Bharathidasan Government College for Women
(Autonomous)
Puducherry – 605 003

NEP BASED
SYLLABUS AND REGULATIONS
FOR

B.Sc. (Hons.) CHEMISTRY

[1 TO 8 SEMESTERS]

[FROM THE YEAR 2024-2028 ONWARDS]

UG BOS in CHEMISTRY

B.Sc. Chemistry – 3 Yrs (or)

B.Sc. (Hons.) Chemistry / B.Sc. (Hons. with Research) – 4 Yrs

[With **Chemistry** major and 2 minors – **Mathematics / CND** (any one of the two) **& Physics / Zoology** (any one of the two)]

1. Programme Outcome (PO)

By the end of this programme the students will:

- Understand the basic principles of various branches of Chemistry
- Demonstrate a range of practical skills to conduct and infer experiments independently and in groups
- Apply the key concepts and standard methodologies to solve problems related to Chemistry
- Apply methodologies to the solution of unfamiliar types of problems
- Exhibit skills leading to employability in Chemistry and allied industries
- Comprehend the fundamental aspects of research in Chemistry
- Possess the level of proficiency in subject required for post graduation as well as for pursuing research in Chemistry and related interdisciplinary subjects
- Design solutions stemming from the application of Chemistry to the local issues.

2. Programme Specific Outcome (PSO)

On successful completion of this programme, the student should be able to:

- **Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.
- **Critical Thinking:** Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively
- **Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.
- **Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.
- **Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.
- **Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

GOVERNMENT OF PUDUCHERRY
BHARATHIDASAN GOVERNMENT COLLEGE FOR WOMEN
PUDUCHERRY - 605 003

Minutes of Meeting, Board of Studies

The meeting Board of Studies in Chemistry was held on 20.09.2024, at 10.00 A.M. in the Department of Chemistry, BGCW, Puducherry. The following members were present.

Sl. No	Name & Designation	Position
1.	Mrs. G. Thirupurasundari Associate Professor & Head BGCW, Puducherry	Chairman
2.	Mrs. N. Couppammalle Assistant Professor BGCW, Puducherry	Member
3.	Mrs. C. Uma Assistant Professor BGCW, Puducherry	Member
4.	Dr. K. S. Prakash Assistant Professor BGCW, Puducherry	Member
5.	Dr. Bala Manimaran Professor & Head Department of Chemistry, Pondicherry University	Member (VC Nominee)
6.	Dr. V. Nandhakumar Associate Professor Department of Chemistry, AVVMS Pushpam College, Poondi– 613 503, Thanjavur District, TamilNadu	Member (Subject Expert)
7.	Dr. G. V. Pandian Associate Professor Department of Chemistry T.B.M.L. College, Porayar – 609 307	Member (Subject Expert
8.	Dr. S. Surendher Industrialist The Flavors India (P) Ltd., C-5, 14 & 15, Pipdic Industrial Estate, Mettupalayam, Marie Oulgaret, Puducherry- 605 009	Member (Rep. related to placement)
9.	Dr. R. Kanemany, Associate Professor & Head Department of Chemistry, Womens Engineering College, Lawspet, Puducherry – 605 008.	Member (Alumnus)

The Chairperson welcomed the members, presented the details of B.Sc. Chemistry (3 years Programme for Batch 2023-2026) and B.Sc., Chemistry (Honors) (4 year Programme from Batch 2024-2028 onwards) framed as per National Education Policy 2020 Guidelines.

The members present in the BOS Meeting was Dr. M. Balamanimaran, Professor of Chemistry, Pondicherry University ,VC nominee, Dr. V. Nandhakumar, AP of Chemistry and Dr. V. Pandian, Assistant Professor of Chemistry, subject experts Dr. R. Kanemany, Associate Professor of Chemistry, Meritorious alumni and Dr. S. Surender the Industrialist.

The Members of Board of Studies contributed their valuable suggestions to frame the course structure and content aiming to achieve a perfect shape for the NEP syllabus.

The following suggestions were offered by the external members and were unanimously agreed by others.

1. Semester – I, II &III – MJD is General Chemistry

Minor courses has three options viz. Mathematics / Zoology / CND (Title: Lifespan Nutrition) courses.

a Minor in Mathematics is option for students who studied Mathematics in H. Sc.

b. Minor in Zoology / Minor in CND (Title: Lifespan Nutrition) during Semester-I, II & III (Option for students who have not studied Mathematics in H. Sc.).

C. Many Topics were edited in General chemistry –I, II, III and IV as per Committee requirements.

2. Semester – IV: Organic Chemistry – I: Corrections included in Unit- II, IV & V

3. Semester – V: In Physical chemistry – I, Unit –III was changed from Catalysis, Absorption, Surface Chemistry & Photochemistry to a detailed topic in Photochemistry

4. Semester – VII: A Practical Course was introduced in the title "***Analytical lab***' in the place of Theory Paper "***Advanced Physical Chemistry'***

5. Semester – VIII:

a. The Course "Heterocyclic Chemistry "was replaced by "***Environmental Chemistry*** ".
b. The Course "Electrochemistry "was replaced by "***Computational Chemistry***'".

6. *MID Courses offered for other Department:*

The Syllabus provides three MID Chemistry Courses

Fundamentals of Chemistry- I, Fundamentals of Chemistry- II and Basic Chemistry Lab (for Physics, Botany, CND, and Zoology Major Students)

These Courses can be opted by other departments either during Semester – I, II & III (Or) Semester – IV, V & VI.

7. *MLDC Courses to be offered in Semester s- I/II/III (Anyone Course)*

a. Chemical in Life

b. Chemistry of Cosmetics

The BOS Approved Syllabus of B.Sc. chemistry (3 years Programme for Batch 2023-2026) and B.Sc. Chemistry (Honors) (4 year Programme from Batch 2024-2028 onwards) will be presented before Academic Council and for General Body Meeting for further approval.

Mrs. G. Thirupurasundari

Mrs. N. Couppammalle

Mrs. C. Uma

Dr. K. S. Prakash

Dr. K. S. PRAKASH, M.Sc., M.Phil., Ph.D.,
Assistant Professor
Department of Chemistry
Bharathidasan Govt. College for Women
Govt. of Puducherry, Puducherry-605 003.

Dr. Bala Manimaran

Dr. V. Nandhakumar

Dr. V. NANDHAKUMAR, M.Phil.,M.Ed.,Ph.D.,
Associate Professor of Chemistry
A.V.V.M. Sri Pushpam College (Autonomous)
Poondi-613 503. Thanjavur-Dt.

Dr. G. V. Pandian

Dr.G.V.PANDIAN,M.Sc.,M.Phil.,Ph.D.,
Associate Professor & HEAD
Department of Chemistry & Bio Chemistry
T.B.M.L. College, Porayar 609 307
Mayiladuthurai Dist. Tamil Nadu

Dr. R. Kanemany

Dr. S. Surendher

3. Course Outcome

	Course Code	Course Title	Course Outcome
MJD 1		**General Chemistry – I**	• Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization enthalpy and electron affinity of elements. • Understand and explain the electronic displacements and reactive intermediates and their applications in basic concepts. • Formulate the mechanistic route of organic reactions by recalling and correlating the fundamental concepts.
SEC 1		**Basic Experiments in Chemistry**	• Acquire the knowledge and skill of basic volumetric and gravimetric estimations. • Gain hands on experience on the purification techniques for organic compounds. • Gain hands on experience on the identification of chemical nature of organic compounds.
MJD 2		**General Chemistry – II**	• Understand the concept of ionic bond. • Understand the concept of lattice energy using Born-Landé equation. • Understand the concept of covalent bonding in VB theory. • Draw the plausible structures and geometries of molecules using radius ratio rules, VSEPR theory
SEC 2		**Preparation of Small Scale Industrial Products**	• Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products. • Learn the use of safe, economic and body-friendly cosmetics • Prepare new innovative formulations. • Understand chemical aspects and applications of

MJD 3		**General Chemistry– III**	• Understand and learn the Hydrogen, Hydrides, and S-block elements. • Understand and learn the properties of solids. • Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction. • Demonstrate the effect of temperature on reaction rate and the significance of activation
MJD 4		**General Chemistry– IV**	• Understand and learn the P-block elements. • Understand and learn the Catalysis, Adsorption, Photochemistry • Gains Knowledge of Aromaticity - Huckel rule - Aromatic, Anti- Aromatic Systems, Non- Aromatic– Structure of benzene, • Learn principles of solubility and solubility product,
SEC 3		**Semi Micro Inorganic Analysis**	• Acquire knowledge on the systematic analysis of Mixture of salts. • Identify the cations and anions in the unknown substance.
MJD 5		**Organic Chemistry – I**	• Learn the chemistry of aromatic polynuclear hydrocarbon and aryl halides. • Learn the chemistry of alcohols and phenols. • Learn the chemistry of carbonyl compounds. • Learn the chemistry of carboxylic acid and their derivatives. • Learn the chemistry of nitrogen compounds.
MJD 6		**Inorganic Chemistry – I**	• Understand and learn Nuclear Chemistry • Understand the Principles of Qualitative Inorganic Analysis • Understand the Theories of Acids, Bases & Non-aqueous solvents • Understand and learn the P-Block Elements

MJD 7 *(Practical)*		**Volumetric Analysis**	• Apply the principles of volumetric analysis. • Understand the conditions of complex formation in complexometric titrations. • Understand the correct titrimetric procedure along with standard performs all sorts of volumetric calculations. • Understand the concept of titrimetric in applied
MJD 8		**Physical Chemistry – I**	• Derive mathematical expressions for different properties of gas, liquid and solids • Explain the crystal structure of cubic systems. • Explain the concept of ionization of electrolytes. • Understand the concepts of surface chemistry
MJD 9		**Organic Chemistry – II**	• Learn asymmetric synthesis, Walden inversion and atropisomerism. • Learn conformational analysis of disubstituted cyclohexane. • Learn the chemistry of heterocyclic compounds. • Learn the chemistry of amino acids, proteins and nucleic acids.
MJD 10 *(Practical)*		**Organic Qualitative Analysis & Organic Preparation**	• Observe the physical state, odor, color and solubility of the given organic compound. • Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis. • Exhibit a solid derivative with respect to the identified functional group.
MJD 12		**Inorganic Chemistry – II**	• Learn the Chemistry of d-block elements • Understand the basis of occurrence of metals in nature and the methods that can be applied on minerals to extract the metals from them. • Apply 18-electron rule to rationalize the stability of metal carbonyls and related species. • Learn how IR data can be used to understand extent

MJD 13		**Physical Chemistry – II**	• Understand the three laws of thermodynamics, concept of State and Path functions, extensive and intensive properties. • Derive the expressions of ΔU, ΔH, ΔS, ΔG, ΔA for ideal gases under different conditions. • Explain the concept of partial molar properties. • Understand the thermochemistry concepts.
MJD 14		**Green Chemistry**	• Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. • Understand stoichiometric calculations and relate them to green chemistry metrics. • Learn to design safer chemical, products and processes that are less toxic, than current alternatives.
MJD 15 *(Practical)*		**Physical Chemistry Experiments & Gravimetric Analysis**	• Describe the principles and methodology for the practical work. • Explain the procedure, data and methodology for the practical work • Apply the principles of kinetics, phase rule and electrochemistry for carrying out the practical work • Acquire practical knowledge in the determination of
MJD 16		**Advanced Organic Chemistry**	• Learn about photochemical intermediates involved in organic reactions. • Understanding the organic synthetic strategies using the disconnection approach. • Learning about Synthesis of heterocyclic compounds with mono and di heteroatoms.
MJD 17		**Spectroscopic Identification of Organic Compounds**	• Describe the applications of UV-Visible spectroscopy in the identification of conjugation in organic compounds • Apply IR spectroscopy to identify the various functional groups in organic molecules • Evaluate the structure of organic compounds using ^{1}H, ^{13}C, and 2D-NMR spectroscopy

MJD 18		**Analytical lab**	• Describe the techniques of Chromatography • Learns the principles & techniques of Separation • **Learns the techniques of solvent separation** • **Learns the techniques in spectrophotometer ,flame photometry** • **Learn sthe techniques involved in measurement of pH**
MID 7		**Pharmaceutical Chemistry**	• Have an idea about the pharmaceutical drugs and its applications • Understand the Indian medicinal plants and its uses. • Understand the knowledge about treatment of cancer • Elaborate the uses of drugs in day today life.
MID 8		**Software's in Chemistry and their applications**	• Applying chemdraw and chemsketch softwares for molecular modeling, writing structures and chemical equations • Understand scientific graphing and data analysis. • Applying computational chemistry softwares for calculating molecular parameters
MJD 19A		**Polymer Chemistry**	• Use essential descriptions about polymer chemistry. • Defines related concepts. • Recognizes monomers and polymers. • Evaluate the structure of polymers. • Recognizes bounds between polymer chains in different polymerization reactions. • Interprets stereochemistry of polymers.
MJD 19B		**Material Chemistry**	• Understands the crystal structure of solids • Recognize the fundamentals of nanomaterials • Explains the characterization of nanomaterials • Apply the skill of polymer science and technology in different areas. • Understands the biodegradable polymers, fiber and rubber
MJD 20A		**Medicinal Chemistry**	• Understands the biological activity parameters • Recognize the properties of drugs • Understands the drug targets • Apply the therapeutic agents in our day today life. • Understands the Steroids, Prostaglandins, Enzyme, Hormone and Vitamins.

MJD 20B		**Research Methodology for Chemistry**	• Learn how to identify research problems. • Evaluate local resources and need for addressing the research problem • Find out local solution. • Know how to communicate the research findings.
MJD 21A		**Nuclear and Radiation Chemistry**	• Understands the of nuclear and radiation chemistry • Recognize types of nuclear reactions • Understands the nuclear fission and fusion reactions • Understands the radiation analysis and radiological safety
MJD 21B		**Bio-Chemistry**	• Understands the biological importance of carbohydrates • Explains the structures of proteins • Understands the enzymes and its classifications, mechanism. • Recognize the biological importance of lipids • Understands the structures of DNA and RNA
MJD 22A		**Environmental Chemistry**	• **Know different world life acts such as forest conversion act, water control pollution act and air prevention and control act.** • **Understand complete Knowledge about all kind of pollutions**
MJD 22B		**Advanced Analytical Chemistry**	• Understand statistical methods in chemical analysis • Gain understanding about statistical evaluation of analytical data • Understand thermo analytical methods • Understand the Polarography techniques • Explain Chromatographic methods

MJD 23A		**Novel Inorganic Solids**	• Understand the mechanism of solid-state synthesis. • Explain about the different characterization techniques and their principle. • Understand the concept of nanomaterials, their synthesis and properties. • Explain the mechanism of growth of self-assembled nanostructures
MJD 23B		**Computational chemistry**	**Understands theoretical knowledge on molecules** • Understands Hartree-Fock SCF method for molecules • **Understands the Calculation methods** • Learns the Janak's theorem, Ionization potential theorem

4. *Course guidelines*

Types of Courses

1. Major Disciplinary Courses (MJD)
2. Minor Disciplinary Courses (MID)
3. Multi - Disciplinary Courses (MLD)
4. Ability Enhancement Courses (AEC)
5. Skill Enhancement Courses (SEC)
6. Value Added Common Courses (VAC)
7. Internships and Community service-based projects
8. Research Project work for 4-years Honours Degree

Multi - Disciplinary Courses (MLD) – (9 Credits):

1. Natural Sciences
2. Physical Sciences
3. Mathematics and Statistics
4. Computer Science/ Applications
5. Data Analysis
6. Social Sciences
7. Humanities
8. Commerce and Management
9. Library Science
10. Media Sciences etc.

Ability Enhancement Courses (AEC) - (8 Credits):

1. English Language
2. Languages (Tamil, Hindi and French)

Skill Enhancement Courses (SEC) – (9 Credits):

- Courses aimed at imparting practical skills, Hands-on training, soft skills etc to enhance the employability and entrepreneurship of the students.
- The course may be designed as per the students need and available Institutional resources.

Value Added Common Courses (VAC) – (8 Credits):

1. Understanding India
2. Environmental Sciences/Education
3. Digital and Technological Solutions
4. Health, Wellness, Yoga Education, Sports and Fitness

Internships:

1. Summer Internship (2 Credits) – (Community Engagement and Service)
2. Winter Internship (4 Credits) – (Internship in an Industrial organisation/Training centres/Research Institutions)

Research Projects - (12 Credits):

- Students may be given necessary guidance by the Faculty Members in identifying the Research Problems, Conduct of Study and preparation of a Project Report.

Major Disciplinary Courses (MJD) (60 Credits for 3 Years Degree, 80 Credits for UG (Hons) :

- Discipline Specific Courses.

Minor Disciplinary Courses (MID) (24 Credits for 3 Years Degree, 32 Credits for UG (Hons) :

- Allied/ Elective subjects to the major Discipline.
- It may be disciplinary/Inter-disciplinary.

Level of courses:

Courses are coded based on the learning outcomes, level of difficulty and academic rigour. The Coding structure is as follows:

- 0-99 – Pre-requisite course with no credits
- 100-199 – Foundation or Introductory Courses
- 200- 299 – Intermediate level Courses
- 300 – 399 – Higher level Courses
- 400- 499 – Advanced Courses

5. Regulations:

Undergraduate degree programmes of either 3- or 4-years duration, with multiple entry and exit points and re-entry option with appropriate certifications such as:

- Certificate in Chemistry after completing 1 year (2 Semesters) of study in the chosen fields
- Diploma in Chemistry after 2 years (4 Semesters) of study
- B.Sc. Chemistry after 3-years (6 Semesters) of study.
- B.Sc. (Hons.) Chemistry after 4-years (8 Semesters) of study.
  If the student completes a rigorous research project in their major area(s) of study in the 4th year of bachelors' degree (Honours with research)

Course Distribution

					Total Credits	
S. No	**Category**	3 - Years Degree	4– Years Degree	Credits for a Course	3- Year Degree	4 – Years Degree
	Major Disciplinary Courses (MJD) – 14+1 (Winter internship 4 Weeks)	15	20	4	60	80
	Minor Disciplinary Courses (MID)			4	24	32
	Multi - Disciplinary Courses (MLD)			3	09	09
	Ability Enhancement Courses (AEC)			2	08	08
	Skill Enhancement Courses (SEC)			3	09	09
	Value Added Common Courses (VAC)			2	08	08
	Summer Internship – Community Engagement			2	02	02
	Research Projects or Additional Major Courses			12 4	-	12
	Total		44 or 46		120	160

Course Distribution - Semester wise

Semester	MJD	MID	MLD	AEC	SEC	VAC	Total
I	1	1	1	1(Eng/Lang)	1	1 & 2	7
II	1	1	1	1	1	3 & 4	7
III	2	1	1	1	1	-	6
IV	3	1	-	1	Community Engagement	-	6
V	3	1	-	-	Winter Internship (MJD)	-	5
VI	4	1	-	-	-	-	5
VII	3	2	-	-	-	-	5
VIII	2	Research Project (or) 3 MJD Courses					3 or 5

Levels and Credits for Each Semester

Semester	Levels	UG 3 Years Degree	UG 4 Years (Hons) Degree
I	100	20	20
II	100	20	20
III	200	20	20
IV	200	20	20
V	300	20	20
VI	300	20	20
VII	400	-	20
VIII	400	-	20
Total		**120**	**160**

Pedagogical Style

- Lecture Classes
- Tutorial Classes
- Experiments in Laboratory
- Seminar Classes
- Internships
- Studio Activities
- Project Work
- Community Engagement

Eligibility

- As per the directions of Govt. of Puducherry and Pondicherry University

Evaluation

All credit courses will be evaluated based on a total of 100 marks, distributed as follows:

Theory

- Internal Assessment: 25 marks
- End Semester Examination:75 marks

Practicals

- Internal Assessment: 50 marks
- End Semester Practical Examination: 50 marks

Breakup of Internal Assessment Marks

For all credit courses, the internal assessment marks will be broken down as follows:

Theory

⇒ Mid-Semester Exam: 20 marks

⇒ Percentage of Attendance: 5 marks

- **Total 25 marks**

Practicals

⇒ Observation note / Demo note / Work dairy: 20 marks

⇒ Practical record: 30 marks

- **Total 50 marks**

Summer Internship/Community Engagement

1. Identifying the problem/Topic Selection – 20 Marks
2. Survey/Data Collection – 20 Marks
3. Analysis, Consolidation and Report Submission– 30 Marks
4. Presentation and Viva voce – 30 Marks

Winter Internship/Industrial Training

1. Attendance – 20 Marks
2. Observational Reports Submission/Certificate – 80 Marks

Internal Test Scheme

- ✓ Mid-Semester Exams: Conducted during the 8th or 9th week from the start of classes.
- ✓ Duration of the Exam: 1 hour 30 minutes (90 minutes).

