HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

Uthamapalayam 625 533.

DEPARTMENT OF CHEMISTRY

BACHELOR OF SCIENCE – CHEMISTRY

SYLLABUS

Choice Based Credit System – CBCS

(As per TANSCHE/MKU Guidelines)

with

Outcome Based Education (OBE)

(with effect from the Academic year 2020 -2021 onwards)

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Name of the Programme: B.Sc. Chemistry

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(As per TANSCHE/MKU Guidelines)

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Outcome Based Education (OBE)

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College Vision and Mission

Vision

Our vision is to provide the best type of higher education to all, especially to students hailing from minority Muslim community, rural agricultural families and other deprived, under privileged sections of the society, inculcating the sense of social responsibility in them. Our college is committed to produce talented, duly-bound citizens to take up the challenges of the changing times.

Mission

Our mission is to impart and inculcate social values, spirit of service and religious tolerance as envisioned by our beloved Founder President Hajee Karutha Rowther.

The Vision beckons..... the Mission continuous forever.

Programme Educational Objectives (PEO)

Our graduates will be progressive, efficient, value based, academically excellent, creative, collaborative, empowered and globally competent literates with the skills required for societal change.

They will demonstrate

PEO1	Comprehensive knowledge and expertise, employability, the acumen of creative and critical thinking, the spirit of enquiry and professional attitude required for a successful career.
PEO2	Accountability, linguistic competence and communication skills in the work environment and beyond.
PEO3	Perseverance, effective collaboration, team spirit, leadership and problem solving skills.
PEO4	Their keen sense of civility, professional ethics, receptivity and moral righteousness.
PEO5	The commitment to address social and environmental threats and as responsible service-minded, duty-bound global citizens.

Department Vision and Mission

Vision

Generate knowledgeable Chemists and scientists to enhance services to the society.

Mission

- Enable the students to excel in the subject, research and services.
- Elevate students to international standards.
- Encourage the students to take up competitive examinations.

Programme Outcomes (PO)

On completion (after three years) of B.Sc. Chemistry Programme, a graduate will

PO1	Recall the knowledge of organic, inorganic, physical, thermodynamics, nuclearchemistry,polymers, photochemistry, nanostructured materials, drugs,catalysis, colloids, electrochemistry, cheminformatics and chemotherapy.
PO2	Explain the experiments in the area of physical chemistry experiments, preparation,estimation and analysis of organic and inorganic compounds.
PO3	Develop critical thinking, analytical reasoning, problem-solving techniques andinnovative methods to design and perform experiments.
PO4	Create an awareness of the impact of chemistry in various disciplines likebiological,biodiversity, pollution, disastermanagement, environment,forensic, analytical and pharmaceutical fields.Use communication skillswith comprehensive subject knowledge for competitive examinations.
PO5	Pursue post graduate program in higher educational institutions and also to getsuitable employment opportunities in industries and academic institutions

Programme Specific Outcomes (PSO)

The graduates are

PSO 1	Expertise in Chemistry: Will be able to nurture the needs of industries/laboratories related to chemistry including pharmaceutical/analytical chemistry
PSO 2	Professional Growth: Will be able to demonstrate information literacy skills for acquiring knowledge of chemistry, as a chemist/researcher and also as a life-long learner
PSO 3	Analytical Skills: Will be able to communicate effectively the scientific information and research results in written and oral formats, to both professional scientists and to the public
PSO 4	Research Skills: Will be able to do research
PSO 5	Employability and Leadership: Students will be equipped with the life-long learning process for self-sustainability, employability and leadership roles inour dynamic society.

Programme Scheme

Eligibility

A candidate, who has passed in Higher Secondary Examination with any Academic stream under Higher Secondary Board of Examination, Tamil Nadu as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, is eligible for the **Bachelor of Science – Chemistry Degree**.

