enhancement Course SEC-3 |
| Course Title: Analytical Chemistry Practical | Type: Practical |
| Total Contact Hours: 60 Hrs. (4 hr/week) | Course credits: 02 |
| College Assessment (CA) : 20 Marks | University Assessment (UA) : 30 Marks |

Course Objectives:

It is expected to

- To apply analytical methods for sampling, titrations, separations and interpret the results for chemical analysis
- Prepare solutions of different concentrations for different estimations.
- Communicate chemical knowledge effectively through written reports, oral presentations.
- Identify and separate the mixture of organic compounds based on thin layer chromatography
- Interpret the difference between Complexometric titrations and redox titrations

A) Analytical Chemistry Experiments (Any Four)

[Instruction-Prepare solutions using 100 ml volumetric flask]

1. Preparation of std. 0.1N $K_2Cr_2O_7$ solution and standardization of ferrous ammonium sulphate solution.
2. Preparation of std. 0.1N NaCl solution and standardization of $AgNO_3$ solution.
3. Determination of loss per gram and percent purity of mixture of $NaHCO_3$ and Na_2CO_3 .
4. Preparation of std. 0.05 N potassium hydrogen phthalate solution and standardization of NaOH solution
5. Estimation of aniline/phenol.
6. Determination of number of molecules of water of crystallization in sample of crystalline barium chloride/magnesium sulphate.

B) Volumetric Analysis (Any five)

1. Estimation of acetic acid in commercial vinegar using NaOH.
2. Estimation of aspirin in drug sample.
3. Estimation of chloride by Mohr's method.
4. Estimation of Fe(II) by redox titration with $KMnO_4$.
5. Estimation of copper iodo metrically.

6. Estimation of Mg^{+2} by complex metric titration with EDTA.
7. Determination of dissolved oxygen (DO) in water sample.
8. Determination of normality and strength of HCl titrating with standard NaOH potentiometrically.

C) Chromatography (Any one)

1. Separation of mixture of o-nitroaniline and p-nitroaniline by Thin Layer Chromatography and to determine their R_f values.
2. Separation of mixture of any two amino acids by paper chromatography.

Course Outcomes (CO):

After successful completion of the course students are expected to

| No. | CO | Cognitive Level |
|-----|--|-----------------|
| 1 | Students will be able to understand the method of preparation of standard solution and its standardization. | 4 |
| 2 | Estimate various compounds like acetic acid, aspirin, copper, chloride, dissolved oxygen etc in a given sample | 4 |
| 3 | Understand the difference between paper chromatography and thin layer chromatography | 4 |
| 4 | Interpret the difference between Complexometric titrations and redox titrations | 3 |
| 5 | Assess the quality of your own work in order to be certain your analysis is correct. | 3 |

Internal Examination Pattern
Chemistry Practical Semester II (CH-128)

| Time: 3 Hrs. | Marks 20 |
|---|-----------------|
| Q. 1. Physical Chemistry/ Analytical Chemistry experiment | 15 Marks |
| OR | |
| Inorganic/ Organic Qualitative analysis | |
| Q. 2. Oral | 02 Marks |
| Q. 3. Attendance and Behavior | 03 Marks |
| Total: 20 Marks | |

External Examination Pattern
Chemistry Practical Semester II (CH-128)

| Time: 3 Hrs. | Marks : 30 |
|--|-------------------|
| Q. 1. Physical Chemistry / Analytical Chemistry experiment | 20 Marks |
| OR | |
| Inorganic/ Organic Qualitative analysis | |
| Q. 2. Oral | 05 Marks |
| Q. 3. Journal | 05 Marks |
| Total: 30 Marks | |

Note: Distribution of Experiments – One fourth of the total students in a batch will be given physical chemistry experiment, one fourth will be given an analytical chemistry experiment and one half of the students will be given an Inorganic / Organic qualitative analysis.