Marks for Attendance

- Below 75%: 0 marks
- 75% to 80%: 1 mark
- 80% to 85%: 2 marks
- 85% to 90%: 3 marks
- 90% to 95%: 4 marks
- 95% to 100%: 5 marks

- A minimum of 70% attendance is required to be eligible to appear in the end-semester exam.
- Attendance Below 70%: Eligible for the Examination with condonation Fee.
- Attendance Below 60%: Not eligible to appear for the Examination.

Criteria for Pass Marks

(Minimum Pass Marks)

- Internal Assessment: No minimum pass marks required.
- End Semester Exams: Minimum pass marks are 30 out of 75.
- Overall Pass Marks: A combined minimum of 40 marks out of 100 (including Internal Assessment and End Semester Exams) is required to pass the course.

End Semester Examination Scheme -Theory Subjects

Total Marks: 75 marks

- Section A : 10 × 2 = 20 Marks (10 out of 12 Questions to be answered)
- Section B : 5 × 5 = 25 Marks (5 out of 8 Questions to be answered)
- Section C : 3 × 10 = 30 Marks (3 Out of 5 Questions to be answered)

Course Structure

SEMESTER – I

Level - 100

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 1		General Chemistry -I	4	4+1
2	MID 1 (Any one of the Three)		Mathematics for Chemistry - I	4	4+1
			Lifespan Nutrition - I		
			Basic Zoology		
3	MLD 1		Mathematics	3	3+1
4	AEC 1		English	2	2+2
5	SEC 1 (Practical)		Basic Experiments in Chemistry	3	3+1
6	VAC 1		VAC 1 – Understanding India	2	2+2
7	VAC 2		VAC 2 – Environmental Science/Education	2	2+2
			Total	**20**	**30**

SEMESTER – II

Level - 100

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 2		General Chemistry -II	4	4+1
2	MID 2 (Any one of the Three)		Mathematics for Chemistry - II	4	4+1
			Lifespan Nutrition - II		
			Public Health & Hygiene		
3	MLD 2		Corporate Secretaryship	3	3+1
4	AEC 2		Tamil/French/Hindi	2	2+2
5	SEC 2 (Practical)		Preparation of Small Scale Industrial Products	3	3+1
6	VAC 3		VAC 3 – Digital Technology Education	2	2+2
7	VAC 4		VAC 4 – Health, Wellness, Yoga Education, Sports & Fitness	2	2+2
			Total	**20**	**30**

SEMESTER – III

Level-200

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 3		General Chemistry-III	4	4+2
2	MJD 4		General Chemistry-IV	4	4+1
3	MID 3 (Any one of the Three)		Mathematics for Chemistry - III	4	4+1
			Lifespan Nutrition Lab		
			Economic Zoology (Practical)		
4	MLD 3		Economics	3	3+1
5	AEC 3		English	2	2+2
6	SEC 3 (Practical)		Semi Micro Inorganic Analysis	3	4+2
			Total	**20**	**30**

SEMESTER – IV

Level - 200

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 5		Organic Chemistry - I	4	4+2
2	MJD 6		Inorganic Chemistry-I	4	4+1
3	MJD 7 (Practical)		Volumetric Analysis	4	4
4	MID 4 (Any one of the Two)		Conceptual Physics -I	4	4+1
			Fundamental Zoology		
5	AEC 4		Tamil/French/Hindi	2	2+2
6	Project		Summer Internship (Community Engagement)	2	6
			Total	**20**	**30**

SEMESTER – V

Level - 300

S. No	Category	Course Code	Course Title	Credits	Lecture /Tutorial Hours
1	MJD 8		Physical Chemistry - I	4	4+2
2	MJD 9		Organic Chemistry - II	4	4+2
3	MJD 10 (Practical)		Organic Qualitative Analysis & Organic Preparation	4	4+2
4	MJD 11		(Winter Internship – Industrial Training)	4	6
5	MID 5 (Any one of the Two)		Conceptual Physics -II	4	4+2
			Public Health & Hygiene		
			Total	**20**	**30**

SEMESTER - VI

Level - 300

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 12		Inorganic Chemistry - II	4	4+2
2	MJD 13		Physical Chemistry - II	4	4+2
3	MJD 14		Green Chemistry	4	4+2
4	MJD 15 (Practical)		Physical Chemistry Experiments & Gravimetric Analysis	4	4+2
5	MID 6 (Any one of the Two)		Conceptual Physics -III	4	4+2
			Economic zoology (Practical)		
			Total	**20**	**30**

SEMESTER – VII

Level - 400

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 16		Advanced Organic Chemistry	4	4+2
2	MJD 17		Spectroscopic Identification of Organic Compounds	4	4+2
3	MJD 18		Analytical lab	4	4+2
4	MID 7		Pharmaceutical Chemistry	4	4+2
5	MID 8		Software's in Chemistry and their applications	4	4+2
			Total	**20**	**30**

SEMESTER – VIII

Level-400

S. No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MJD 19 (Any one of the Two)		Polymer Chemistry	4	4+2
			Material Chemistry		
2	MJD 20 (Any one of the Two)		Medicinal Chemistry	4	4+2
			Research Methodology for Chemistry		
3A	Research Project (OR)		Research Project (OR)	12	18 (OR)
3B	MJD 21 (Any one of the Two)		Nuclear and Radiation Chemistry	4	4+2
			Bio-Chemistry		
	MJD 22 (Any one of the Two)		Environmental Chemistry	4	4+2
			Advanced Analytical Chemistry		
	MJD 23 (Any one of the Two)		Novel Inorganic Solids	4	4+2
			Computational Chemistry		
			Total	**20**	**30**

Semester-wise Chemistry Course Structure and Scheme
For Under Graduate Students of Other Departments

(Minor Disciplinary & Multi Disciplinary Courses in CHEMISTRY)

SEMESTER – I / II / III

Multi-Disciplinary Course

S.No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MLD 3 (Any one of the Two)		Chemicals in life	3	3+1
			Chemistry of Cosmetics		

SEMESTER – IV

Minor Disciplinary Course (For Physics ,Botany ,Zoology & CND Department)

S.No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MID 4		Fundamentals of Chemistry – I	4	4+1

SEMESTER – V

Minor Disciplinary Course (For Physics ,Botany ,Zoology & CND Department)

S.No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MID 5		Fundamentals of Chemistry – II	4	4+1

SEMESTER – VI

Minor Disciplinary Course (For Physics ,Botany ,Zoology & CND Department)

S.No	Category	Course Code	Course Title	Credits	Lecture/Tutorial Hours
1	MID 6		Basic Chemistry Practical	4	4+1

SEMESTER - I

Programme / Class: Certificate in Chemistry				Department: Chemistry					
Department of Chemistry									
Year: I	Course Category: Major Disciplinary Course (MJD 1)						Semester : I		
Course Name: General Chemistry – I							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	5	60	-	25	75	100
Prerequisite:	Higher Secondary with chemistry as one of the subject								
Course Objective	. This course aims at providing an overall view of the • Various atomic models and atomic structure • Wave particle duality of matter • Periodic table, periodicity in properties and its application in explaining the chemical behavior. • Fundamental concepts of organic chemistry • Behavior of gases. • SI Units, concentration terms, various analytical methods, and safe usage of chemicals and its waste								
Course Outcome	**By the end of this course, students will be able to:** • Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, Understand and explain the electronic displacements and reactive intermediates and their applications in basic concepts. • Understand and learn the properties of gaseous state.								

Content

UNIT-I	Atomic Structure	No. of Hours: 12

Atomic Structure

Bohr's theory & its limitations, atomic spectrum of hydrogen atom.

de Broglie equation, Heisenberg's Uncertainty Principle and its significance. Postulates of wave mechanics, Time independent Schrödinger's wave equation, significance of ψ and ψ^2. Shapes of *s*, *p*, and *d* orbital's, Relative energies of orbital's. Pauli's Exclusion Principle, Hund's rule of maximum spin multiplicity, Aufbau principle and its limitations.

UNIT-II	Periodic properties of Elements & Periodic Trends	No. of Hours: 12

.

Periodic properties of Elements & Periodic Trends

Modern Periodic Law-Periodicity of Elements- Long Form of Periodic table-Grouping of Elements into s,p,d,f –Blocks. Brief discussion of the following properties of the elements, with reference to

s- & *p*-block - their trends and contributing factors:

(a) Effective nuclear charge, shielding or screening effect and Slater's rules

(b) Atomic and ionic radii

Ionization enthalpy (Successive ionization enthalpies)

(d) Electron gain enthalpy

(e) Electronegativity, Pauling's / Alfred – Rochow red scale of Electronegativity. Variation of Electronegativity with bond order, partial charge, hybridization and group Electronegativity

UNIT-III	Basic Concepts of Organic Chemistry	No. of Hours: 12

Brief Review of Basics in Organic Chemistry

(a) Hybridization: sp^3, sp^2 and sp.

(b) Electronic displacements and their applications: inductive, Inductomeric effect, electromeric, resonance, mesomeric effects and hyper conjugation and Dipole moment.

(c) Reaction intermediates: Formation, stability and shapes of Carbocations, Carbanions, carbene, free radical, Nitrene and Aryne.

(d) Electtrophile & Nucleophile, types of organic reactions: addition, elimination, substitution reactions and Rearrangement Reactions.

UNIT-IV	Gaseous state	No. of Hours: 12

States of Matter: Five different states of matters (solid, liquid, vitreous, gas and plasma) – Definition and example

Gaseous State: Postulates of kinetic theory of gases – derivation for pressure of an ideal gas – derivation of gas laws from ideal gas equation (Boyle's law, Charles's law, Avogadro's law, Dalton's law, Graham's law.)

Behavior of real gases – van der Waal's equation – critical phenomenon –experimental determination of critical constants. Relation between critical constants and van der Waals constants – Reduced equation of state. Distribution of molecular velocities – average, most probable and root mean square velocity – collision number, collision diameter, collision frequency and mean free path.

UNIT-V	Analytical chemistry-I	No. of Hours: 12

(A) Laboratory Glassware:

Types, maintenance and cleaning. Calibration of burette, pipette and standard flask; practice of inter-calibration. Laboratory first aids.

(B) Stoichiometry and concentration systems:

Stoichiometric **–** Mole and equivalent concepts – Stoichiometric calculations - concentration systems – Molarity – Normality – p-functions – percent concentration – ppm and ppb - calculations involving various types of concentration systems.

(C) Language of analytical chemistry:

Definitions of analysis, determination, measurement, techniques and methods. Significant figures, Classification of analytical techniques.

.

	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments /dramatizing model / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Madan, R.D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S.Chand and Company: New Delhi, 2003.
- Rao, C.N.R. University General Chemistry, Macmillan Publication: NewDelhi, 2000.
- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone.
- Arun Bahl, Bahl, B.S. and Tuli G.D. *Essentials of Physical Chemistry,* S. Chand & Co, 2012.
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.

Reference Books

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. &Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- Christian, G.D. (2004), Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.organic-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.organic-chemistry.org/info/chemistry/inorganicchemistry.shtm
- https://www.youtube.com/results?search_query=analytical+chemistry

Evaluation methodology

⇒ End Semester Examination

SEMESTER - I

<table>
<tr><td colspan="5">Programme / Class: Certificate in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: I</td><td colspan="5">Course Category: Skill Enhancement Course (SEC 1)</td><td colspan="3">Semester : I</td></tr>
<tr><td colspan="7">Course Name: Basic Experiments in Chemistry</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>4</td><td>-</td><td>60</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">Higher Secondary with chemistry as one of the subject</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for chemistry.
• introduce the fundamentals and basic techniques of volumetric and gravimetric estimations.</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Acquire the knowledge and skill of basic volumetric and gravimetric estimations.
• Gain hands on experience on the purification techniques for organic compounds.
• Gain hands on experience on the identification of chemical nature of organic compounds</td></tr>
<tr><td colspan="10"><u>Practical Component</u></td></tr>
<tr><td colspan="10">Calibration of burette, pipette and volumetric flask.</td></tr>
<tr><td colspan="10"><u>Preparation of standard solutions of various Normality's</u>
• Preparation of standard solutions of sodium carbonate, borax, oxalic acid, dichromate, FAS.</td></tr>
<tr><td colspan="10">Determination of melting point of organic compounds (ranging 60 to 100°C)
Determination of boiling point of organic compounds.</td></tr>
<tr><td colspan="10">Purification of Organic compounds by Crystallization.</td></tr>
<tr><td colspan="10"><u>Separation of the following mixtures</u>:
a. Naphthalene & Benzoic acid
b. Benzoic acid & Glucose
c. Naphthalene & Glucose</td></tr>
<tr><td colspan="10"><u>Water Analysis</u>
1.Determination of Calcium and Magnesium in Tap water
2.Determination of Total Hardness of water</td></tr>
<tr><td colspan="8">Total Hours</td><td colspan="2">60 Hrs.</td></tr>
<tr><td>Pedagogy</td><td colspan="9">Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the</td></tr>
</table>

	students.

Reference Books

- Higson, S. P.J. (2003), Analytical Chemistry, Oxford University Press
- Fifield, F.W.; Kealey, D. (2000), Principles and Practice of Analytical Chemistry, Wiley.
- Harris, D. C. (2007), Exploring Chemical Analysis, W.H. Freeman and Co.
- Day. R. A.; Underwood, A. L. (1991), Quantitative Analysis, Prentice Hall of India.
- Gordus, A. A. (1985), Schaum's Outline of Analytical Chemistry, Tala McGraw-Hill.
- Dean J. A. (1997), Analytical Chemistry Handbook, McGraw Hill.
- Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989), Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences

Evaluation methodology

⇒ End Semester Practical Examination (Total- 50 marks)

- Separation -10 marks
- Preparation -10 marks
- Purification-10 marks
- Record-10 marks
- Viva-10 marks

SEMESTER – II

Programme / Class: Certificate in Chemistry				Department: Chemistry					
Department of Chemistry									
Year: I	Course Category: Major Disciplinary Course (MJD 2)			Semester : II					
Course Name: General Chemistry – II				Course Code:					
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	5	60	-	25	75	100
Prerequisite:	Higher Secondary with chemistry as one of the subject								
Course Objective	This course aims at providing an overall view of the • basic knowledge about ionic and covalent bonding • nature of chemical bonding in compounds. • principles of solutions • aliphatic hydrocarbons and its applications • errors in analytical methods and titrimetric analysis.								
Course Outcome	By the end of this course, students will be able to: • Understand the concept of ionic bond. • Understand the concept of lattice energy using Born-Landé equation. • Understand the concept of covalent bonding in VB theory. • Draw the plausible structures and geometries of molecules using radius ratio rules, VSEPR theory. • Understand the principles and behavior of solutions • Understand and suitably use the chemistry of hydrocarbons • Calibrate the apparatus used in titrimetric analysis and prepare standard solutions for titration • Understand the theory and application of various acid-base and redox titrations.								

Content

UNIT-I	Chemical Bonding - I	No. of Hours: 12

Ionic bond - General characteristics of ionic compounds–Size Effect, The Radius Ratio Rule, Limitation of Radius ratio Rule, Lattice energy, Born Equation, and Made lung constant, application of Born Equation and solvation energy . Born-Haber cycle, Applications of Lattice Energy, Role of Lattice energy and Hydration energy, Covalent character in ionic compounds polarizing power and polarizability, Fajan's rules, Effects of Polarization. Role of Electronegativity difference and dipole moment in percent ionic character.

UNIT-II	Chemical Bonding - II	No. of Hours: 12

Covalent bonding: General characteristics of Covalent Compounds-Valence Bond theory
Concept of Hybridization – sp, sp^2, sp^3 , sp^3d, sp^2d and dsp^2 with one example each.
Three electron bonds in Diborane – Bond length, Bond Order, Bond Energy and their applications
Resonance and resonance energy. Ionic character in covalent compounds: Bond moment and dipole moment.

Hydrogen Bonding: Types, Inter and Intra molecular hydrogen bonding and consequences.

VSEPR Theory: Lewis structure, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_3, PCl_5, SF_6, ClF_3, I_3^-, BrF_2^+, PCl_6^-, ICl_2^-, ICl_4^-, and SO_4^{2-}.

Bent rule and its applications.

UNIT-III	Solutions	No. of Hours: 12

Solutions

Ideal and Non-ideal solutions. Concept of activity and activity coefficients –

Completely miscible liquid systems - benzene and toluene. Raoult's law and Henry's law. Deviation from it. .Azeotropes- HCl-water and Ethanol-water system –

Partially miscible liquid systems - Upper and lower Critical Solution Temperature

(a) Phenol-water system

(b)Triethylamine-water

© Nicotine-water systems.

UNIT-IV	Aliphatic Hydrocarbons	No. of Hours: 12

Alkanes: Isomerism, Preparation – Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, Corey-House synthesis, from Grignard reagent. Physical and Chemical Properties with special emphasis on free radical substitution, Halogenations.

Cycloalkanes: Preparation by Dieckman condensation. – Stability of Cycloalkanes, Baeyer's strain theory- Sache-Mohr Theory, Ring opening reactions, of Cyclopropane and Cyclobutane.

Alkenes: Preparation by Dehydration, dehydrohalogenation, Hoffman's Elimination - Saytzeff's rule.

Markownikoff's and anti- Markownikoff's rule - ozonolysis, oxymecuration- demercuration, hydroboration-oxidation.

Dienes: Classification-1,2 and 1,4 addition- Diels-Alder reaction

Alkynes: Preparation – acidity of Terminal alkyne, Reactions of Alkynes.