For Programme Completion

A Candidate shall complete:

- Part I - Language papers – Tamil/Arabic/Malayalam in semesters I, II, III and IV respectively
- Part II - Language papers - English in semesters I, II, III, IV respectively
- Part III - Core papers in semesters I, II, III, IV, V, and VI respectively
- Part III - Elective papers in semesters V and VI respectively
- Part III - Allied papers in semesters I, II, III and IV respectively
    - ✓ Allied Zoology/Botany in semesters I & II
    - ✓ Allied Physics in semesters III & IV
- Part IV - Non-Major Elective papers in semesters I and II respectively
- Part IV - Skill based Subject papers in semesters V and VI respectively
- Part IV - Environmental Studies paper in semester II
- Part IV - Value Education paper in semester I
- Part V - Extension activity in semester IV

Scheme of Examinations under Choice Based Credit System

Term End Examinations (TEE)	- 75 Marks
Continuous Internal Assessment Examinations (CIAE)	- 25 Marks
Total	- 100 Marks

Pattern of Continuous Internal Assessment Examinations (CIAE)

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Assignments	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examination
(Max. marks: 75 / Time: 3 Hours)

External Examinations Question Paper Pattern for Part I & III and Part IV (Non- Major Elective & Skill based Subject)

Section – A (10 X 1 = 10 Marks)
Answer ALL questions.

- Questions 1 - 10
- Two questions from each unit
- Multiple choice questions and each question carries Four choices

Section – B (5 X 7 = 35 Marks)
Answer ALL questions choosing either A or B.

- Questions 11 - 15
- Two questions from each unit (either…. or…. type)
- Descriptive Type

Section – C (3 X 10 = 30 Marks)
Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Descriptive Type

External Examinations Question Paper Pattern for Part IV (Environmental Studies and Value Education)

Section – A: (5 X 6 = 30 Marks)
Answer ALL questions choosing either A or B.

- Questions 1 - 5
- Two questions from each unit (either…. or…. type)
- Descriptive Type

Section – B (3 X 15 = 45 Marks)
Answer any THREE out of five questions.

- Questions 6 – 10
- One question from each unit
- Descriptive Type

External Examinations Question Paper Pattern for Part IV
(Environmental Studies and Value Education)

SBS - III
Section – A: (150 X 0.5 = 70 Marks)
Answer ALL Questions.

- Questions 1 – 150 (from Core and SBS subjects)
- Multiple choice questions and each question carriers four choices

SBS - IV
Section – A: (150 X 0.5 = 70 Marks)
Answer ALL Questions.

- Questions 1 – 100 (from Core and SBS subjects)
- Questions 101 – 150 (from Aptitude &Resoning)
- Multiple choice questions and each question carriers four choices

Part V(Extension Activities)

- Internal Evaluation

Passing Marks

Minimum 27 for External Exam
Eligibility for the degree – passing minimum is **40%**

Practical Examination

Internal – 40 marks
External – 60 marks
Total – 100 marks
Passing minimum is **40%**

Weightage

Weightage for Bloom's Taxonomy	**Percentage**	**Marks**	
		CIAE	**TEE**
Knowledge (Remembering) – K1	40	10	30
Understanding – K2	40	10	30
Applying – K3	20	5	15
Gross Total	**100**	**25**	**75**

Assessment

Distribution of questions and marks for Continuous Internal Assessment Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge (K1)	2 (2)	1 (a or b) (3)	1 (5)	**25 marks**
Understanding (K2)	2 (2)	1 (a or b) (3)	1 (5)	
Apply (K3)	**Assignment (5)**			

Distribution of questions and marks for Term End Examinations

Bloom's Taxonomy	Section A	Section B	Section C	Total
Knowledge (K1)	2 (2)	4 (a or b) (28)	-------	**Total 75 Marks**
Understanding (K2)	3 (3)	1 (a or b) (7)	2 out of 3 (20)	
Apply (K3)	5 (5)	-------	1 out of 2 (10)	

Note: Figures in parenthesis are Marks

Credits Distribution

Part	Course Category	Courses	Credits	Total Marks
I	Tamil/ Arabic/ Malayalam	4	12	400
II	English	4	12	400
III	Core, Elective & Allied	25	98	2500
IV	Non- Major Elective	2	4	200
	Skill based Subject	4	8	400
	Environmental Studies	1	2	100
	Value Education	1	2	100
V	Extension Activities	1	2	100
		42	**140**	**4200**