UNIT-V	Analytical chemistry-II	No. of Hours: 12

Errors and treatment of analytical data: Errors: Determinate and indeterminate errors, some important terms replicate, outlier, Accuracy, precision, ways of expressing accuracy, absolute error, relative error, minimization of errors. Mean, median, range, standard deviation and variance. Numerical problems.

Titrimetric analysis: Basic principle of titrimetric analysis. Preparation and dilution of reagents / solutions. Equivalent masses of compounds Normality, Molarity and Mole fraction. Use of $N_1V_1 = N_2V_2$ formula. Numerical problems.

Acid-base titrimetry: Theory of acid base indicators. Titration curves for strong acid vs. strong base, weak acid vs. strong base and weak base vs. strong acid titrations. Primary and secondary titrant.

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments /dramatizing model / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Madan, R.D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S.Chand and Company: New Delhi, 2003.
- Rao, C.N.R. University General Chemistry, Macmillan Publication: NewDelhi, 2000.
- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone.
- Arun Bahl, Bahl, B.S. and Tuli G.D. *Essentials of Physical Chemistry,* S. Chand & Co, 2012.
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
- Dr. Alka Gupta, Analytical Chemistry, Pragati Prakashan
- Higson, S. P.J. (2003), Analytical Chemistry, Oxford University Press.
- Skoog, D.A.; West, D.M. (2003), Fundamentals of Analytical Chemistry, Brooks/Cole.

Reference Books

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. &Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- R. Gopalan and others, Elements of Analytical Chemistry, Sultan chand& Co.
- Christian, G.D. (2004), Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.organic-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.organic-chemistry.org/info/chemistry/inorganicchemistry.shtm
- https://www.youtube.com/results?search_query=analytical+chemistry

Evaluation methodology

⇒ End Semester Examination

SEMESTER – II

<table>
<tr><td colspan="6">Programme / Class: Certificate in Chemistry</td><td colspan="4">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: I</td><td colspan="5">Course Category: Skill Enhancement Course (SEC 2)</td><td colspan="3">Semester: II</td></tr>
<tr><td colspan="7">Course Name: Preparation of Small Scale Industrial Products</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>4</td><td>-</td><td>90</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">Higher Secondary with chemistry as one of the subject</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• theoretical and practical knowledge on basic principles of cosmetic chemistry.
• manufacture, formulation of various cosmetic products.</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products.
• Learn the use of safe, economic and body-friendly cosmetics
• Prepare new innovative formulations.
• Understand chemical aspects and applications of perfumes and skin care products</td></tr>
<tr><td colspan="10"><u>Practical Component</u></td></tr>
<tr><td colspan="10">Preparation of:
❖ Talcum powder
❖ Shampoo
❖ Face cream
❖ Nail polish and nail polish remover
❖ Hand wash
❖ Hand sanitizer
❖ Body lotion
❖ Soap
❖ Tooth powder
❖ Tooth paste
❖ Phenoyl
❖ Floor wash and disinfectants
❖ Vinegar</td></tr>
<tr><td colspan="10">• Field Visit</td></tr>
<tr><td colspan="8">Total Hours</td><td colspan="2">90 Hrs.</td></tr>
<tr><td>Pedagogy</td><td colspan="9">Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the</td></tr>
</table>

	students.

Text Books

- Barel, A.O.; Paye, M.; Maibach, H.I. (2014), Handbook of Cosmetic Science and Technology, CRC Press.
- Garud, A.; Sharma, P.K.; Garud, N. (2012), Text Book of Cosmetics, Pragati Prakashan.
- Gupta, P.K.; Gupta, S.K. (2011), Pharmaceutics and Cosmetics, Pragati Prakashan
- Butler, H. (2000), Poucher's Perfumes, Cosmetic and Soap, Springer
- Kumari, R.(2018),Chemistry of Cosmetics, Prestige Publisher.

Reference Books

- Fricke's.(1990), Cosmetic and toiletry formulations**,** Noyes Publications / William Andrew Publishing.
- Natural Ingredients for Cosmetics; EU Survey 2005
- Formulation Guide for cosmetics; The Nisshin OilliO Group, Ltd.
- Functional Ingredients & Formulated Products for Cosmetics & Pharmaceuticals; NOF Corporation.

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences

Evaluation methodology

⇒ End Semester Practical Examination(Total- 50 marks)

- Preparation of any two products -20 marks
- Field visit report-10 marks
- Record-10 marks
- Viva-10 marks

SEMESTER - III

Programme / Class: Diploma in Chemistry				Department: Chemistry				
Department of Chemistry								
Year: II	Course Category: Major Disciplinary Course (MJD 3)					Semester : III		
Course Name: General Chemistry – III						Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks	
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	5	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • basic knowledge about hydrogen, hydrides and s-block elements. • physical properties and laws of solids. • chemical kinetics and different types of chemical reactions • stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane, propane, butane and cyclohexane. • redox and complexometric titrations.								
Course Outcome	**By the end of this course, students will be able to:** • Understand and learn the Hydrogen, Hydrides, and S-block elements. • Understand and learn the properties of solids. • Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction. • Demonstrate the effect of temperature on reaction rate, and the significance of activation energy. • Assign R, S notations to chirals and E, Z notations to olefins and explain conformations of ethane, propane, butane and cyclohexane.								

Content

UNIT-I	Hydrogen, Hydrides, and S-block elements	No. of Hours: 12

Hydrogen: Isotopes, ortho- and para-hydrogens.

Hydrides: Ionic, covalent, metallic and interstitial hydrides, Hydrogen bonding.

Alkali metals: Introduction, halides, oxides and hydroxides, salts of oxo-acids, aqueous solution chemistry, complexes and organometallic compounds.

Alkaline Earth metals: Introduction, halides, oxides and hydroxides, salts of oxo-acids, aqueous solution chemistry, complexes and organometallic compounds.

UNIT-II	Solid State-I	No. of Hours: 12

Classification of solids: Isotropic and anisotropic crystals. Crystalline and amorphous solids– Types of Crystalline Solid -Symmetry elements in crystal and crystal classes

Unit cell –seven crystal systems: Representation of planes, Miller indices, Weiss Indices, Indexing of Crystal Planes. Examples of Miller Indices (110), (111), (210), (100), (010), (001

), Interplanar spacing in Crystal System, Space lattice and Crystal Lattice , Unit cell, Symmetry Elements and Symmetry Operations . Symmetry Elements present in Cubic Crystal-Plane of Symmetry, Axis of Symmetry and Centre of Symmetry

Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Law of symmetry.

UNIT-III	**Chemical Kinetics**	**No. of Hours: 12**

Rate and specific reaction rate; Factors influencing the rate of reaction- Order and Molecularity of reactions; Derivation of rate constants-zero, first and second order reactions; Half-life period; Pseudo order reactions; Determination of order of reactions-differential method, method of integration and method of half-life period.

Effect of temperature on reaction rate; Arrhenius equation; Activation energy and its significance;

UNIT-IV	**Stereochemistry-I**	**No. of Hours: 12**

Stereoisomerism: Geometrical Isomerism -Cis -Trans, Syn – Anti and E, Z Notations, Geometrical Isomerism, in cyclic compounds, Determination of Configuration of Geometrical isomers

Conformational Isomerism - Conformational analysis of Ethane, Propane, butane and cyclohexane, Mono and Di substituted Cyclohexane.

Optical isomerism – Specific rotation, Chirality, Elements of Symmetry, Molecular Asymmetry, and Dissymmetry, Enantiomers and Diastereoisomers- Racemization and Resolution- Relative and Absolute Configurations – CIP Rules. Projection formulae - Newman, Sawhorse, Fischer. Chirality in molecules with one and two stereocenters; meso configuration. Racemic mixture and their resolution.

UNIT-V	**Redox and complexometric titrations**	**No. of Hours: 12**

Redox Titrations: Nernst equation — Theory of redox indicators — Types of Redox indicators.
Complex Formation Titrations: Chelating agents – EDTA- Theory of metallochromic indicators – Titrations involving EDTA – Types of EDTA titrations. -Applications of Complexometric Titrations

	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments /dramatizing model / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Madan, R.D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S.Chand and Company: New Delhi, 2003.
- Rao, C.N.R. University General Chemistry, Macmillan Publication: NewDelhi, 2000.
- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone.
- Arun Bahl, Bahl, B.S. and Tuli G.D. *Essentials of Physical Chemistry,* S. Chand & Co, 2012.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi

SEMESTER – III

<table>
<tr><td colspan="5">Programme / Class: Diploma in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="5">Course Category: Major Disciplinary Course (MJD 4)</td><td colspan="3">Semester : III</td></tr>
<tr><td colspan="7">Course Name: General Chemistry – IV</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>4</td><td>4</td><td>-</td><td>-</td><td>5</td><td>60</td><td>-</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">-</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• Basic knowledge about boron, carbon, nitrogen and carbon group elements.
• Catalysis, adsorption and photochemistry
• Aromaticity - Huckel rule - Aromatic, Anti- Aromatic Systems, Non- Aromatic– Structure of benzene
• Principles of solubility and solubility products.
• Standard semi micro procedure of identifying common anions and cations in a mixture containing two salts.</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Understand and learn the P-block elements.
• Understand and learn the Catalysis, Adsorption, Photochemistry
• Gains Knowledge of Aromaticity - Huckel rule - Aromatic, Anti-Aromatic Systems, Non- Aromatic– Structure of benzene,
• Learn principles of solubility and solubility product, Common ion effect.
• Understand and learn standard semi micro procedure of identifying common anions and cations in a mixture containing two salts.</td></tr>
<tr><td colspan="10"><u>Content</u></td></tr>
<tr><td>UNIT-I</td><td colspan="6">P-BLOCK ELEMENTS –I (Boron and Carbon group)</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">(a) General characteristics of Boron group elements - Diagonal relationship between B and Si. Hydrides of Boron – preparation, properties and structure of Diborane. Boron Nitride, Borazine, Sodium Borohydride and Lithium Aluminum hydride, Boric acid.
(b) General characteristics of carbon group elements – Allotropy of carbon, structure of Diamond and Graphite, catenation, fullerenes. Fluorochlorocarbons, silicates and carbides.</td></tr>
<tr><td>UNIT-II</td><td colspan="6">P-BLOCK ELEMENTS –II (Nitrogen and Oxygen group)</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">(a) General characteristics of Nitrogen group elements. Allotropy of phosphorus, oxides (N_2O, NO_2, N_2O_3, N_2O_5, P_2O_3, P_2O_5) and Acids of Nitrogen (HNO_2, HNO_3) & Phosphorus (H_3PO_3, H_3PO_4, $H_4P_2O_7$). Preparation and Structure and uses of Hydrazine, Hydrazoic acid and Hydroxylamine.
(b) General characteristics of Oxygen group. Allotropy of Sulphur - oxides, halides, oxyhalides of</td></tr>
</table>

Sulphur. Oxyacid's (H_2SO_4, H_2SO_3, $H_2S_2O_7$) of Sulphur. Persulphuric acids, Di thionic and Thiosulphuric acid (structure, preparation and properties).

UNIT-III	Photochemistry	No. of Hours: 12

***Photochemistry* :**

Absorption, Excited States,

Difference between thermal and photochemical reactions;

Laws of photochemistry; Grothus- Drapper and Stark-Einstein laws.

Jablonski diagram: Qualitative description of fluorescence and phosphorescence; non-radiative processes –internal conversion and inter system crossing; Vibronic Coupling, Quantum yield.

Solar spectrum, Photoprocess, Semiconductor Junctions and Applied Photochemistry.

UNIT-IV	Aromatic Hydrocarbons	No. of Hours: 12

Aromaticity – Huckel rule – Frost circle method - Aromatic, Anti- Aromatic Systems, Non-Aromatic– Structure of benzene, Resonance and Aromaticity in Benzene. M.O picture. Side chain reactions of benzene and its Side chain derivatives. Birch reduction.

Aromatic electrophilic substitution: – Role of sigma complexes – Mechanism of Nitration, Halogenations, Sulphonation and Friedel-Crafts reactions.

Arenes: Activating and deactivating substituent's. Directive nature of substituent's, ortho / para ratio.

UNIT-V	Ionic Equilibria -I	No. of Hours: 12

Principles of solubility and solubility product, Common ion effect. Separation of metal ions based on solubility differences. Applications of solubility product principle in qualitative and quantitative analysis. Elimination of interfering radicals. Standard semi micro procedure of identifying common anions and cations in a mixture containing two salts. Spot tests for common cations. Spot test reagents and tests with them - Cupferon, DMG, thiourea, Magneson, alizarin and Nessler reagent

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments /dramatizing model / Presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Madan, R.D. and Sathya Prakash, *Modern Inorganic Chemistry*, 2nd ed.; S.Chand and Company: New Delhi, 2003.
- Rao, C.N.R. University General Chemistry, Macmillan Publication: NewDelhi, 2000.
- Puri B.R., Sharma L.R. and Kalia K.C. *Principles of Inorganic Chemistry*, Milestone.
- Arun Bahl, Bahl, B.S. and Tuli G.D. *Essentials of Physical Chemistry,* S. Chand & Co, 2012.
- McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).

SEMESTER – III

<table>
<tr><td colspan="5">Programme / Class: Diploma in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="6">Course Category: Skill Enhancement Course (SEC 3)</td><td colspan="2">Semester : III</td></tr>
<tr><td colspan="8">Course Name: Semi Micro Inorganic Analysis</td><td colspan="2">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>6</td><td>-</td><td>90</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">-</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• skill on systematic analysis of simple inorganic salts and mixture of salts.
• analysis of simple and interfering acid radicals.
• elimination of interfering acid radicals.
• analysis of basic radicals.</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Acquire knowledge on the systematic analysis of Mixture of salts.
• Identify the cations and anions in the unknown mixture.</td></tr>
<tr><td colspan="10"><u>Practical Component</u></td></tr>
<tr><td colspan="10">➢ Analysis of simple acid radicals: Carbonate, sulphate, halides, nitrate</td></tr>
<tr><td colspan="10">➢ Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate.</td></tr>
<tr><td colspan="10">➢ Elimination of interfering acid radicals and Identifying the group of basic radicals</td></tr>
<tr><td colspan="10">➢ Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, iron, aluminium, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium.</td></tr>
<tr><td colspan="10">o Semi-micro analysis of inorganic salt mixture –I to V containing two cations and two anions (one of the anions should be an interfering one) from the following: Cations: Lead, Copper, Cadmium, Bismuth, Ferrous, Aluminum, Manganese, Zinc, Cobalt, Nickel, Calcium, Strontium, Barium, Magnesium and Ammonium.
o Anions: Carbonate, Sulphate, Nitrate, Fluoride, Chloride, Bromide, Borate, Oxalate and Phosphate.
o (Spot tests should be carried out wherever feasible)
(Combination of mixtures forming insoluble salts shall be avoided)</td></tr>
<tr><td colspan="8">Total Hours</td><td colspan="2">90 Hrs.</td></tr>
<tr><td>Pedagogy</td><td colspan="9">Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the</td></tr>
</table>

	students.

Text Books

- Svehla, G, Vogel's Qualitative Inorganic Analysis, 7th Ed, 4th Ed., Pearson Education (2007).
- Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011)
- V. Venkateswaran, R.Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition,1997.

Reference Books

- J. Mendham, R.C. Denney, J. D. Barnes, M.J.K. Thomas, Vogel's Quantitative Chemical Analysis, Pearson, 2009.
- Gulati Shikha , Sharma Gulati JL and Manocha Shagun, Practical Inorganic Chemistry, 1st Edn., CBS Publishers & Distributors Pvt Ltd., (2017).

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences

Evaluation methodology

⇒ End Semester Practical Examination (Total- 50 marks)

- Acid radical-10
- Elimination of interfering acid radical -5
- Identifying the group of basic radicals-5
- Identification of cations-10
- Record-10
- Viva-10

SEMESTER - IV

<table>
<tr><td colspan="5">Programme / Class: Diploma in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="5">Course Category: Major Disciplinary Course (MJD 5)</td><td colspan="3">Semester : IV</td></tr>
<tr><td colspan="7">Course Name: Organic Chemistry – I</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>4</td><td>4</td><td>-</td><td>-</td><td>5</td><td>60</td><td>-</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">-</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• Reactions of poly nuclear hydrocarbons and their derivatives.
• Preparation and properties of alcohols, phenols and ethers.
• Chemistry of aldehyde and ketone
• Preparation and properties of carboxylic acids and their derivatives.
• Preparation and properties of aromatic and aliphatic nitro compounds and amines.</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Learn the chemistry of aromatic polynuclear hydrocarbon and aryl halides.
• Learn the chemistry of alcohols and phenols.
• Learn the chemistry of carbonyl compounds.
• Learn the chemistry of carboxylic acid and their derivatives.
• Learn the chemistry of nitrogen compounds.</td></tr>
<tr><td colspan="10"><u>Content</u></td></tr>
<tr><td colspan="2">UNIT-I</td><td colspan="5">Aromatic Polycyclic hydrocarbons</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">Reactions of Diphenyl, diphenylmethane, triphenylmethane, triphenylmethyl chloride, Naphthalene, naphthol, naphthylamines, naphthoquinones, anthracene, anthroquinone, phenanthrene, phenanthraquinone.
Aryl Halides: Methods of formation of aryl halides – nuclear and side chain reactions. The addition – elimination and elimination – addition of nucleophilic aromatic substitution reactions.</td></tr>
<tr><td colspan="2">UNIT-II</td><td colspan="5">Alcohols, Phenols and Ethers</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">Alcohols: Nomenclature, Classification, General,Preparation and reactions of mono, di, and tri hydric alcohols. Methods to distinguish primary, secondary and tertiary alcohols
Phenols: Preparation and reactions of phenol. Acidity of phenol and factors affecting it. Electrophilic substitution -Kolbe Reaction, Reimer-Tiemann reaction, Gattermann-Koch reaction, Houben- Hoesch condensation, Schotten Baumann reaction.
Ethers and Epoxides: Preparation and Reactions of diethyl ether, Anisole, Phenetole, Ethylene Oxide and 1,4- Dioxan. Crown ethers and their uses.</td></tr>
<tr><td colspan="2">UNIT-III</td><td colspan="5">Aldehydes & ketones</td><td colspan="3">No. of Hours: 12</td></tr>
</table>

Structure of the carbonyl group- Keto-enol tautomerism- Synthesis of aldehyde and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction, Cannizaro reaction, Stork Enamine Reaction MPV reduction, Clemmensen, Wolf Kishner , $LiAlH_4$, $NaBH_4$ reduction.

UNIT-IV	**Carboxylic acids & their derivatives**	**No. of Hours: 12**

General methods of Preparation and reactions. Strength of Aliphatic and Aromatic acids. Preparation and reactions of Carboxylic acid derivatives.

Ester hydrolysis with B_{AC}^2 and A_{AC}^2 mechanisms, Keto-enol tautomerism in diethyl malonate & ethyl acetoacetate. Preparation using Claisen condensation, Dieckmann condensation and their synthetic uses.