Details of Course Category, Code, Credits & Title

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester - I							
Part - I							
Language - I	20UTAL11/ 20UARL11/ 20UMLL11	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - I	20UENL11	English Paper - I	6	25	75	100	3
Part – III (OBE)							
Core – I	20UCHC11	General Chemistry - I	5	25	75	100	5
Core – III	20UCHC2P	Inorganic Semi micro Qualitative Analysis	3	-	-	-	-
Allied – I	20UBYA11/ 20UZYA11	Ancillary Botany/Zoology - I	4	25	75	100	3
Allied – III	20UBYA2P/ 20UZYA2P	Ancillary Practical Botany/Zoology -I	2	-	-	-	-
Part - IV							
NME – I	20UCHN11	Chemistry in Every Day Life-I	2	25	75	100	2
VED	20UVED11	Value Education	2	25	75	100	2
		Total	30			600	18
Semester - II							
Part - I							
Language - II	20UTAL21/ 20UARL21/ 20UMLL21	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - II	20UENL21	English Paper - II	6	25	75	100	3
Part – III (OBE)							
Core – II	20UCHC21	General Chemistry –II	5	25	75	100	5
Core – III	20UCHC2P	Inorganic Semi micro Qualitative Analysis	3	40	60	100	4
Allied – II	20UBYA21/ 20UZYA21	Ancillary Botany/Zoology-II	4	25	75	100	3
Allied – III	20UBYA2P/ 20UZYA2P	Ancillary Practical Botany/Zoology- I	2	40	60	100	1
Part - IV							
NME – II	20UCHN21	Chemistry in Every Day Life-II	2	25	75	100	2
EVS	20UEVS21	Environmental Studies	2	25	75	100	2
		Total	**30**			**800**	**23**

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester - III							
Part - I							
Language- III	20UTAL31/ 20UARL31/ 20UMLL31	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - III	20UENL31	English Paper - III	6	25	75	100	3
Part – III (OBE)							
Core – IV	20UCHC31	Organic and Inorganic Chemistry	5	25	75	100	5
Core – V	20UCHC32	Physical Chemistry-I	4	25	75	100	4
Core – VIII	20UCHC4P	Volumetric Analysis	3	-	-	-	-
Allied - IV	20UPHA11	Ancillary Physics – I	4	25	75	100	3
Allied - VI	20UPHA2P	Ancillary Physics Practical-I	2	-	-	-	-
		Total	**30**			**500**	**18**
Semester – IV							
Part - I							
Language - IV	20UTAL41/ 20UARL41/ 20UMLL41	Tamil / Arabic / Malayalam	6	25	75	100	3
Part - II							
English - IV	20UENL41	English Paper - IV	6	25	75	100	3
Part – III (OBE)							
Core – VI	20UCHC41	Organic & Physical Chemistry	5	25	75	100	5
Core - VII	20UCHC42	Inorganic Chemistry - I	4	25	75	100	4
Core - VIII	20UCHC4P	Volumetric Analysis	3	40	60	100	3
Allied - V	20UPHA21	Ancillary Physics-II	4	25	75	100	3
Allied - VI	20UPHA2P	Ancillary Physics Practical-I	2	40	60	100	1
Part - V							
EA		Extension Activities**	--	100	--	100	2
		Total	**30**			**800**	**24**

Part – V
Extension Activities**

S. No.	Course Code	Course Title	Max. Marks	Credits
1.	20UNCC41	National Cadet Corps (Army)	100	2
2.	20UNCC42	National Cadet Corps (Navy)	100	2
3.	20UNSS41	National Service Scheme	100	2
4.	20UPED41	Physical Education	100	2
5.	20UYRC41	Youth Red Cross	100	2
6.	20URRC41	Red Ribbon Club	100	2
7.	20UHRC41	Human Rights Club	100	2
8.	20UCOC41	Consumer Club	100	2
9.	20UYOC41	Yoga Club	100	2
10.	20UHFC41	Health and Fitness Club	100	2
11.	20UECC41	Eco Club	100	2
12.	20ULIC41	Library & Information Science Club	100	2
13.	20USCC41	Science Communication Club	100	2
14.	20UFAC41	Fine Arts Club	100	2