UNIT-V	**Nitrogen compounds**	**No. of Hours: 12**

a) Nitro compounds: Preparation of nitroalkanes and nitrobenzenes. Reduction of nitrobenzene under various conditions, nitro-acinitro tautomerism, NEF reaction & its synthetic importance.

b) Amines and Diazonium Salts: Preparation from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Separation of amines: Hofmann method and Hinsberg method.

Reactions: Hofmann exhaustive methylation, Hofmann vs. Saytzeff's elimination, Carbylamines reaction, Schotten – Baumann Reaction. Diazotization and coupling . Electrophilic substitutions in aniline.

Diazonium salts: Preparation and reactions of benzene diazonium chloride.

c) Amide: Preparation and reactions of Benzamide, Urea and Thiourea.

	Total Hours	**60 Hrs.**

Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing model / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.

Basic Text Books

- M.K. Jain, S.C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.
- S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.
- Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand & Company Pvt. Ltd., Multi colour edition, 2012.
- P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
- C.N. Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.

SEMESTER – IV

<table>
<tr><td colspan="5">Programme / Class: Diploma in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: II</td><td colspan="5">Course Category: Major Disciplinary Course (MJD 6)</td><td colspan="3">Semester : IV</td></tr>
<tr><td colspan="7">Course Name: Inorganic Chemistry – I</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>4</td><td>4</td><td>-</td><td>-</td><td>5</td><td>60</td><td>-</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">-</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• Study Nuclear Chemistry
• Study the Principles of Qualitative Inorganic Analysis
• Study the Theories of Acids, Bases & Non-aqueous solvents
• Study the P-Block Elements</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of the course, the students will be able to:
• Understand and learn Nuclear Chemistry
• Understand the Principles of Qualitative Inorganic Analysis
• Understand the Theories of Acids, Bases & Non-aqueous solvents
• Understand and learn the P-Block Elements</td></tr>
<tr><td colspan="10"><u>Content</u></td></tr>
<tr><td>UNIT-I</td><td colspan="7">P-Block Elements –III (Halogens and noble gases group)</td><td colspan="2">No. of Hours: 12</td></tr>
<tr><td colspan="10">(a) General characteristics of halogen group elements, Oxides and oxoacids of halogens, Relative strength of oxo acids of the halogens, inter halogen compounds, Pseudo halogens and Electro positive character of iodine.
(b) Chemistry of noble gases:- Position in the periodic table. Occurrence- isolation and separation of noble gases from atmosphere. Physical properties of noble gases, flurides oxy flurides and oxides of xenon (preparation, properties and structure). Applications of noble gases.</td></tr>
<tr><td>UNIT-II</td><td colspan="6">General Principles of Metallurgy</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy with reference to cyanide process for silver and gold. Methods of purification of metals: Electrolytic process, Van Arkel-De Boer process, Zone refining.</td></tr>
<tr><td>UNIT-III</td><td colspan="6">Chemistry of d-block elements - First transition series</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">General characteristics of d-block elements. Properties of the elements of the first transition series. Relative stabilities of their oxidation states. Extraction from ores and refining of Ti, Mn, Cr, Fe, Co, Ni, Cu and Zn and their uses.</td></tr>
<tr><td>UNIT-IV</td><td colspan="6">Chemistry of d-block elements –II and III transition series</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">General characteristics – Comparative treatment with their 3d analogues in respect of ionic radii,</td></tr>
</table>

oxidation states, magnetic behavior. Metallurgy of silver, gold, platinum and palladium.		
UNIT-V	**Nuclear Chemistry**	**No. of Hours: 12**
Nuclear forces- atomic mass unit- packing fraction – mass defect and binding energy of the nucleus. Stability of nuclei. Nuclear models- the liquid drop model. Nuclear reactions-nuclear fission- fission of uranium- Fissile and Fertile nuclei. Nuclear reactors- types- importance of thorium in India's nuclear energy production. Nuclear fusion. Radio activity- natural radio activity- rate of radio activity disintegration – half life period- transmutation of elements- group displacement law- radio active decay series. Isotopes-separation of isotopes - applications of isotopes in analytical chemistry, medicine, and in reaction mechanism. Carbon dating. Neutron activation analysis.		
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing model / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone.
- Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.
- Hari Jeevan Arnikar, Essentials of Nuclear Chemistry, Revised 4th Ed., New Age International Publishing, 1995.

Reference Books

- Cotton, F.A., Wilkinson, G. &Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
- Lee, J.D. Concise Inorganic Chemistry, John Wiley & Sons.
- Atkin, P. Shriver & Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.epgpathshala.nic.in/

Evaluation methodology

⇒ End Semester Examination

Programme / Class: Diploma in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: II	Course Category: Major Disciplinary Course (MJD 7) *(Practical)*						Semester : IV		
Course Name: Volumetric Analysis							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	-	-	4	6	-	60	50	50	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • basic principles involved in titrimetric analysis • skill on the methodologies of different titrimetric analysis • skill to estimate the amount of a substance present in a given solution								
Course Outcome	**By the end of this course, students will be able to:** • Apply the principles of volumetric analysis. • Understand the conditions of complex formation in complexometric titrations. • Understand the correct titrimetric procedure along with standard performs all sorts of volumetric calculations. • Identify the end point of various titrations.								

Practical Component

1. Estimation of sodium carbonate and sodium hydroxide in a mixture.
2. Estimation of Ferrous ion using $KMnO_4$.
3. Estimation of oxalic acid using $KMnO_4$.
4. Estimation of Fe (II) ions using $K_2Cr_2O_7$ (internal indicator).
5. Estimation of Copper ions using Iodometry.
6. Estimation of $K_2Cr_2O_7$ using Iodometry.
7. Estimation of total hardness of water by EDTA method.
8. Estimation of Mg (II) ions by EDTA method.
9. Estimation of Zn (II) ions water by EDTA method.
10. Determination of acetic acid in commercial vinegar using NaOH.
11. Determination of hydroxide content of an antacid tablet using HCl.
12. Determination of Acetylsalicylic acid in aspirin tablet.
13. Determination of Ascorbic acid (vitamin-C) using standard Iodine solution.
14. Determination of total alkali content of a commercial detergent.
15. Estimation of chlorine content in bleaching powder.

Total Hours	**60 Hrs.**
Pedagogy	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of

	each experiment. Each of the experiments should be done individually by the students.

Text Books

- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. &Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
- V.Venkateswaran, R.Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition,1997.

Reference Books

- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences
- http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
- https://chemdictionary.org/titration-indicator/

Evaluation methodology

⇒ End Semester Practical Examination (Total- 50 marks)

- Brief procedure-10 marks
- Experiments-20 marks
- Record-10 marks
- Viva-10 marks

SEMESTER – V

Programme / Class: Degree in Chemistry					Department: Chemistry				
Department of CHEMISTRY									
Year: III	Course Category: Major Disciplinary Course (MJD-8)						Semester: V		
Course Name: Physical Chemistry – I							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • Advance concepts regarding gaseous and liquid states. • determining the physical properties of gases, liquids and solids. • Study of surface chemistry. • Concept of ionization in aqueous solution.								
Course Outcome	**By the end of this course, students will be able to:** • Derive mathematical expressions for different properties of gas, liquid and solids • Explain the crystal structure of cubic systems. • Explain the concept of ionization of electrolytes. • Understand the concepts of surface chemistry								

Content

UNIT-I	Gaseous state –II	No. of Hours: 12

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. Equation of states for real gases; van der Waals equation of state, its derivation and application in explaining real gas behaviour, Viral coefficients, calculation of Boyle temperature. Isotherms of real gases and their comparison with VanderWaals isotherms, continuity of states, critical state, relation between critical constants and VanderWaals constants, law of corresponding states.

UNIT-II	Liquid state	No. of Hours: 12

Liquid state: Some Properties of Liquids (molecular basis)-Equilibrium vapor pressure of a liquid, boiling point, heat of evaporation, heat of condensation, freezing point. Surface tension-definition, measurement of surface tension, effect of temperature on surface tension. Parachor-definition, calculation and applications.

Viscosity or fluidity-definition, measurement and calculation, factors affecting viscosity.

UNIT-III	Solid state – II	No. of Hours: 12

Solid State - Lattice Planes-. Types of cubic unit cells – Bravais Lattice ,General space Lattice, Special Space lattice ,Primitive Space lattice and Plane Lattice, Seven Crystal System, Symmetry Group, Point Group, Symmetry Elements and their orientation, Selection of an unit Cell SCC, FCC ,BCC Unit Cells. Study of (100) planes, (110) planes and (111) planes in Crystal Systems –X-ray diffraction by crystals -– Derivation of Bragg's equation. Determination of structures of NaCl,

CsCl, KCl, (Laue's method and powder method).

UNIT-IV	Surface Chemistry and Catalysis	No. of Hours: 12

a) Surface Chemistry: Adsorption – Types of Adsorption - Physical adsorption and Chemisorption, Factors influencing adsorption, Adsorption isotherms (Langmuir and Freundlich). Nature of adsorbed state. Qualitative discussion of BET Theory.

(b) Catalysis

Types of catalysis: Homogeneous and heterogeneous catalysis with examples; Acid-base catalysis with examples; Enzyme catalysis-general characteristics; Auto catalysis; Derivation of Michaelis - Menten Theory . Theories of catalysis-intermediate compound formation theory and adsorption theory.

UNIT-V	Ionic equilibria – II	No. of Hours: 12

Electrical transport and conductance in metal and in electrolytic solution. Specific conductance and equivalent conductance. Measurement of equivalent conductance. Ostwald's dilution laws-applications and limitation. Variation of equivalent conductance with concentration. Migration of ion-ionic mobility. Kohlraush's law and its applications. The elementary treatment of the Debye-Hückel Onsager equation for strong electrolytes. Transport number - Determination by Hittorf method and moving boundary method. Application of conductance measurements- Determination of Λ^0 of strong electrolytes.

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing model/ presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th ed., Vishal Publishing Company, 2016.
- Sharma K.K. and Sharma L.K., A Text Book of Physical Chemistry, 6th ed., S. Chand, 2016.
- Problems and Solutions : Physical Chemistry, C Kalidas and M V Sangaranarayanan, Universities Press Private Limited, Chennai, 2020

Reference Books

- Maron S.H. and Lando J.B. Fundamentals of Physical Chemistry, Macmillan.
- Glasstone S. and Lewis. D., Elements of Physical Chemistry, Macmillan.
- Kheterpal S.C. Pradeep Physical Chemistry, Volume I & II, Pradeep Publications Jalandhur, 2004.
- Jain D.V.S. and Jainhar S.P., Physical Chemistry, Principles and Problems, Tata McGraw Hill, New Delhi, 1988.
- Bajpai D.N., Advanced Physical Chemistry, S. Chand Publishing, 2001.
- Negi A.S. and Anand S.C., A Textbook of Physical Chemistry, John Wiley & Sons Pvt. Ltd., 1986.

SEMESTER - V

Programme / Class: Degree in Chemistry				Department: Chemistry					
Department of CHEMISTRY									
Year: III	Course Category: Major Disciplinary Course (MJD 9)					Semester : V			
Course Name: Organic Chemistry – II						Course Code:			
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • Asymmetric synthesis, Walden inversion and atropisomerism. • Preparation and properties of five membered heterocycles like pyrrole, furan and thiophene • Preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline. • Structure and properties of amino acids, peptides, proteins and nucleic acids. • Preparation and properties of synthetic polymers and dyes.								
Course Outcome	**By the end of this course, students will be able to:** • Learn asymmetric synthesis, Walden inversion and atropisomerism. • Learn conformational analysis of disubstituted cyclohexane. • Learn the chemistry of heterocyclic compounds. • Learn the chemistry of amino acids, proteins and nucleic acids. • Learn the chemistry of synthetic polymers.								

Content

UNIT-I	Stereochemistry-II	No. of Hours: 12

Walden inversion, Philips Kenyon reaction, Cram's rule -Stereospecific, Stereo selective, Enantiomers, Diasteriomers and Diastereoselective Reactions- Asymmetric Synthesis. Atropisomerism in Biphenyls, Allenes, spiranes and RS configuration.

UNIT-II	Heterocyclics-I	No. of Hours: 12

Nomenclature and classification. General characteristics – aromatic character and reactivity.

Five-membered hetero cyclic compounds

Pyrrole–preparation-from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.

Furan–preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction

Thiophene synthesis – from acetylene; reactions – reduction; oxidation; electrophilic substitution reactions.

UNIT-III	Heterocyclics-II	No. of Hours: 12

Six-membered hetero cyclic compounds

Pyridine – synthesis - from acetylene, Physical properties; reactions –basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution - uses Condensed ring systems

Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions–basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions–Chichibabin reaction

Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

preparation and properties of indole, Izatin.

UNIT-IV	Amino acids, proteins and Nucleic acids	No. of Hours: 12

Amino acid: Classification, structure and stereochemistry of amino acids, isoelectric point, preparation and reactions of α-amino acids.

Peptides -structure and Nomenclature, synthesis of polypeptides (general methods), solid-phase peptide synthesis.

Protein-Classification- structure of proteins- end group analysis, protein denaturation, renaturation.

Nucleic acids - constituents of nucleic acid, RNA and DNA, structure of DNA.

UNIT-V	Synthetic Polymers and Dyes	No. of Hours: 12

Synthetic polymers: Addition or chain growth polymerization. Free radical Vinyl polymerization, Ionic vinyl polymerization. Condensation or step growth polymerization, PE, PVC, Teflon, Polyesters, polyamides, phenol-formaldehyde resins, urea – formaldehyde resins. Advances in polymer; bio-polymer, biomaterials, polymer in medical field, high temperature and fire resistance polymer – silicones.

Dyes: Colour and constitution, electronic concept – Classification, chemistry and synthesis of methyl orange, Congo red, malachite green, alizarin, indigo and bismark brown.

	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing model / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.organic-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.organic-chemistry.org/info/chemistry/inorganicchemistry.shtm
- https://www.epgpathshala.nic.in/

Evaluation methodology

⇒ End Semester Examination

Programme / Class: Degree in Chemistry				Department: Chemistry					
Department of Chemistry									
Year: III	**Course Category: Major Disciplinary Course (MJD 10)** ***(Practical)***						**Semester : V**		
Course Name: Organic Qualitative Analysis & Organic Preparation							**Course Code:**		
Credits	**Credit distribution of the course**			**No. of Hours / Week**	**Total Hours**		**End Semester Exam. Maximum Marks**		
	Lecture	**Tutorial**	**Practical /Practice**		**Theory**	**Lab Session**	**CA**	**ESE**	**TM**
4	**-**	**-**	**4**	**6**	**-**	**90**	**50**	**50**	**100**
Prerequisite:	**-**								
Course Objective	This course aims at providing an overall view of the • analysis of organic compounds • preparation of organic compounds								
Course Outcome	**By the end of this course, students will be able to:** • Observe the physical state, odour, colour and solubility of the given organic compound. • Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis. • Compare mono and dicarboxylic acids, primary amine, mono and diamides, aldehyde, ketone, reducing sugars and explain the reactions behind it. • Exhibit a solid derivative with respect to the identified functional group. • Prepare of some simple organic compounds.								

Practical Component

A. Organic Qualitative Analysis:

- Preparation of reagents used in organic analysis.
  (Borshe's reagent, Schiff's reagent, phenolphthalein, Neutral $FeCl_3$,
  Tollen's reagent, Fehling's solution, Molisch's reagent, Bromide-Bromate mixture).
- Characteristic test for functional groups and detection of special elements.
- Preparation of derivatives for functional groups.
- Systematic Analysis of Unknown organic compounds:
  - Tests to find whether saturated or unsaturated.
  - Tests to find whether aromatic or aliphatic.
  - Detection of nitrogen, sulphur and halogens.
  - Tests to find the functional group.
    (Carboxylic acid (mon and di), phenol, aldehyde, ketone, carbohydrate, aromatic primary amine, aromatic mono amide, aliphatic diamide (Urea & Thiourea), nitro compound and ester).
  - Confirmation of functional group by preparation of derivatives.

B. Organic Preparations:

- Preparation of benzoic acid by hydrolysis of benzamide /ethylbenzoate.
- Preparation of benzoic acid by oxidation of toluene / benzaldehyde.
- Benzoylation of aniline / phenol.

- Preparation of Iodoform from ethanol / acetone
- Preparation of Osazone.
- Preparation of methyl orange.

Total Hours	**90 Hrs.**
Pedagogy	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.

Text Books

- Vogel's Textbook of Practical Organic Chemistry, ELBS.
- B.S.Furnis, A.J. Hannaford, P.W.G. Smith and T.R.Tatchell *Vogel's Text book of Practical Organic Chemistry* ELBS / Longman 1989.
- V.K.Ahluwalia, Sunitha Dhingra, Adarsh Gulate, *College Practical Chemistry*, Universities Press (India) Pvt Ltd 2008 (reprint)
- V.K. Ahluwalia & Aggarwal, R. *Comprehensive Practical Organic Chemistry*, Universities Press.

Reference Books

- S.P. Bhettani & Aruna Chhikara, *Practical organic chemistry* (qualitative analysis) Ane books (India) Pvt Ltd, 2008.
- O.P. Pandey, D.N Bajpai, S. Gini, *Practical Chemistry*, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
- P.R. Singh, D.C. Gupta, K.S. Bajpal *Experimental Organic Chemistry* Vol.I and II, 1980.12

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences

Evaluation methodology

⇒ End Semester Practical Examination (Total – 50 marks)

- Analysis-20
  - Saturated /Unsaturated - 2 marks
  - Aromatic / Aliphatic - 2 marks
  - Elements present /Absent - 6 marks
  - Functional Test-6
  - Conformation by derivative -4
- Preparation and Recrystallization-7+3
- Record-10
- Viva-10

SEMESTER – VI

Programme / Class: Degree in Chemistry					Department: Chemistry				
Department of CHEMISTRY									
Year: III	Course Category: Major Disciplinary Course (MJD 12)						Semester : VI		
Course Name: Inorganic Chemistry – II							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • Study of the Chemistry of d-block elements • basis of occurrence of metals in nature and the methods that can be applied on minerals to extract the metals from them. • 18-electron rule to rationalize the stability of metal carbonyls and related species. • study of IR data can be used to understand extent of back bonding in metal carbonyls • Study the Lanthanides and Actinides.								
Course Outcome	**By the end of this course, students will be able to:** • Learn the Chemistry of d-block elements • Understand the basis of occurrence of metals in nature and the methods that can be applied on minerals to extract the metals from them. • Apply 18-electron rule to rationalize the stability of metal carbonyls and related species. • Learn how IR data can be used to understand extent of back bonding in metal carbonyls • Understand the Lanthanides and Actinides.								

Content

UNIT-I	Lanthanides and Actinides	No. of Hours: 12

Lanthanides:

General characteristics of f-block elements - Comparative account of lanthanides and actinides - Occurrence, Oxidation states, Occurrence, electronic configuration, -oxidation states, lanthanide contraction, Colour and spectra, magnetic properties. - Lanthanides and Actinides Separation by ion-Exchange and Solvent extraction methods Extraction of lanthanides from monazite sand & separation of lanthanide elements by ion exchange method.

Actinides: Position of actinides in the periodic table. General characteristics of actinides: occurrence, electronic configuration, oxidation states, colour, magnetic properties Comparison

between lanthanides and actinides. Th and U (extraction only). Separation of Np, Pu and Am from U.

UNIT-II	Coordination compounds-I	No. of Hours: 12

Definition of terms - classification of ligands -Werner's theory – EAN rule - Chelation and effect of chelation - Co-ordination number and stereo chemistry of complexes - Nomenclature of mono nuclear and binuclear (bridged) complexes. Isomerism in complexes – ionization isomerism, hydrate isomerism, linkage isomerism, ligand isomerism, co-ordination isomerism, polymerization isomerism, geometrical and optical isomerism in 4 and 6 co-ordinated complexes.

Applications of Co-ordination compounds in qualitative and quantitative analysis - Applications in industry and medicine.

UNIT-III	Coordination compounds-II	No. of Hours: 12

Valence bond theory - hybridisation - geometry and magnetic properties - limitations of VBT.

Crystal field theory - splitting of *d*-orbitals in octahedral, tetrahedral and square planar complexes - crystal field stabilisation energy - calculation of CFSE in tetrahedral and octahedral complexes - Low spin and high spin complexes – explanation of magnetic properties, colour and geometry using CFT - Comparison of VBT and CFT.

UNIT-IV	Coordination compounds-III	No. of Hours: 12

Basic principles of molecular orbital theory (MOT) of co-ordination compounds as applied to octahedral complexes without π-bonding and its MO correlation diagram of $[Co(NH_3)_6]^{3+}$- The adjusted crystal field theory (ACFT) or the ligand field theory (LFT) - Types of magnetic behavior. Methods of determination of magnetic susceptibility and magnetic moments (Guoy's method only). Term Symbol, Orgel diagram- TS diagram. The electronic spectrum of ions in solution. Spectrochemical series.

UNIT-V	Acids, Bases & Non-aqueous Solvents	No. of Hours: 12

(a) Acids and Bases-Bronsted acids and bases: Lewis acids and bases: definitions, strengths, representative Lewis acids, heterogeneous acid-base reactions.

Hard & soft acids & bases (HSAB): Classification, Pearson's HSAB concept, acid base strength & Electronegativity and Hardness and softness, Symbiosis.

(b) Physical properties of a solvent, Types of solvents and their general characteristics. Reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments /dramatizing models/ presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone.
- Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.
- Hari Jeevan Arnikar, Essentials of Nuclear Chemistry, Revised 4th Ed., New Age International Publishing, 1995.

Evaluation methodology

⇒ End Semester Examination

SEMESTER: VI

Programme / Class: Degree in Chemistry				Department: Chemistry					
Department of CHEMISTRY									
Year: III	Course Category: Major Disciplinary Course (MJD-13)						Semester: VI		
Course Name: Physical Chemistry – II							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • Thermodynamic concepts, terminology. • Properties of thermodynamic systems. • Laws of thermodynamics and their correlation with other branches of physical chemistry and make them able to apply thermodynamic concepts to the system of variable compositions, equilibrium and colligative properties.								
Course Outcome	**By the end of this course, students will be able to:** • Understand the three laws of thermodynamics, concept of State and Path functions, extensive and intensive properties. • Derive the expressions of ΔU, ΔH, ΔS, ΔG, ΔA for ideal gases under different conditions. • Explain the concept of partial molar properties. • Understand the thermo chemistry concepts.								

Content

UNIT-I	Chemical Thermodynamics	No. of Hours: 08
Fundamentals of Thermodynamics, Intensive and extensive variables; state and path functions; isolated, closed and open systems. Mathematical treatment - Exact and inexact differential, Partial derivatives, Euler's reciprocity rule, cyclic rule.		
UNIT-II	**First law of Thermodynamics**	**No. of Hours: 08**
Concept of heat, Q, work, W, internal energy, U, and statement of first law; enthalpy, H, statement-definition of Internal Energy (E), Enthalpy (H) and Heat capacity. Relation between Cp and Cv. Calculation of W, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic condition of reversible and irreversible processes. Joule- Thompson effect and Coefficient (μ_{JT})-Calculation of μ_{JT} for ideal and real gases - Inversion temperature.		
UNIT-III	**Second Law of Thermodynamics**	**No. of Hours: 12**
Second Law of Thermodynamics -Limitations of first law & Need for the second law - Different statements of the law - Carnot's cycle and efficiency of heat engine-Carnot's theorem- Concept of Entropy - Definition and physical significance of entropy - Entropy as a function of P, V and T- Entropy changes during phase changes - Entropy of mixing- Gibb's free energy (G) and Helmholtz free energy (A) - Variation of A and G with P, V and T - Gibb's Helmholtz equation and its applications - Thermodynamic equation of state - Maxwell's relations.		
UNIT-IV	**Third Law of Thermodynamics & Thermo chemistry**	**No. of Hours: 16**

Third Law: Statement of third law , Unable of absolute zero, calculation of absolute entropy of molecules, concept of residual entropy, calculation of absolute entropy of solid, liquid and gases.

Thermo chemistry: Relation between enthalpy of reaction at constant volume (q_v) and at constant pressure (q_p) - Temperature dependence of heat of reaction - Kirchoff equation-Derivation and application-Enthalpy of formation and combustion - Bond energy and its calculation from thermo chemical data.

UNIT-V	Chemical Equilibrium	No. of Hours: 16

Systems of Variable Composition: Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs Duhem equation, chemical potential of ideal mixtures, Change in thermodynamic functions on mixing of ideal gases.

Chemical Equilibrium: Criteria of thermodynamic equilibrium, degree of advancement of reaction, Chemical equilibrium in ideal gases, Thermodynamic derivation of relation between Gibbs free energy of a reaction and reaction quotient, Equilibrium constants and their dependence on temperature, pressure and concentration, Le Chatelier's Principle (Quantitative treatment), Free energy of mixing and spontaneity, Equilibrium between ideal gases and a pure condensed phase.

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing models/ presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th ed., Vishal Publishing Company, 2016.
- Sharma K.K. and Sharma L.K., A Text Book of Physical Chemistry, 6th ed., S. Chand, 2016.
- Problems and Solutions : Physical Chemistry, C Kalidas and M V Sangaranarayanan, Universities Press Private Limited, Chennai, 2020.
- Negi A.S. and Anand S.C., A Textbook of Physical Chemistry, John Wiley & Sons Pvt. Ltd., 1986.
- Jain D.V.S. and Jainhar S.P., Physical Chemistry, Principles and Problems, Tata McGraw Hill, New Delhi, 1988.
- Bajpai D.N., Advanced Physical Chemistry, S. Chand Publishing, 2001.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.physical-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.physical-chemistry.org/info/chemistry/.shtm
- https://www.epgpathshala.nic.in/

Year: III	Course Category: Major Disciplinary Course (MJD-14)						Semester: VI		
Course Name: Green Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. • stoichiometric calculations and relate them to green chemistry metrics. They will learn about atom economy and how it is different from percentage yield. • Green chemistry is a way to boost profits, increase productivity and ensure sustainability with absolute zero waste.								
Course Outcome	**By the end of this course, students will be able to:** • Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. • Understand stoichiometric calculations and relate them to green chemistry metrics. They will learn about atom economy and how it is different from percentage yield.								

Content

UNIT-I	Green Chemistry - I	No. of Hours: 12

Need for Green Chemistry. Atom economy, Yield calculations, 12 principles of green chemistry, green solvents, Ionic liquids,
Retro synthetic analysis, Synthon and synthetic equivalent approach.
Microwave assisted reactions: Applications to reactions (i) in water: Hofmann Elimination, hydrolysis (of benzyl chloride, methyl benzoate to benzoic acid), Oxidation (of toluene, alcohols); (ii) reactions in organic solvents: Diels-Alder reaction and Decarboxylation reaction.
Ultrasound assisted reactions: Applications to esterification, saponification, Simmons-Smith Reaction (Ultrasonic alternative to Iodine). Contemporary applications.

UNIT-II	Green Chemistry - II	No. of Hours: 12

Green Catalysis – Heterogeneous – use of zeolites, silica, alumina, supported catalysis –bio catalysis: Enzymes, microbes, phase transfer catalysis (miscellar / surfactant).
Microwave, ultrasound and light promoted reactions (few examples for each type).

UNIT-III	Designing a Chemical synthesis	No. of Hours: 12

Green solvents – super critical fluids, fluorous biphasic solvent, PEG, solventless processes, immobilized solvents and how to compare greenness of solvents
Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy

Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking / protecting groups.

UNIT-IV	Green Synthesis	No. of Hours: 12

Examples of Green Synthesis / Reactions and some real world cases

Green Synthesis of the following compounds : adipic acid, catechol, disodiuminodiacetate (alternative to Strecker synthesis)

Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.

UNIT-V	Future Trends in Green Chemistry	No. of Hours: 12

Designing of Environmentally safe marine antifoulant.

Right fit pigment : synthetic azo pigment store place toxic organic and inorganic pigments.

An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

Healthier Fats and oil by Green Chemistry : Enzymatic Inter esterification for production of no Trans-Fats and Oils

Development of Fully Recyclable Carpet : Cradle to Cradle Carpeting

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; cocrystal controlled solid state synthesis (C^2S^3); Green chemistry in sustainable development.

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing models/ presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Matlack, A.S.(2001),Introduction to Green Chemistry, Marcel Dekker.
- Alhuwalia,V. K.; Kidwai, M.R.(2005),New Trends in Green chemistry, Anamalaya Publishers.
- Cann , M. C.; Umile, T.P. (2008), Real world cases in Green chemistry Vol 11, American chemical Society,Washington.
- Benyus,J. (1997),Innovations Inspired by nature, Harper collins.

Reference Books

- Anastas, P.T.; Warner, J.C.(1998),Green Chemistry, Theory and Practice, Oxford University Press.
- Lancaster, M.(2016),Green Chemistry An Introductory Text.2nd Edition, RSC Publishing.
- Cann , M. C. ;Connely,M. E.(2000), Real-World cases in Green Chemistry, American Chemical Society, Washington.
- Garay,A. L; Pichon, A.; James,S.L. Chem Soc Rev, 2007, 36,846-855.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer

Evaluation methodology

⇒ End Semester Examination

Programme / Class: Degree in Chemistry							Department: Chemistry		
Department of CHEMISTRY									
Year: III	**Course Category: Major Disciplinary Course (MJD-15)** *(Practical)*						**Semester : VI**		
Course Name:	**Physical Chemistry Experiments & Gravimetric Analysis**						**Course Code:**		
Credits	**Credit distribution of the course**			**No. of Hours / Week**	**Total Hours**		**End Semester Exam. Maximum Marks**		
	Lecture	**Tutorial**	**Practical /Practice**		**Theory**	**Lab Session**	**CA**	**ESE**	**TM**
4	**-**	**-**	**4**	**6**	**-**	**90**	**25**	**75**	**100**
Prerequisite:	**-**								
Course Objective	This course aims at providing an overall view of the • basic principles of physical chemistry experiments and gravimetric analysis • laboratory experiments in order to understand the concepts of physical changes in chemistry • rates of chemical reactions • hands on experience in carrying out the experiments. • study the gravimetric analysis method.								
Course Outcome	**By the end of this course, students will be able to:** • Describe the principles and methodology for the practical work. • Explain the procedure, data and methodology for the practical work • Apply the principles of kinetics, phase rule and electrochemistry for carrying out the practical work • Acquire practical knowledge in the determination of solubility of sparingly soluble salt, conductometric titrations. • Demonstrate laboratory skills for safe handling of the equipment and chemicals.								

Practical Component

Physical Chemistry Experiments

- Determination of rate constant of the acid catalyzed hydrolysis of ester.
- Construction of the phase diagram of a binary system (simple eutectic).
- Determination of the critical solution temperature (CST) of Phenol-Water system
- Determination of Unknown concentration of an electrolyte (KCl / NaCl) using phenol-water system.
- Determination of molecular weight by Rast method.
- Determination of transition temperature of the given substance ($Na_2S_2O_3.5H_2O$; $SrCl_2.6H_2O$; $CH_3COONa.3H_2O$)
- Determination of cell constant of the conductivity cell and equivalent conductance of KCl
- Determination of solubility and solubility product using conductometric method

Gravimetric Analysis

- Estimation of water of hydration.
- Estimation of Barium as Barium sulphate.
- Estimation of Lead as Lead chromate.

Total Hours	**90 Hrs.**

Pedagogy	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.

Text Books

- Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India : New Delhi, 2005.
- Khosla, B. D. Garg,V. C.; Gulati, A. *Senior Practical Physical Chemistry,* R. Chand : New Delhi, 2011.

Reference Books

- Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International : New Delhi, 2017.
- Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles of Practical Chemistry,*2nd ed.; Sultan Chand &Sons: New Delhi, 1997.

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences

Evaluation methodology

⇒ End Semester Practical Examination (Total-50 marks)

- Any one Experiment-30
  - Tabulation & Formula-10
  - Calculation & Nil Error-15
  - Graph -5
- Record-10
- Viva-10

SEMESTER – VII

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 16)						Semester: VII		
Course Name: Advanced Organic Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • photochemical intermediates involved in organic reactions. • organic synthetic strategies using the disconnection approach. • reactivity patterns of enolates and their mechanisms • synthesis of heterocyclic compounds with mono and di heteroatoms. • synthetic schemes based on photochemistry, enolates, and heterocyclics.								
Course Outcome	**By the end of the course, the students will be able to:** • Learn about photochemical intermediates involved in organic reactions. • Understanding the organic synthetic strategies using the disconnection approach. • Learning about Synthesis of heterocyclic compounds with mono and di heteroatoms.								

Content

UNIT-I	Photochemistry	No. of Hours: 12
Franck-Condon principle, Jablonski diagram, fluorescence and phosphorescence, Singlet and triplet states, Photosensitization, Quantum efficiency, Photochemistry of carbonyl compounds, Norrish type-I and type-II cleavages, Paterno-Buchi reaction, Photoreduction, Photochemistry of enones and para-benzoquinones, Di π – methane rearrangement, Photodynamic therapy, Photochemical [4+2] cycloaddition using singlet Oxygen; Barton reaction.		
UNIT-II	**Synthetic strategies - I**	**No. of Hours: 12**
Synthon, Synthetic equivalent, Functional group interconversion (FGI), Functional group addition, Functional group elimination. Criteria for selection of target; Linear and convergent synthesis; Retrosynthetic analysis and synthesis involving chemo selectivity, regioselectivity, reversal of polarity and cyclizations.		
UNIT-III	**Synthetic strategies - II**	**No. of Hours: 12**
Criteria for disconnection of strategic bonds; One group and two group C-X disconnections in 1,2-, 1,3-, 1,4- difunctional compounds. Protection and deprotection of functional groups in synthetic strategy: Protection of alcohols by silyl ethers and ester formations and their deprotection;		
UNIT-IV	**Enolate of carbonyl compounds**	**No. of Hours: 12**

Kinetic and thermodynamic control, Potential energy diagrams, methods of determining mechanisms isotopes effects, region and stereoselective reactions. Enolates: Regio- and stereo-selectivity in enolat generation. "O" versus "C" alkylation, Effect of solvent, Counter cation and Electrophiles; Symbioti effect; Thermodynamically and kinetically controlled enolate formations; Various transition state model to explain stereoselective enolate formation; Enamines; Regioselectivity in generation, Application i controlling the selectivity of alkylation.

UNIT-V	**Total Synthesis of Natural Products**	**No. of Hours: 12**

Importance, Recent advances and Need of Total synthesis.
Overview of total synthesis and biomimetic synthesis of natural products with importance in drug discovery
Retrosynthesis: Introduction to Synthons, Synthetic equivalent groups, Umpolung strategy, Disconnection approaches, Functional group interconversion. (With recent examples)
Role of protection and deprotection in natural product synthesis, Commonly utilized reagents for protection/deprotection of functional groups (carbonyl, acids, hydroxyl and amines)
Total synthesis of natural products with one recent example.

Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing models / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.

Text & Reference Books

- Finar, I.L. (2006). Organic Chemistry: Stereochemistry and the Chemistry of Natural Products. Dorling Kindersley Pvt. Ltd., 6th edition, India.
- McMurry J., Organic Chemistry, Asian Book Pvt. Ltd, 8th edition, New Delhi.
- Morrison, R.T., Boyd, R.N. (2011). Organic Chemistry, Prentice- Hall of India, 6th edition, New Delhi.
- Clayden,J.; Greeves,N.; Warren,S., (2012). Organic Chemistry, Oxford University press, 2nd edition.
- Warren S.; Wyatt, P. (2008). Organic Synthesis The Disconnection Approach, Wiley 2nd edition.
- Classics in Total Synthesis: Targets, Strategies, Methods, K.C. Nicolaou and E. J. Sorenson, 1996, Wiley-VCH.
- Organic synthesis: The disconnection approach, 2nd Edition, S. Warren and P. Wyatt, 2008 Wiley

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.organic-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.organic-chemistry.org/info/chemistry/inorganicchemistry.shtm
- https://www.epgpathshala.nic.in/

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry				Department: Chemistry					
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 17)						Semester: VII		
Course Name: Spectroscopic Identification of Organic Compounds							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60		25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • applications of UV-Visible spectroscopy in the identification of conjugation in organic compounds • IR spectroscopy to identify the various functional groups in organic molecules • structure of organic compounds using ^{1}H, ^{13}C, and 2D-NMR spectroscopy • basic principles and applications of organic-mass spectrometry. • UV-Visible, IR, NMR, and mass spectrometry in structure elucidation of organic compounds.								
Course Outcome	**By the end of the course, the students will be able to:** • Describe the applications of UV-Visible spectroscopy in the identification of conjugation in organic compounds • Apply IR spectroscopy to identify the various functional groups in organic molecules • Evaluate the structure of organic compounds using ^{1}H, ^{13}C, and 2D-NMR spectroscopy • Describe the basic principles and applications of organic-mass spectrometry. • Apply UV-Visible, IR, NMR, and mass spectrometry in structure elucidation of organic compounds.								
Content									
UNIT-I	Introduction to spectroscopic techniques:						No. of Hours: 12		
Structure elucidation. Application of UV – Visible and IR spectroscopy to organic structure elucidation. Electromagnetic spectrum, absorption of energy by organic compounds, types of spectroscopic methods to organic structure elucidation. Woodward – Fisher rules, Octant rule, Application of ORD – CD to stereochemical assignments. Organic functional group identification through IR spectroscopy									
UNIT-II	Application of NMR Spectroscopy						No. of Hours: 12		

Basic principles. Introduction to NMR techniques. CW and FT NMR techniques. 1H NMR Spectral parameters – intensity, chemical shift, spin-spin splitting, coupling constant, Anisotropic effect. Analysis of first order and second - order spectra. Structure determination of organic compounds by 1H NMR spectra

UNIT-III	**^{1}H NMR &^{13}C NMR:**	**No. of Hours: 12**

Proton coupled, off resonance decoupled, proton noise decoupled 13C NMR spectra, spin decoupling technique. Assignment of chemical shifts, additively effect, characteristic chemical shifts of common organic compounds and functional groups, DEPT & SEFT spectra. 2D NMR techniques ^{1}H – ^{1}H COSY, ^{1}H – ^{13}C COSY – HMBC, and NOESY.