Course Category	Course Code	Course Title	Hrs	CIAE	TEE	Max. Marks	Credits
Semester - V							
Part – III (OBE)							
Core - IX	20UCHC51	Organic Chemistry - I	4	25	75	100	4
Core - X	20UCHC52	Physical Chemistry - II	5	25	75	100	5
Core – XI	20UCHC53	Inorganic Chemistry - II	4	25	75	100	4
Core – XV	20UCHC6P	Gravimetric Estimation and Organic Preparation	3	-	-	-	-
Core – XVI	20UCHC6Q	Organic Analysis and Estimation	3	-	-	-	-
Core – XVII	20UCHC6R	Physical Chemistry Practical	3	-	-	-	-
Elective - I	20UCHE51	Polymer Chemistry	4	25	75	100	4
	20UCHE52	Applied Chemistry					
	20UCHE53	Computational Chemistry & Cheminformatics					
Part - IV							
SBS - I	20UCHS51	Pharmaceutical Chemistry	2	25	75	100	2
SBS - II	20UCHS52	Competitive Examination Skills in Chemistry –I	2	25	75	100	2
		Total	**30**			**600**	**21**
Semester - VI							
Part – III (OBE)							
Core –XII	20UCHC61	Organic Chemistry - II	4	25	75	100	4
Core – XIII	20UCHC62	Physical Chemistry - III	5	25	75	100	5
Core - XIV	20UCHC63	Spectroscopy and Its Applications	4	25	75	100	4
Core – XV	20UCHC6P	Gravimetric Estimation and Organic Preparation	3	40	60	100	5
Core - XVI	20UCHC6Q	Organic Analysis and Estimation	3	40	60	100	5
Core – XVII	20UCHC6R	Physical Chemistry Practical	3	40	60	100	5
Elective - II	20UCHE61	Green Chemistry	4	25	75	100	4
	20UCHE62	Nano Chemistry					
	20UCHE63	Forensic Chemistry					
Part - IV							
SBS – III	20UCHS61	Medical Laboratory Technology and Clinical Biochemistry	2	25	75	100	2
SBS - IV	20UCHS62	Competitive Examination Skills in Chemistry –II	2	25	75	100	2
		Total	**30**			**900**	**36**
		Grand Total	**180**			**4200**	**140**

Course Code	Course Title	Category	Total Hours	Credits
20UCHC11	General Chemistry-I	Core-I	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To gain knowledge about organic and inorganic basic concepts, IUPAC Nomenclature of organic compounds, colloids, hydrogen, hydrides, oxides, empirical and molecular formulae. To understand the redox reactions and laboratory hygiene and safety.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Recall IUPAC nomenclature, classification of organic compounds and explain the uses of methane, ethane, ethylene, propene and acetylene	**K1, K2**
CO2	Demonstrate the detection of nitrogen, Sulphur and halogens in organic compounds	**K1, K2**
CO3	Explain the atomic structure of atom and related theories and concepts	**K1, K2**
CO4	Develop the knowledge to adopt safety measures in laboratory	**K1, K2, K3**
CO5	Find the preparation, properties and applications of colloids	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**1**	**2**	**1**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**1**	**2**	**3**
CO4	**3**	**3**	**2**	**1**	**3**
CO5	**3**	**1**	**1**	**3**	**2**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2
CO2	3	3	3	3	1
CO3	3	2	1	2	2
CO4	1	1	3	3	1
CO5	2	2	2	3	1

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Introduction to Organic Chemistry: Sources and Classification of organic compounds - Definition – vital force theory – various functional groups – homologous series – alcohol, amines, acids, esters, aldehydes and ketones. IUPAC nomenclature taking examples from aliphatic and aromatic chemistry involving the functional groups (alcohols, amines, acids, esters, aldehydes and ketones). General methods of preparation, properties and uses of methane, ethane, ethylene, propene and acetylene.

UNIT II 12 Hours

Composition of organic compounds, Empirical and molecular formulae: Detection of nitrogen (Lassaigne's test), sulphur (sodium test) and halogens (sodium test), estimation of nitrogen (Kjeldahl method), sulphur (Carius method) and chlorine (Carius method) in organic compounds – empirical formula – molecular formula – structural formula – simple calculations.

UNIT III 18 Hours

Atomic Structure and periodic properties: Rutherford model of the atom-defects of Rutherford model - Discovery of neutron, Bohr model of an atom-merits and demerits - Hydrogen atom spectra - Sommerfield modification-de Broglie's conceptdual nature, quantum numbers- shapes of s, p, d atomic orbitals. Arrangement of electrons in atoms - Hund's rule – Pauli exclusion principle- Heisenberg's uncertainty principle. Periodic law and Cause of periodicity. Division of elements in to s, p, d and f blocks. Elementary ideas of covalent radius - van der Waals radius-Ionic radius Ionisation Energy, Electron affinity, and their periodic trends. Electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions.