UNIT-IV	**Application of Mass Spectrometry**	**No. of Hours: 12**

Basic principles, mass analyzers, ionization methods: EI, PI, CI, FAB, MALDI, ESI. Liquid chromatography and mass spectrometry, types of ions and fragmentations, even electron rule, nitrogen rule, isotope abundance, McLafferty rearrangement.

Organic structure elucidation, techniques of ion production, ion and daughter ions, molecular ion and isotope abundance. Nitrogen rule energetics of fragmentation, metastable ions, common fragmentation pathways, fragmentation pattern of common chemical classes. Illustrative examples from macromolecules and supramolecules.

UNIT-V	**Structural Elucidation of Organic Compounds**	**No. of Hours: 12**

Hands on Experience to interpret spectra such as UV-Visible, FT-IR, FT-Raman, NMR.
Methods of analyzing the data and interpretation of results.

	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / dramatizing models / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- R. M. Silverstein and F. X. Webster, Spectrometric identification of organic compounds, 6th Edn, Wiley.
- W. Kemp, Organic Spectroscopy, 3rdEdn., MacMillon, 1994.
- Pavia, Lampman and Kriz, Introduction to Spectroscopy, 3rdEdn., Brooks/Cole.
- D. H Williams and Ian Fleming, Spectroscopic methods in organic chemistry, Tata McGraw Hill,1998.
- W. Kemp, Introduction to multinuclear NMR.
- P. S. Kalsi, Spectroscopy of Organic Compounds, 6th edition, New age international, 2004.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.organic-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/

- https://sdbs.db.aist.go.jp/
- https://orgchemboulder.com/Spectroscopy/
- https://scilearn.sydney.edu.au/OrganicSpectroscopy/
- https://www.epgpathshala.nic.in/

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry				Department: Chemistry				
Department of Chemistry								
Year: IV	Course Category: Major Disciplinary Course (MJD 18)					Semester: VII		
Course Name Analytical lab						Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks	
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4		1	5	6	-	60	50	50	100
Prerequisite:	B.Sc., III year Completion with 75% of Marks							
Course Objective	This course aims at providing an overall view of the •							
Course Outcome	By the end of the course, the students will be able to: • Describe the techniques of Chromatography • Learns the principles & techniques of Separation • **Learns the techniques of solvent separation** • **Learns the techniques in spectrophotometer ,flame photometry** • **Learn sthe techniques involved in measurement of Ph**							

Content

UNIT-I	Chromatography	No. of Hours: 12

Paper chromatographic separation of Fe3+, Al3+, and Cr3+.
(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
iii. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.
(iv) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

UNIT-II	Solvent Extractions:	No. of Hours: 12

To separate a mixture of Ni2+ & Fe2+ by complexation with DMG and extracting the Ni2+-DMG complex in chloroform, and determine its concentration by spectrophotometry.
ii. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
iii. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques

UNIT-III	. Analysis of soil:	No. of Hours: 12

Determination of pH of soil.
(ii) Total soluble salt
(iii) Estimation of calcium, magnesium, phosphate, nitrate

UNIT-IV	Ion exchange	No. of Hours: 12

Determination of exchange capacity of cation exchange resins and anion exchange resins.
(ii) Separation of metal ions from their binary mixture.
(iii) Separation of amino acids from organic acids by ion exchange chromatography.

UNIT-V	Spectrophotometry	No. of Hours: 12

Determination of pKa values of indicator using spectrophotometry.
(ii) Structural characterization of compounds by infrared spectroscopy.
(iii) Determination of dissolved oxygen in water.
(iv) Determination of chemical oxygen demand (COD).
(v) Determination of Biological oxygen demand (BOD).
(vi) Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

Total Hours	**60 Hrs.**
Pedagogy	

Text & Reference Books

1.Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.
2. Willard, H.H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, D.C. Exploring Chemical Analysis, 9th Ed. New York, W.H. Freeman, 2016.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Edition.
7. Mikes, O. &Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
8. Ditts, R.V. Analytical Chemistry: Methods of separation. Van Nostrand, New York, 1974.

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Minor Disciplinary Course (MID 7)						Semester : VII		
Course Name: Pharmaceutical Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • Effectively impart knowledge about various diseases and their treatment. • Importance of Indian medicinal plants. • know about the different types of drugs								
Course Outcome	**By the end of this course, students will be able to:** • Have an idea about the pharmaceutical drugs and its applications • Understand the Indian medicinal plants and its uses. • Understand the knowledge about treatment of cancer • Elaborate the uses of drugs in day today life.								

Content

UNIT-I — **No. of Hours: 12**

Introduction to Pharmaceuticals :

Important terminologies- Drug – Pharmacy – Pharmacology – Pharmacodynamics – Pharmacokinetics – Molecular Pharmacology – Pharmacophore- Antimetabolites – Actinomycetes – Bacteria- Virus- Fungi- mutation- Chemotherapy- Pharmacopoeia – Pharmacognosy-Toxicology-Therapeutic index-classification of drugs- chemical- biological.

UNIT-II — **No. of Hours: 12**

Mechanism of drug action

extracellular and intracellular sites-drug receptors and biological responses - different types of drug action

Metabolism of drugs by oxidation, reduction, hydrolysis and conjugation or synthetic reactions.

Absorption of drugs - factors affecting it- routes of administration - enteral, parenteral, topical routes, their advantages and disadvantages.

UNIT-III — **No. of Hours: 12**

a) **First aid** – important rules – first aid kit – some common poisons and their antidotes.

b) **Common diseases** - Insect borne - air borne and water borne – their control and treatment – Disorders of digestive system, respiratory and nervous system – prevention and treatment - sexually transmitted diseases – symptoms & prevention - Indian medicinal plants and trees – their uses

c) **Anaemia** – Types – Causes and control

d) **Diabeties** – Types, Preventive measures and treatement.

e**) Blood pressure** – Systolic and diastolic – hypertensive drugs.

f) **sexually transmitted diseases** – Symptoms & Prevention

g) **Indian medicinal plants** and trees – their uses

UNIT-IV		**No. of Hours: 12**

Definition, Types, examples, structure, uses and side effects of

a) **Antibacterials** – Sulpha drugs-Sulphanilamide,Sulphapyridine,Sulphaguanidine,Structure – activity relationship

b) **Antibiotics** (Penicillin, Streptomycin, Chloramphenicol

c) **Antimalarials –Life Cyvle of** Malarial Parasite and drugs at different phases

d) **Antiseptics** and disinfectants

e) **Antineoplastic** agents

f) **Analgesics** – Antipyretics – narcotic and non-narcotic – anti-inflammatory

UNIT-V		**No. of Hours: 12**

a) **Anaesthetics**-

General (nitrous oxide, ether, ethyl chloride, Chloroform, cyclo propane, halo ethane) – Local (Cocaine, Benzocaine Procaine, Amethocaine, Lignoaine, Cinchocaine) Structure and uses- methods of administration.

b) **CNS affecting agents** –

Tranquilizers, sedatives, hypnotics, anti epileptics, psychedelic drugs - LSD Hashish- their effects.

	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- A Text Book of Pharmaceutical Chemistry - Jayashree Ghosh - S. Chand Company Ltd.
- A Text Book of Synthetic drugs - O.D. Tyagi - Ammol Publications.
- Introduction to Biological Chemistry _- J. Awapara Prentice Hall
- A text book of Biochemistry - Ambika.S
- Biochemistry - A.L.Lehinger.

Reference Books

- Pharmaceutical Chemistry - S. Lakshmi -Sultan Chand.
- Pharmacology and Pharmatherapeutics - R.S. Satoskar - Popular Prakashan - Vol.I and Vol.II
- Medicinal Chemistry - Asuthosh Kar - New Age International Publishers.
- Essentials of Biological Chemistry - James Fanley - East West Press

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.youtube.com/
- https://library.rcsi-mub.com/c.php?g=714082&p=5080092
- https://www.acsmedchem.org/
- https://researchguides.njit.edu/pharmaceutical/pharmaceutical-online-resources

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Minor Disciplinary Course (MID 8)						Semester: VII		
Course Name: Software's in Chemistry and their applications							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	3	-	1	6	45	30	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • ChemDraw software, it provides chemists and biologists with a rich set of easy-to-use tools for creating publication. • scientifically meaningful drawings of molecules, reactions and biological entities and pathways and for generating associated properties, systematic names and spectra. • Softwares in chemistry are highly useful to draw the exact structures and plotting the datas in a perfect and catchy way. • peak fitting with Origin software								
Course Outcome	**By the end of the course, the students will be able to:** • Applying chemdraw and chemsketch softwares for molecular modeling, writing structures and chemical equations • Understand scientific graphing and data analysis. • Applying computational chemistry softwares for calculating molecular parameters. • Communicate research and ideas using an extensive set of biological templates and drawing objects to create compelling illustrations of cells and pathways, including live chemical objects as needed.								
Content									
UNIT-I	**Basic ChemDraw Learning**					**No. of Hours: 12**			
Introduction to basic features of Chemdraw, Chemical structure to name conversion, Chemical name to structure conversion, NMR spectrum simulation (both H NMR &C13 NMR), Mass spectrum simulation, structure clean up, export to SVG,PDF. Introduction to Chemsketch-Molecular modelling, create and modifying images of chemical structures, write and perform chemical equations and diagrams.									
UNIT-II	**NMR spectral analysis using ChemDraw**					**No. of Hours: 12**			
Drawing a molecular Structure of Organic and Biochemical Compounds in 2D and 3D Dimensions. Drawing Chemistry Lab Equipment's, glassware's...Etc. Writing chemical equations. Determining Stereochemistry(Spatial Arrangement of particles), Chemical and physical properties of organic Compounds. 'H- NMR and C-13 NMR Spectral.									
UNIT-III	**Origin Software**					**No. of Hours: 12**			
Introduction to Origin, basic features like Scientific graphing, drawing various 2D &3D plots, Data									

analysis, statistics, signal processing, curve fitting, peak analysis, conversion of graph to various file format like JPEG, GIF, EPS.		
UNIT-IV	**Practical - I**	**No. of Hours: 12**
Hands on training of ChemDraw NMR Spectra Simulation		
UNIT-V	**Practical - II**	**No. of Hours: 12**
Hands on training of ChemSketch Origin Software		
	Total Hours	**75 Hrs.**
Pedagogy	⌖ Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning. ⌖ Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.	

References

- TopSpin | NMR Data Analysis | Bruker
- OriginLab - Origin and OriginPro - Data Analysis and Graphing Software
- Free Chemical Drawing Software for Students | ChemSketch | ACD/Labs (acdlabs.com)

Evaluation methodology

- End Semester Examination

SEMESTER- VIII

<table>
<tr><td colspan="5">Programme / Class: B.Sc. Honors in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Department of Chemistry</td></tr>
<tr><td colspan="2">Year: IV</td><td colspan="5">Course Category: Major Disciplinary Course (MJD 19 A)</td><td colspan="3">Semester: VIII</td></tr>
<tr><td colspan="7">Course Name: Polymer Chemistry</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical / Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>4</td><td>4</td><td>-</td><td>-</td><td>6</td><td>60</td><td>-</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">-</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• structure and properties of monomers, polymers, biopolymers
• types of polymerization reactions
• industrial methods of preparations of polymers
• characterization of polymers
• applications of polymers</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of the course, the students will be able to:
• Use essential descriptions about polymer chemistry.
• Defines related concepts.
• Recognizes monomers and polymers.
• Evaluate the structure of polymers.
• Recognizes bounds between polymer chains in different polymerization reactions.
• Interprets stereochemistry of polymers.
• Understand the characterization and identifications of polymers</td></tr>
<tr><td colspan="10"><u>Content</u></td></tr>
<tr><td colspan="2">UNIT-I</td><td colspan="5">Introduction</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">Polymer, monomer, examples of polymers, biopolymers, classification, polymerization process, degree of polymerization, condensation, addition polymers, kinetics of addition polymerization process.</td></tr>
<tr><td colspan="2">UNIT-II</td><td colspan="5">Polymeric Structure and Property Relationship</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">Structure of polymers - Linear, branched, cross linked, and network polymers, molecular weight (number average, weight average, viscosity average) and distribution of molecular weight, polydispersity index, crystallinity in polymer, melting temperature and glass transition temperature, Volumetric properties – molar volume, density, VanderWaals volume – Coefficient of linear thermal expansion and volumetric thermal expansion - Pressure volume temperature (PVT) relationship.</td></tr>
</table>

UNIT-III	Polymerization Chemistry	No. of Hours: 12
Industrial methods of polymerization such as a bulk, solution, emulsion, suspension. Stereochemistry of polymers and stereo-specific polymerization, Catalysts- their utility in polymers and stereo-specific polymerizations, Catalysts their utility in polymer manufacture, Zieglar-Natta, Metallocene and others.		
UNIT-IV	**Characterization of Polymers**	**No. of Hours: 12**
Molecular Weight Determination by Light Scattering, Osmometry, End-Group Analysis, Viscosity, Gel Permeation Chromatography.		
UNIT-V	**Identification of Polymers**	**No. of Hours: 12**
Application of FTIR, UV-visible, NMR, and Mass Spectroscopy for Identification of polymers.		
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- D.W.Van Krevelen and P.J.Hoftyzen, "Properties Of Polymer, 3rd Edition Elsevier Scientific, Publishing Company Amsterdam-Oxford -Newyork. 1990.
- J. E. Mark Ed. AIP, Physical Properties Of Polymers Hand Book,Williston,Vt,1996.
- Reaction Engineering of Step Growth Polymerization, SK Gupta and Anil Kumar, Plenum Press, 1987.
- Odian; George, Principles of Polymerization, McGraw-Hill Book Co., New York (1970).
- W. Billmeyer, Textbook of polymer science, 3rd Edn., 2007, Wiley.
- J. R. Fried, PolymerS cience and Technology, PHI publication, 2005.
- Billmeyer Jr.; Fred W., Textbook of Polymer Science, Wiley- Interscience Publishers,

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.youtube.com/
- https://www.epgpathshala.nic.in/
- https://www.polychemistry.com/
- https://guides.loc.gov/chemistry-resources/print-materials/polymers
- https://chimpoly.ulb.be/

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 19 B)						Semester: VIII		
Course Name: Material Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • crystal structure of solids • fundamentals of nanomaterials • characterization of nanomaterials • frontier areas of polymer science and technology • biodegradable polymers, fiber and rubber.								
Course Outcome	**By the end of the course, the students will be able to:** • Understands the crystal structure of solids • Recognize the fundamentals of nanomaterials • Explains the characterization of nanomaterials • Apply the skill of polymer science and technology in different areas. • Understands the biodegradable polymers, fiber and rubber.								

Content

UNIT-I	Crystal structure of solids	No. of Hours: 12

Fundamental of lattices, unit cell, atomic coordinates, Bravais lattices, crystal direction and planes, types of close packing, packing efficiency, radius ratios; few important crystal structures. Synthesis of Inorganic solids; solid state, solution phase and vapor phase synthesis; precipitation, hydrothermal, sol-gel, surfactant based synthesis. Growth of single crystals. Crystal structure determination by X-ray diffraction, d-spacing formula, symmetrically absent reflections, Multiplicities, Scattering of X-rays by an atom and a crystal. Single crystal and powder diffraction. Electron and neutron diffraction. Concept of reciprocal lattice. Electron microscopy techniques.

UNIT-II	Nanomaterial fundamentals	No. of Hours: 12

Synthesis: Bottom-up vs. Top-down Methods. Solution phase synthetic methods. Role of surfactant in shape and size control of nanomaterials. Synthesis of nanowires and nanotubes by CVD and MOCVD method.

UNIT-III	Characterization of Nanomaterial	No. of Hours: 12

Nanomaterials Characterization: XRD of nanomaterials, Electron microscopy (SEM, TEM, HRTEM and EDX) of nanomaterials, Scanning probe microscopy. Nanomaterial properties and applications: Magnetic properties of nanoparticles; super paramagnetism, ferromagnetismin

	antiferromagnetic nanoparticles and single domain to multi domain transition. magnetic nanoparticles as MRI contrast agents.	
UNIT-IV	**Frontier areas of polymer science and technology**	**No. of Hours: 12**
	Conducting polymers: basic principles of conducting polymers, delocalized electronic states of conjugated polymers, polyanilines, polyacetylenes, polythiophene, applications of conducting polymers.	
UNIT-V	**Bio Degradable Polymers**	**No. of Hours: 12**
	Biodegradable polymers: Definition, classification of natural biodegradable polymers, cellulose, cellulose acetate, cellophane, soy protein, corn, zein protein, wheat gluten protein, synthetic biodegradable polymers, polyhydroxy alkanoates, polycarpolactone, poly(vinylalcohol), polyacetic acid, application of biodegradable and biomedical polymers, contact lens, dental polymers, artificial heart, kidney, skin, and blood cells. Fibers: naturalfibers, cotton, wool, silk, rayon, artificial fibers, polyamides, acrylicacid, PVC, PVA. Rubber : Compounding and elastomeric properties, vulcanization, reinforcement.	
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- Zhen Guo and Li Tan, *Fundamentals and Applications of Nanomaterials*. 2009, Artech House, London Publication.
- Physical methods for chemistry: R.S.Drago, 1992, Saunders college publication.
- Polymer science, V.R.Gowariker, N.V.Viswanathan, J.Sreedhar, New Age International(P) Ltd., 2015.
- V.Gowriker, N.V.Viswanathan, J.Sreedhar, Polymer Science, New Age Int. Publication, 2019

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.youtube.com/
- https://www.epgpathshala.nic.in/
- https://www.polychemistry.com/
- https://guides.loc.gov/chemistry-resources/print-materials/polymers
- https://chimpoly.ulb.be/
- https://www.alfa-chemistry.com/products/nanomaterials-14.htm

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 20 A)						Semester: VIII		
Course Name: Medicinal Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • bio-physico chemical properties • structural properties of drugs • drug targets • medicinal chemistry of therapeutic agents • steroids, Prostaglandins, Enzyme, Hormone and Vitamins								
Course Outcome	**By the end of the course, the students will be able to:** • Understands the biological activity parameters • Recognize the properties of drugs • Understands the drug targets • Apply the therapeutic agents in our day today life. • Understands the Steroids, Prostaglandins, Enzyme, Hormone and Vitamins.								
Content									
UNIT-I	Bio-physico chemical properties						No. of Hours: 12		
Acidity / Basicity, Solubility, Ionization, Hydrophobic properties, Hydrophilic properties, Lipinski Rule, Drug-like properties, Understanding of the biological activity parameters such as Ki, Kd, LD50, EC50, IC50, CC50, ADMET properties									
UNIT-II	Structural properties						No. of Hours: 12		
Isosterism, Bioisosterism, Non classical isosteres, Understanding of the 3D-structure along with bond length, bond angle and dihydral angle, Concept of Configuration and Conformation with examples, Concept of stereochemistry in terms of biological response with examples, Stereo selective receptors or enzymes such as muscarinicreceptor, Stereochemically pure drug and recemates, Examples such as catecholamines, etc									
UNIT-III	Drug target understanding						No. of Hours: 12		
Metabolism, Drug metabolism, Anti-metabolite, Enzyme inhibitor, Agonist, Antagonist, Examples.									
UNIT-IV	Medicinal Chemistry of Therapeutic Agent						No. of Hours: 12		
Structure, Chemistry, Mode of action and adverse effect of the representative therapeutic agents such as Anti-infective agent, Antimalarials, Antibacterial, Antiviral, Anticancer, CNS									

	acting drugs, Adrenergic Agents, Cholinergic Drugs, Diuretics, Cardivascular, local anesthetic agent, Analgesic Agents, Histamine and Antihistamine agents	
UNIT-V	**Steroids, Prostaglandins, Enzyme, Hormone and Vitamins**	**No. of Hours: 12**
	Bio physico-chemical properties, Steroid Hormone Receptors, Chemical Contraceptive agents, COX-2 inhibitors, Prostaglandins for Ophthalmic use, pharmaceutically important enzyme products such as Pancreatin, Trypsin, Insulin. Classification of vitamins with examples.	
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical by Charles Owens Wilson, John H.Block, OleGisvold, John Marlowe Beale.
- Foye's Principles of Medicinal Chemistry by DavidA.Williams, Thomas L.Lemke, William O.Foye (2008), Kluwer publication.
- Remington: The Science and Practice of Pharmacy Vol 1, Ed. 19 by Joseph Price Remington, Alfonso R. Gennaro.(1995), MACK Publishing.
- Burgers Medicinal Chemistry by Manfred E. Wolff, AlfredBurger
- Burgers Medicinal Chemistry and Drug Discovery by Abraham D.J., LewisF.L., BurgerA., vol.5, 6th Edn., 2003,
- Hoboken N. J. Wiley, The Organic Chemistry of Drug Design and Drug Action by Silverman R.B., 2nd Edn., Academic Press. 2012.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.youtube.com/
- https://www.epgpathshala.nic.in/
- https://guides.library.vcu.edu/c.php?g=47681&p=298306
- https://www.organic-chemistry.org/
- https://www.ebi.ac.uk/chembl/

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 20 B)						Semester: VIII		
Course Name: Research Methodology for Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • identification of research problems • local resources and need for addressing the research problem and connect the research outcomes to society • communication of research findings • knowledge of safety and ethical handlings of chemicals in the lab and households								
Course Outcome	**By the end of the course, the students will be able to:** • Learn how to identify research problems. • Evaluate local resources and need for addressing the research problem • Find out local solution. • Know how to communicate the research findings.								

Content

UNIT-I	Literature Survey	No. of Hours: 12

Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, SciFinder, Scopus.

UNIT-II	Methods of Scientific Research and Writing Scientific Papers	No. of Hours: 12

Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation.

Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

UNIT-III	Research in Chemistry	No. of Hours: 12

Selecting a topic – hypothesis- design of experiment: variables, correlation and causality,

	sampling, use of controls, experimental bias, analysis, results, discussion of results, models., statistical analysis of experimental data using computers, mean, mode, deviation, standard deviation, plotting graph using spread sheet, preparation of seminar papers, project etc. using computers. Background Reading - Selected Internet Resources in chemistry –Major Publishers in Chemical science, Author, Citation, Computer Searching, Reviews, Keywords	
UNIT-IV	**Chemical Safety and Ethical Handling of Chemicals**	**No. of Hours: 12**
	Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.	
UNIT-V	**Data Analysis**	**No. of Hours: 12**
Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments. Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemo metrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations. Basic aspects of multiple linear regression analysis.		
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- Dean, J.R.; Jones, A.M.; Holmes, D;, Reed, R.; Jones, A.Weyers, J. (2011),Practical skills in chemistry, Prentice-Hall.
- Hibbert, D.B.; Gooding, J.J. (2006),Data analysis for chemistry, Oxford University Press.
- Topping, J.(1984),Errors of observation and their treatment, Chapman Hall, London
- Levie, R. de.(2001),How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge University Press.
- Le, C.T.; Eberly,L.E. (2016),Introductory Biostatistics, Wiley.
- Chemical safety matters IUPAC – IPCS, Cambridge University Press, 1992.
- OSU safety manual 1.01.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.youtube.com/
- https://libguides.eku.edu/chemistry
- https://iphindia.org/training/short-courses/erm-elearning-course-in-research-methods/?utm_medium=googlead&utm_campaignid=&utm_source=&utm_term=&gad_source=1&gclid=Cj0KCQjwi5q3BhCiARIsAJCfuZmhHzJKX5R6UlmZynYneNdD0DYVCl9tYnH_ArcIGRzi0hrMTtNDSFIaAmYgEALw_wcB
- https://www.rsc.org/journals-books-databases/research-tools/

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 21 A)						Semester: VIII		
Course Name: Nuclear and Radiation Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • fundamentals of nuclear and radiation chemistry • types of nuclear reactions • nuclear fission, nuclear fusion and nuclear reactors • radiation analysis and radiological safety								
Course Outcome	**By the end of the course, the students will be able to:** • Understands the of nuclear and radiation chemistry • Recognize types of nuclear reactions • Understands the nuclear fission and fusion reactions • Understands the radiation analysis and radiological safety								

Content

UNIT-I		No. of Hours: 12
Nucleus and its classification, nuclear forces, nuclear stability, binding energy, nuclear models. Radioactive decay (Radioactive elements, general characteristics of radioactive decay, decay kinetics - decay constant, half-life, mean life period), units of radioactivity, Transient and secular equilibria, Carbon dating and its usefulness.		
UNIT-II		**No. of Hours: 12**
Nuclear reactions: Bethenotation, types of nuclear reactions (n, p, α, β and γ), conservation of quantities (mass-energy and linear momentum) in nuclear reactions, reaction cross-section, compound nucleus theory and nuclear reactions. Nuclear fission: the process, fragments, mass distribution, and fission energy.		
UNIT-III		**No. of Hours: 12**
Measurement of radioactivity, idea about accelerator and detectors, Van de Graaaf and linear acceletors, synchrontrons, Geiger-Muller detector, Scintillaton detectors, Type of nuclear reactions, Nuclear fission, Nuclear fusion, Nuclear reactor: classification of reactors, the natural uranium reactor, breeder reactor. Nuclear fusion and stellar energy.		
UNIT-IV		**No. of Hours: 12**
Radiation chemistry: Elementary ideas of radiation chemistry, radiolysis of aqueous solutions, unit of radiation chemical yield (G-value), radiation dosimetry (Fricke'sdosimeter), units of radiation energy(Rad, Gray, Rontgen, RBE, Rcm, Sievert).		

UNIT-V		No. of Hours: 12
Nuclear pollution and Radiological safety: Interaction of radiation with matter, Radiolysis of water, Radiation dosimetry. Radioactive isotopes and their applications, Isotopic dilution analysis, Neutron activation analysis, disposal of nuclear waste, nuclear disaster and its management (nuclear accidents and holocaust– discussion about case studies).		
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- Friend lander G, Kennedy Gand Miller J.M. Nuclear and Radiochemistry, Wiley Inter science
- Harvey, B.G. Introduction to Nuclear Physics & Chemistry, Prentice– Hall,
- Overman R.T, Basic concept of Nuclear Chemistry, Chapman &Hall.
- A. N. Nesmeyanov, Radio chemistry, MIR Publication, Moscow.
- Spinks J. W.T. and Woods R. J. An Introduction to Radiation Chemistry, Wiley
- Arnikar H.J., Essentials of Nuclear Chemistry, Wiley Eastern, Second Edition.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.youtube.com/
- https://www.nrc.gov/reading-rm/basic-ref/glossary/radiation-nuclear.html

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 21 B)						Semester: VIII		
Course Name: Bio-Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • biological importance of carbohydrates • structures of proteins • enzymes and its classifications, mechanism. • biological importance of lipids • structures of DNA and RNA								
Course Outcome	**By the end of the course, the students will be able to:** • Understands the biological importance of carbohydrates • Explains the structures of proteins • Understands the enzymes and its classifications, mechanism. • Recognize the biological importance of lipids • Understands the structures of DNA and RNA								

Content

UNIT-I	Carbohydrates	No. of Hours: 12
Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle.		
UNIT-II	**Proteins**	**No. of Hours: 12**
Classification, biological importance; Primary, secondary and tertiary structures of proteins: α- helix and β- pleated sheets, Denaturation of proteins.		
UNIT-III	**Enzymes**	**No. of Hours: 12**
Nomenclature, Characteristics (mention of Ribozymes), Classification; Active site, Mechanism of enzyme action, Stereospecificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Biocatalysis in Green Chemistry and Chemical Industry		
UNIT-IV	**Lipids**	**No. of Hours: 12**
Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications.		
UNIT-V	**Structure of DNA/RNA**	**No. of Hours: 12**
Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy.		
	Total Hours	**60 Hrs.**

Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.

Text & Reference Books

- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VI the Edition. W.H.Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A. L. (2009) principles of Biochemistry.IV Edition.
- W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange medical Books/ McGraw-Hill

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.youtube.com/
- https://swayam.gov.in/explorer

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc., Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 22 A)						Semester: VII		
Course Name: Environmental Chemistry							Course Code: MJD 21A		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	SE	TM
4	5	-	-	5	60		25	75	100
Prerequisite:	B.Sc., III year Completion with 75% of Marks								
Course Objective	By the end of the course, the students will be able to: • Basic concepts of different water pollutants • Basic concepts of different soil pollutants • Basic concepts of different air pollutants • Basic concepts of different Noise and thermal pollutants • Environmental management and environmental laws								
Course Outcome	Learning outcomes By the end of the course, the students will be able to: • now different world life acts such as forest conversion act, water control pollution act and air prevention and control act. • Understand complete Knowledge about all kind of pollutions								

Content

UNIT-I	Water Pollution	No. of Hours: 12

Basic aspects of water-general principles of water (physical and chemical)-criteria of water quality.Types of water pollutants: sewage and domestic wastes-industrial wastes-agriculture discharges- toxic metals-oxygen demanding wastes-disease causing agents-oils- detergents and phosphates. Sampling: Basics of Sampling, sampling procedure, statistics, sampling and physical state, crushing and grinding, hazards waste of sampling, pre-concentration methods

UNIT-II	Soil Pollution	No. of Hours: 12

Introduction – soil pollution by industrial wastes. soil pollution by urban wastes, Radioactive pollutants and Agricultural waste- chemical and metallic pollutants-Biological agents – mining - Detrimental effects of soil pollutants – Effects of industrial pollutants- Effects of sewage and domestic wastes- Effects of heavy metals- Effects of radioactive pollutants- Effects of modern agro- technology – Diseases caused by soil pollution – solid waste management – sources and classification -public Health Aspects – methods of collection- Disposal methods – potential methods of disposal.

UNIT-III	Air Pollution	No. of Hours: 12

Classification and properties of air pollutants-emission sources-major emissions from global sources importance of anthropogenic sources-behavior and fate of air pollutants photochemical smog and its effects on health-vegetation-material damage in India. Air pollution sampling and measurement-ambient air sampling-collection of gaseous air pollutants collection of particulate pollutants-stack

sampling-analysis of air pollutants-sulphur dioxide-carbon monoxide-nitrogen dioxide-oxidants-ozone-hydro carbons and particulate matter		
UNIT-IV	**Noise and Thermal Pollution**	**No. of Hours: 12**
Noise pollution: sources-measurement of noise and indices-effect of meteorological parameters on noise propagation-noise exposure levels and standards –measurement of noise-impact of noise on human health Thermal pollution: Introduction-definition-sources-harmful effects-toxic compounds in traces prevention and control of thermal pollution –thermal power projects in India.		
UNIT-V	**Environmental Management and Important Environmental Laws:**	**No. of Hours: 12**
Environmental Management: Introduction-objectives-components-environmental impact assessment (EIA)-historical background-elements of EIA process-participants in EIA processes contents of EIS-design of EIA. Important Environmental Laws: the world life act-the forest conservation act-the water and control pollution act-air prevention& control act—the environment act-environmental quality management standard-ISO 14000 series.		
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Reference Books

- Environmental Chemistry by W. Moore and J.Moore
- Environmental chemistry by J.O.M. Bokriss
- Environmental by BK Sharma
- Environmental chemistry by SS Dara
- Environmental chemistry by Mahajan
- Environmental chemistry by a.K.De.

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 22 B)						Semester: VIII		
Course Name: Advanced Analytical Chemistry							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • study the statistical methods in chemical analysis • study the atomic spectroscopy • study the thermo analytical method • learn Polarography techniques • learn Chromatographic methods								
Course Outcome	**By the end of the course, the students will be able to:** • Understand statistical methods in chemical analysis • Gain understanding about statistical evaluation of analytical data • Understand thermo analytical methods • Understand the Polarography techniques • Explain Chromatographic methods								

Content

UNIT-I	Statistical methods in chemical analysis	No. of Hours: 12

Theory of error and treatment of quantitative data, accuracy and precision, ways of expressing accuracy and precision, Normal error curve and its equation. Useful statistical tests with equation, test of significance, the F-test, the students t-test, the Chi-test, the correlation coefficient, confidence limit of the mean, comparison of two standard values, comparison of two standard values, comparison of standard deviation with average deviation, comparison of mean with true values, regression analysis (least square method).

UNIT-II	Polarography	No. of Hours: 12

Current-voltage relationship, theory of polarographic waves, instrumentation, qualitative and quantitative applications.

UNIT-III	Atomic spectroscopy	No. of Hours: 12

Atomic absorption spectroscopy, theory and application (with some examples).

UNIT-IV	Thermal analysis	No. of Hours: 12

Theory, methodology, instruments and applications of theromo gravimetric analysis (TGA/DTA)

UNIT-V	Chromatography	No. of Hours: 12

	Principles of chromatography, paper, column and thin layer chromatography, Gas-liquid chromatography, HPLC.	
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons, 1989.
- Willard, H.H., Merritt, L.L., Dean,J.A. and Settle, F. A., Instrumental Methods of Analysis, CBS Publishers, 7th Edition, 1988.
- Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
- Skoog, D.A, Holler, S.J,.Nilman, T.A., Principles of Instrumental Analysis, Cengage Learning India Ed. (Skoog, D.A, Holler, S.J,.Nilman, T.A., Principles of Instrumental Analysis, 5th Edn.,Saunders college publishing, London, 1998.)
- Mikes, O. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
- Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.
- Ewing, G.W., Instrumental Methods of Chemical Analysis, 5th Edition, McGraw-Hill,New York, 1988.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.youtube.com/
- https://swayam.gov.in/explorer
- https://www.epgpathshala.nic.in/
- https://www.youtube.com/results?search_query=analytical+chemistry

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc. Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course (MJD 23 A)						Semester: VIII		
Course Name: Novel Inorganic Solids							Course Code:		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	ESE	TM
4	4	-	-	6	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • Solid-state chemistry also referred as material chemistry currently has emerged with great focus on novel inorganic solids. • enormous applications in both industrial and research areas • materials such as semiconductors, metals, composites, nanomaterials, carbon or high-tech ceramics make life easier in this era and are great sources of industrial growth and technological changes. • undergraduates with science backgrounds can groom them for future researches.								
Course Outcome	**By the end of the course, the students will be able to:** • Understand the mechanism of solid-state synthesis. • Explain about the different characterization techniques and their principle. • Understand the concept of nanomaterials, their synthesis and properties. • Explain the mechanism of growth of self-assembled nanostructures. • Appreciate the existence of bioinorganic nanomaterials. • Explain the importance of composites, conducting polymers and their applications. • Understand the usage of solid materials in various instruments, batteries, etc. which would help them to appreciate the real life importance of these materials								
Content									
UNIT-I							No. of Hours: 12		
Basic introduction to solid-state chemistry: Semiconductors, different types of semiconductors and their applications. **Synthesis of inorganic solids:** Conventional heat and beat method, Co-precipitation method, Sol-gel method, Hydrothermal method, Chemical vapor deposition (CVD), Ion-exchange and Intercalation method.									
UNIT-II							No. of Hours: 12		

	Characterization techniques of inorganic solids: Powder X-ray Diffraction, UV-visible spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Fourier-Transform Infrared (FTIR) spectroscopy, Brunauer–Emmett–Teller (BET) surface area analyser, Dynamic Light Scattering (DLS)	
UNIT-III		**No. of Hours: 12**
Speciality polymers: Conducting polymers - Introduction, conduction mechanism, polyacetylene, polyparaphenylene, polyanilineandpolypyrrole, applications of conducting polymers, ion-exchange resins and their applications. **Ceramic & Refractory:** Introduction, classification, properties, manufacturing and applications of ceramics, refractory and superalloys as examples.		
UNIT-IV		**No. of Hours: 12**
	Nanomaterials: Overview of nanostructures and nanomaterials, classification, preparation and optical properties of gold and silver metallic nanoparticles, concept of surface plasmon resonance, carbon nanotubes, inorganic nanowires, Bioinorganic nanomaterials, DNA and its nanomaterials, natural and artificial nanomaterials, self-assembled nanostructures, control of nanoarchitecture, one dimensional control	
UNIT-V		**No. of Hours: 12**
	Composite materials: Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, bio-nanocomposites, environmental effects on composites, applications of composites.	
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Text & Reference Books

- West, A. R. (2014), Solid State Chemistry and Its Application, Wiley.
- Smart, L. E.; Moore, E. A., (2012), Solid State Chemistry: An Introduction CRC Press Taylor & Francis.
- Poole Jr.; Charles P.; Owens, Frank J. (2003), Introduction to Nanotechnology, John Wiley and Sons.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.youtube.com/

Evaluation methodology

- End Semester Examination

Programme / Class: B.Sc., Honors in Chemistry					Department: Chemistry				
Department of Chemistry									
Year: IV	Course Category: Major Disciplinary Course -MJD 23 B						Semester: VII		
Course Name: Computational Chemistry (MJD 23 B)							Course Code: MJD 23 B		
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam Maximum Marks		
	Lecture	Tutorial	Practical / Practice		Theory	Lab Session	CA	SE	TM
4	5	-	-	5	60		25	75	100
Prerequisite:	B.Sc., III year Completion with 75% of Marks								
Course Objective	By the end of the course, the students will be able to: • This is an advanced course for students who are intrestedin Computational Chemistry. • The objective of this course is that students learn the techniques of molecular quantum chemistry and apply them to study chemical and biochemical problems.								
Course Outcome	Learning outcomes By the end of the course, the students will be able to: • **Understands theoretical knowledge on molecules**								

Content

UNIT-I		No. of Hours: 12
Many Electron atoms: Electron correlation, addition of angular momentum, Clebesch-Gordan series, total angular momentum and spin-orbit interaction.		
UNIT-II		**No. of Hours: 12**
Ab Initio Methods: Review of molecular structure calculations, Hartree-Fock SCF method for molecules, Roothaan-Hartree-Fock method, selection of basis sets.		
UNIT-III		**No. of Hours: 12**
Electron Correlation and Basis Sets: Configuration Interaction, Multi-Configuration Self Consistent Field, Multi-Reference Configuration Interaction, Many-Body Perturbation Theory, Coupled Cluster, Basis sets.		
UNIT-IV		**No. of Hours: 12**
DFT and Force Fields method: Energy as a functional of charge density, Kohn-Sham equations. Molecular mechanics methods, minimization methods, QSAR.		
UNIT-V		**No. of Hours: 12**
Practical Implementation of Density Functional Theory (DFT): Kohn-Sham formulation: Plane waves and pseudopotentials, Janak's theorem, Ionization potential theorem, Self consistent field (SCF) methods, Understanding why LDA works, Consequence of discontinuous change in chemical potential for exchange-correlation, Strengths and weaknesses of DFT.		