UNIT IV 15 Hours

Laboratory hygiene and safety: Carcinogenic chemicals – general precautions for avoiding accidents – first aid techniques - Principles of semi micro methods – solubility product and common ion effect – in groups II, III and IV – preparation of original solution for cation testing on semi micro scale – removal of interfering ions in the analysis of cations – oxalate, borate, fluoride, chromate and phosphate.

UNIT V 15 Hours

Colloids: Colloidal States of matter-various types - classification –Sols-kinetic, optical and electrical properties-stability of colloids and protective action – Hardy Schulze law- Gold number-Hofmeister series – emulsions-types of emulsion-emulsifier with an example – Gels - Classification - Applications of colloids.

Reference Book

B. S. Bahl & ArunBahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

B.R. Puri and L.R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

P. L. Soni, O. P. Dharmarha and U. N. Dash, ***Textbook of Physical Chemistry***, Sulthan & Sons publication, 22nd revised edition, 2001.

R.D. Madan, ***Modern Inorganic Chemistry***, S. Chand, 2013, revised edition,

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Sources and Classification of organic compounds - Definition – vital force theory	3	E-Resources
1.2	Sources and Classification of organic compounds - Definition – vital force theory	3	E-Resources
1.3	IUPAC nomenclature taking examples from aliphatic and aromatic chemistry	3	Chalk & Talk
1.4	Functional groups alcohols, amines, acids, esters, aldehydes and ketones	3	E-Resources
1.5	General methods of preparation, properties and uses of methane, ethane, ethylene, propene and acetylene	3	Chalk & Talk
UNIT - II			
2.1	Detection of nitrogen (Lassaigne's test), sulphur (sodium test) and halogens (sodium test) in organic compounds	4	E-Resources
2.2	Estimation of nitrogen (Kjeldahl method), sulphur (Carius method) and chlorine (Carius method) in organic compounds	4	Chalk & Talk
2.3	Empirical formula – molecular formula – structural formula – simple calculations	4	E-Resources
UNIT - III			
3.1	Rutherford model of the atom and its defects	2	E-Resources
3.2	Discovery of neutron, Bohr model of an atom- merits and demerits	2	E-Resources
3.3	Hydrogen atom spectra - Sommerfield modification- de Broglie's concept- dual nature, quantum numbers- shapes of s, p, d atomic orbitals.	4	Chalk & Talk
3.4	Arrangement of electrons in atoms- Hund's rule – Pauli exclusion principle- Heisenberg's uncertainty principl	3	E-Resources

3.5	Elementary ideas of covalent radius - van der Waals radius-Ionic radius Ionisation Energy	3	Chalk & Talk
3.6	Electron affinity, and their periodic trends. - Electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions	4	E-Resources
UNIT - IV			
4.1	Carcinogenic chemicals – general precautions for avoiding accidents – first aid techniques	5	E-Resources
4.2	Preparation of original solution for cation testing on semi micro scale	5	Chalk & Talk
4.3	Removal of interfering ions in the analysis of cations – oxalate, borate, fluoride, chromate and phosphate	5	Chalk & Talk
UNIT - V			
5.1	Colloidal States of matter, various types and classification of colloids	3	E-Resources
5.2	Kinetic, optical and electrical properties of colloids	3	Chalk & Talk
5.3	Stability of colloids and protective action – Hardy-Schulze law Gold number-Hofmeister series	3	E-Resources
5.4	Emulsions- types of emulsion- emulsifier with an example	3	E-Resources
5.5	Gels - Classification - Applications of colloids	3	Chalk & Talk
	Total	**75**	

Course Designer
Dr. S. A. Noor Mohamed
Head & Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UBYA11	**Thallophyta, Bryophyta, Pteridophyta, Gymnospermae, Physiology & Plant Ecology**	**Allied - I**	**60**	**3**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students acquire knowledge on general characters, classification and life cycle of Thallophyta, Bryophyta, Pteridophyta, Gymnospermae and enable the students to understand the physiological process and ecological adaptations of plants

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Illustrate the structure, life cycle of *Nostoc, Sargassum* and Economic importance of Algae.	**K1, K2,K3**
CO2	Explain the structure, life cycle of Fungi with the reference of *Saccharomyces*, *Agaricus* and Economic importance, listing the general features of Bacteria and its Economic importance.	**K1, K2, K3**
CO3	Compare and contrast the general structure and life cycle of *Funaria, Selaginella* and *Pinus*.	**K1, K2**
CO4	Discuss the physiological process and mechanism of Transpiration, Photosynthesis and Respiration.	**K1, K2**
CO5	Interpret the adaptation of Hydrophytes, Xerophytes and factors affecting the vegetations.	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 11 Hours

Thallophyta - General characters of algae. A study on the structure and life cycle of the following genera- *Nostoc*and *Sargassum*(need not study the development of sex organs). Economic importance of Algae.