	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Reference Books

- Introduction to Computational Chemistry, F. Jensen, 2nd edition, Wiley-Blackwell (2006).
- Molecular Quantum Mechanics, P. W. Atkins and R. S. Friedman, 3rd edition, Oxford University Press, Oxford (1997).
- Quantum Chemistry, H. Eyring, J. Walter and G.E. Kimball, (1944) John Wiley, New York.
- Quantum Chemistry, I.N. Levine, 5th edition (2000), Pearson Educ., Inc., New Delhi.
- Modern Quantum Chemistry: Introduction to Advanced Electronic Structure, A. Szabo and N. S. Ostlund, (1982), Dover, New York

Minor for other Departments
SEMESTER - IV

Programme / Class: Minor in Chemistry				**Department: Chemistry**				
Can be opted by Department of Physics , Botany, Zoology & CND								
Year: II	**Course Category: Minor Disciplinary Course (MID 4)**					**Semester : IV**		
Course Name*:* ***Fundamentals of Chemistry - I***						**Course Code:**		
Credits	**Credit distribution of the course**			**No. of Hours / Week**	**Total Hours**		**End Semester Exam. Maximum Marks**	
	Lecture	**Tutorial**	**Practical /Practice**		**Theory**	**Lab Session**	**CA**	**ESE**	**TM**
4	**4**	**-**	**-**	**5**	**60**	**-**	**25**	**75**	**100**
Prerequisite:		**-**							
Course Objective	This course aims at providing an overall view of the • Concepts of carbohydrates. • Amino acids, proteins, enzymes and essential elements of biosystem. • Basics of hormones, nucleic acids and vitamins. • Chemistry of oil, fats and lipids.								
Course Outcome	**By the end of this course, students will be able to:** • Explain the preparation and property of carbohydrate. • Enlighten the biological role of amino acids, proteins and enzymes. • Gain in-depth knowledge about the nucleic acids and vitamins. • Understand and learn the properties of oil, fats and lipids.								

Content

UNIT-I	**Atomic Structure and Periodic Classification of Elements**	**No. of Hours: 12**

Structure of Atom, Fundamental Particles, Atomic Mass, Atomic number, Isotopes, Bohr Theory of atoms. Orbital –Quantum Numbers, Aufbau Principle, Hund's rule, Pauli's exclusion principle,. Electronic configurations of the atoms –Half-filled and completely filled orbital's, Modern Periodic Table : Periods, Groups ,Periodicity - Valency, Atomic Radius, Electronegativity ,Ionization Potential & Electron Affinity .

UNIT-II	**Fundamentals of Organic Chemistry**	**No. of Hours: 12**

Classification of Organic Compounds- IUPAC Nomenclature and simple organic molecules, Hybridization (sp, sp2 and sp3) in organic compounds ,localized and delocalized chemical bonds , Hydrogen Bonding ,Dipole Moments in Organic Molecules ,Homolytic and Heterolytic Bond cleavage ,Electtrophiles ,Nucleophiles and free Radicals ,Carbocations and Carbanions .

UNIT-III	**Isomerism**	**No. of Hours: 12**

Isomerism – Structural and Stereo isomerism

(a) Geometrical isomerism – Cis, trans Isomers with Respect to Maleic acid and Fumaric acid

(b) Optical isomerism -Optical activity , Specific Rotation ,enantiomers, diastereomers, Chirality,

racemization and resolution. Of Lactic acid and Tartaric acid.

UNIT-IV	Nuclear Chemistry	No. of Hours: 12

Natural Radioactivity –Properties of Alpha, Beta and Gamma Rays, Fundamentals Particles. Isotopes, Isobars, Isotones and Isomers. Differences between Chemical Reactions and Nuclear Reactions –Group Displacement law –Rate of Radio Active Disintegration –Half –Life Period – Nuclear Fission – Nuclear Fusion –Fertile and Fissile Isotope –Radio Active Isotopes – Applications in Medicine ,Industry and Plant Science. Nuclear reactors – working principle

UNIT-V		No. of Hours: 12

.a) Environmental Chemistry : Sources and control of Pollution (Pesticides, Nuclear & Industrial)
b) Natural Products - Definition ,Sources and Applications of the following compounds :
(i) Alkaloids- Nicotine and Quinine
(ii) Terpenoids – Citral and Menthol
(iii) Anthocyanin – Cyanine
C0 production of Ethanol by Industrial method using Fermentation Process.

	Total Hours	60 Hrs.
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Madan,R.D. and SathyaPrakash, *Modern Inorganic Chemistry,* 2nd ed.; S.Chand and Company : New Delhi, 2003.
- Rao,C.N.R. University General Chemistry, Macmillan Publication : New Delhi, 2000.
- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone.

Reference Books

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. &Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://www.organic-chemistry.org/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.organic-chemistry.org/info/chemistry/inorganicchemistry.shtm
- https://www.youtube.com/

Evaluation methodology

⇒ End Semester Examination

SEMESTER - V

Programme / Class: Minor in Chemistry				Department: Chemistry					
Can be opted by Department of Physics , Botany, Zoology & CND									
Year: III	Course Category: Minor Disciplinary Course (MID 5)					Semester : V			
Course Name: *Fundamentals of Chemistry – II*						Course Code:			
Credits	Credit distribution of the course			No. of Hours / Week	Total Hours		End Semester Exam. Maximum Marks		
	Lecture	Tutorial	Practical /Practice		Theory	Lab Session	CA	SE	TM
4	4	-	-	5	60	-	25	75	100
Prerequisite:	-								
Course Objective	This course aims at providing an overall view of the • . Understand the chemistry of Carbohydrate • Analysis and Sources of oils ,fats and vitamins • .Importance of Lipids and nucleic Acid • Classification & Preparation of Amino acid • Analytical uses of Chromatography								
Course Outcome	**By the end of this course, students will be able to:** • Understand the chemistry of Carbohydrate • Understand the chemistry of oils, Vitamins and Fats. • Understand the knowledge of Amino Acids and proteins • Recognize the uses of Chromatography in today life.								

Content

UNIT-I	Carbohydrates	No. of Hours: 12

Definition, Classification, Reactions of glucose and fructose. Mutarotation – Disaccharides-Sucrose-Invert sugar and Maltose sources and uses. Polysaccharides-Starch & cellulose and their derivates, sources and uses. Biological importance of carbohydrates.

UNIT-II	Oils, Fats & Vitamins	No. of Hours: 12

Oils and fats: Classification, extraction methods, refining of fats and oils, properties, analysis of oils and fats- Acid value, Saponification value, Iodine number, hydrogenation of oils -Distinction between oils and fats-Difference between vegetable and mineral oils-Uses of oils and fats.
Vitamins and minerals: sources and deficiency diseases.

UNIT-III	Lipids and Nucleic acid	No. of Hours: 12

Lipids: Definition, Classification, Biological importance of triglycerides and phosphoglycerides and cholesterol**.**
Nucleic acid: Nucleic acid – Structure of DNA and RNA, brief account of m-RNA, t-RNA and ϑ-RNA – differences between DNA and RNA. Biological functions –nucleosides –nucleotides &

nitrogenous bases (A, T, G, C, U)		
UNIT-IV	**Amino Acids and Proteins**	**No. of Hours: 12**
Amino Acids: Classification–zwitter ion and isoelectric point of amino acids. Preparation of alpha-amino acids with special reference to Gabriel Phthalimide and Strecker method. Tests for amino acids**.** Peptide linkage –synthesis of dipeptide -polypeptides **Proteins:-** Classification of protein, structure of protein (determination of structure are not required). Protein denaturation, renaturation. Test for protein		
UNIT-V	**Chromatographic Methods**	**No. of Hours: 12**
Theory and Principles –Classification of Chromatographic methods- (a) Column chromatography: Principles and experimental Procedures –Adsorbents an solvent systems –Applications. (b) Thin Layer Chromatography: Principles and experimental Procedures –Adsorbents –preparation of TLC Plates –Rf Values – Applications –Separation of dyes. © Paper Chromatography: -Principles –Ascending, Descending and radial techniques –Rf Values –Applications – Separation of Amino acids.		
	Total Hours	**60 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry,* 2nd ed.; S. Chand and Company: New Delhi, 2003.
- Rao, C.N. R. University General Chemistry, Macmillan Publication: NewDelhi, 2000.
- Puri B.R., Sharma L.R. and Kalia K.C. Principles of Inorganic Chemistry, Milestone. .

Reference Books

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd Ed., Wiley.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education India, 2006.
- Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
- A.K. De,"Environmental Chemistry".

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.chemtube3d.com/
- https://www.youtube.com/

Evaluation methodology

⇒ End Semester Examination

SEMESTER - VI

<table>
<tr><td colspan="5">Programme / Class: Minor in Chemistry</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Can be opted by Department of Physics , Botany, Zoology & CND</td></tr>
<tr><td colspan="2">Year: III</td><td colspan="5">Course Category: Minor Disciplinary Course (MID 6)</td><td colspan="3">Semester : VI</td></tr>
<tr><td colspan="7">Course Name: Basic Chemistry Practical</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="3">Credits</td><td colspan="3">Credit distribution of the course</td><td rowspan="3">No. of Hours / Week</td><td colspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="5"></td><td colspan="3">Maximum Marks</td></tr>
<tr><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>4</td><td>-</td><td>1</td><td>4</td><td>5</td><td>-</td><td>60</td><td>50</td><td>50</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">-</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• Theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for chemistry.
• Basic principles involved in titrimetric analysis
• Skill on the methodologies of different titrimetric analysis
• Analysis of organic compounds</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Apply the principles of volumetric analysis
• Select the correct titrimetric procedure along with standard and nonstandard solutions.
• Perform all sorts of volumetric calculations.
• Understand the concept of titrimetric in applied analysis
• Observe the physical state, odour, colour and solubility of the given organic compound.
• Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.</td></tr>
<tr><td colspan="10"><u>Content</u></td></tr>
<tr><td colspan="10">• Volumetric Analysis
1. Estimation of oxalic acid against NaOH.
2. Estimation of Ferrous ion using $KMnO_4$.
3. Estimation of oxalic acid using $KMnO_4$.</td></tr>
<tr><td colspan="10">• Systematic Analysis of Unknown organic compounds:
o Tests to find whether saturated or unsaturated.
o Tests to find whether aromatic or aliphatic.</td></tr>
</table>

- Detection of nitrogen, sulphur and halogens.
- Tests to find the functional group.
  (Carboxylic acid (mono and di), phenol, aldehyde, ketone, carbohydrate, aliphatic diamide (Urea).

Total Hours	**60 Hrs.**
Pedagogy	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.

Reference Books

- Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
- Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. &Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
- V. Venkateswaran, R.Veeraswamy and A.R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.

Web Resource

- https://www.vlab.co.in/broad-area-chemical-sciences
- http://www.federica.unina.it/agraria/analytical-chemistry/volumetric- analysis
- https://chemdictionary.org/titration-indicator/

Evaluation methodology

⇒ End Semester Practical Examination (Total – 50 marks)

- Brief procedure-5 marks
- Volumetric Experiment-15 marks
- Organic Analysis-20 marks
- Record-10 marks

MULTIDISCIPLINARY COURSES
MLDC
Can be opted by other Departments (semester –I / II / III)

<table>
<tr><td colspan="5">Programme / Class: Certificate / Diploma</td><td colspan="5">Department: Chemistry</td></tr>
<tr><td colspan="10">Can be opted by all Departments</td></tr>
<tr><td colspan="2">Year: I / II</td><td colspan="5">Course Category: Multi Disciplinary Course (MLD)</td><td colspan="3">Semester : I / II / III</td></tr>
<tr><td colspan="7">Course Name: Chemicals in life</td><td colspan="3">Course Code:</td></tr>
<tr><td rowspan="2">Credits</td><td colspan="3" rowspan="2">Credit distribution of the course</td><td rowspan="2">No. of Hours / Week</td><td colspan="2" rowspan="2">Total Hours</td><td colspan="3">End Semester Exam.</td></tr>
<tr><td colspan="3">Maximum Marks</td></tr>
<tr><td></td><td>Lecture</td><td>Tutorial</td><td>Practical /Practice</td><td>Theory</td><td>Lab Session</td><td>CA</td><td>ESE</td><td>TM</td></tr>
<tr><td>3</td><td>3</td><td>-</td><td>-</td><td>4</td><td>45</td><td>-</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="8">Nil</td></tr>
<tr><td colspan="2">Course Objective</td><td colspan="8">This course aims at providing an overall view of the
• importance of Chemistry in everyday life
• chemistry of soap, detergents, cosmetics and food
• chemistry of Drugs and pharmaceuticals</td></tr>
<tr><td colspan="2">Course Outcome</td><td colspan="8">By the end of this course, students will be able to:
• Familiarize the students on chemistry in everyday life
• Know about various food preservatives, adulterants, additives and their analysis
• Identity the adulterants present in regular food items
• Understand the hazards of food colors and its real life implications
• Know about the health hazards of the cosmetic items and food colors
• Know about the pharmaceutical drugs and its activity.</td></tr>
<tr><td colspan="10"><u>Content</u></td></tr>
<tr><td colspan="2">UNIT-I</td><td colspan="5">Chemicals in life- I</td><td colspan="3">No. of Hours: 05</td></tr>
<tr><td colspan="10">Household chemicals: Common chemicals used at home.
Toxic household chemicals and their effects (antifreeze, bleach, drain cleaners, carpet cleaners, ammonia, air fresheners).
(No structural formula and preparation needed)</td></tr>
<tr><td colspan="2">UNIT-II</td><td colspan="5">Chemicals in life- II</td><td colspan="3">No. of Hours: 12</td></tr>
<tr><td colspan="10">Chemicals in food production -Artificial sweeteners, food additives, food preservatives. Important chemical ingredients/ taste makers used in packed food and soft drinks - its health hazards.
Adulterants in Milk, Ghee, Oil, Coffee powder, Tea, Asafoetida, Chilli powder, Pulses andTurmeric powder – identification techniques (outline only).
(No structural formula and preparation needed)</td></tr>
</table>

UNIT-III	Chemicals in life- III	No. of Hours: 08
Tooth paste – Contents of toothpaste, chemical name, ingredients, flavor and its role. **Cosmetics** – Contents and uses of Face powder, snow, lipsticks, lip Bomb, Mehandi and perfumes. **Plastics** in daily use, polythene, PVC, Bakelite, polyesters and their applications. **(No structural formula and preparation needed)**		
UNIT-IV	**Chemicals in life- IV**	**No. of Hours: 12**
Soaps and detergents- Types of soaps, synthetic detergents (neutral, anionic and cationic), cleansing action of detergents. Advantages and disadvantages of detergents over soaps. Common detergent chemicals. Additives, Excipients colours and flavours. Enzymes used in commercial detergents. Environmental Hazards. **(No structural formula and preparation needed)**		
UNIT-V	**Chemicals from Natural sources**	**No. of Hours: 08**
Uses of Aloe Vera ,Neem ,Anthocyanin, Rose flower ,Hibiscus Rosa -Sinensis, , sandalwood Tree ,Cucumber ,Lemon Tree, Tomato plant ,Amla ,Henna ,Thoothuvalai ,Avaram Poo ,Soapnut,,Pachai Payaru in Cosmetic Field .		
	Total Hours	**45 Hrs.**
Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	

Basic Text Books

- Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
- A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
- S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
- B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, 16th edition, 2014.
- Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.
- Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S.Chand & Co. Publishers, second edition, 2006.
- Chemistry in Daily Life: Third Edition Paperback – 1 January 2012 by Singh K.

CHEMISTRY OF COSMETICS

Certificate / Diploma						**Department: Chemistry**			
Can be opted by all Departments									
Year: I / II	**Course Category: Multi Disciplinary Course (MLD)**						**Semester : I / II / III**		
Course Name: Chemistry of Cosmetics							**Course Code:**		
Credits	**Credit distribution of the course**			**No. of Hours / Week**	**Total Hours**		**End Semester Exam. Maximum Marks**		
	Lecture	**Tutorial**	**Practical /Practice**		**Theory**	**Lab Session**	**CA**	**ESE**	**TM**
3	**3**	**-**	**-**	**4**	**45**	**-**	**25**	**75**	**100**

Prerequisite:	**Nil**
Course Objective	This course aims at familiarizing the • students with formulations of various types of cosmetics and their significance • hair, skin and dental care • makeup preparations and personal grooming
Course Outcome	**By the end of this course, students will be able to:** • Know about the composition of various cosmetic products • Understand chemical aspects and applications of hair care and dental care and skin care products. • Understand chemical aspects and applications of perfumes and skin care products. • Understand the methods of beauty treatments their advantages And disadvantage • Understand the hazards of cosmetic products.

Content

UNIT-I		**No. of Hours: 12**

Skin care

Nutrition of the skin, skin care and cleansing of the skin; face powder–ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels–formulation and advantages; astringent and skin tonics–key ingredients, skin lightness, depilatories.

UNIT-II		**No. of Hours: 08**

Hair care

Shampoos – types – powder, cream, liquid, gel–ingredients; conditioner – types – ingredients

Dental care

Toothpastes – ingredients – mouth wash

UNIT-III		**No. of Hours: 05**

Make up

Base – foundation – types – ingredients; lipstick, eye liner, mascara, eye shadow, concealers, rouge

UNIT-IV		No. of Hours: 10

Perfumes

Classification – Natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic–classification emphasizing characteristics – esters – alcohols – aldehydes – ketones

UNIT-V	Chemicals from Natural sources	No. of Hours: 10

Uses of Aloe Vera ,Neem ,Anthocyanin, Rose flower ,Hibiscus Rosa -Sinensis, , sandalwood Tree ,Cucumber ,Lemon Tree, Tomato plant ,Amla ,Henna ,Thoothuvalai ,Avaram Poo ,Soapnut,,Pachai Payaru in Cosmetic Field .

	Total Hours	45 Hrs.

Pedagogy	Mainly lectures, tutorials and practice. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.

Basic Text Books

- Thankamma Jacob, (1997) Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.
- Butler, H. (2000), Poucher's Perfumes, Cosmetic and Soap, Springer.
- Garud, A.; Sharma, P.K.; Garud, N. (2012), Text Book of Cosmetics, Pragati Prakashan.

Reference Books

- Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London.
- George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Therones, Chettenham
- Natural Ingredients for Cosmetics; EU Survey 2005

Web Resource

- https://onlinecourses.nptel.ac.in/
- https://swayam.gov.in/explorer
- https://www.khake.com/page75.html
- Net.foxsm/list/284

Evaluation methodology

⇒ End Semester Examination