UNIT II 12 Hours

Fungi - General characters. A study on the structure and life cycle of the following genera- *Saccharomyces and Agaricus*.Elementary knowledge of Bacteria.Economic importance of Fungi and Bacteria.

UNIT III 15 Hours

Bryophyta, Pteridophyta andGymnospermae; A study on the structure and life cycle of the following genera- *Funaria, Selaginella* and *Pinus*(need not study the development of sex organs)

UNIT IV 12 Hours

Plant physiology; Transpiration- Types and Mechanism of stomata. Photosynthesis – Light reaction – Calvin cycle. Respiration – Glycolysis – Krebs cycle

UNIT V 10 Hours

Plant ecology; Factors affecting vegetation – Climatic factor, Morphological and Anatomical adaptations in Hydrophytes and Xerophytes.

Text Books

K.S.Bilgrami and L. C. Saha, ***Text book of Algae***, CBS Publishers, New Delhi 2015, Ist Edition.

B.P. Pandey, ***A Textbook of Botany: Angiosperms - Taxonomy, Anatomy, Embryology and Economic Botany***, S. Chand Limited, 2014**.**

SohanSharma, ***Advances in Mycology,***Random Publications Publishers and Distributors, New Delhi*, 2012.*

O. P. Sharma, ***Algae*****,** Tata McGraw-Hill Education, New Delhi, 2011.

B. P. Pandey, ***Text book of Botany, Vol. I & II*** S. Chand & Co. New Delhi, 1986.

Ganguly, A. K. ***General Botany*** Vol. I (1971) and Vol. II.The new book stall, Calcutta, 1975.

Fuller, H. J. and Tippo, O. ***College Botany***, Henry Holt & Company. 1949

Reference Books

Vashishta, B. R. Sinha, A. K, ***Botany for Degree student – Fungi***, S. Chand & Co. New Delhi. 2010.

Panday.S.N.,Misra. S.P and Trivethi P.S, ***A Text book of Botany***, Volume II Vikas Publishing House Pvt. Ltd., Delhi, 2009.

Rao, K. N., Krishnamoorthy, K. V. and Rao, G. S. ***Ancillary Botany***, S. VisvanathanPvt, Madras, 1979.

Pedagogy

Chalk & Talk, Group Discussion& E-Resources

Teaching aids

Black Board, Collected Plants specimens, Permanent Slides, Specimens, Charts & LCD projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	General character of Algae	2	Chalk & Talk
1.2	Structure of *Nostoc*	2	Permanent Slides
1.3	Reproduction of *Nostoc*	2	Discussion
1.4	Structure of *Sargassum*	2	Plants specimens
1.5	Reproduction of *Sargassum*	2	E-Resources
1.6	Economic importance of Algae	1	Discussion

UNIT - II			
2.1	General character of Fungi	1	Discussion
2.2	Structure of Yeast	1	Permanent Slides
2.3	Life cycle of Yeast	2	Chalk & Talk
2.4	Structure of *Agaricus*	2	E-Resources
2.5	Life cycle of *Agaricus*	2	E-Resources
2.6	Economic Importance of Fungi	1	Discussion
2.7	General features of Bacteria	2	E-Resources
2.8	Economic importance of Bacteria	1	Discussion
UNIT - III			
3.1	Structure of *Funaria*	3	Chalk & Talk
3.2	Life cycle of *Funaria*	2	E-Resources
3.3	Structure of *Selaginella*	3	Chalk & Talk
3.4	Life cycle of *Selaginella*	2	E-Resources
3.5	Structure of P*inus*	3	Plants specimens
3.6	Life cycle of *Pinus*	2	Discussion
UNIT - IV			
4.1	Transpiration	4	Chalk & Talk
4.2	Light reaction	2	E-Resources
4.3	Dark reaction	2	E-Resources
4.4	Glycolysis	2	Discussion
4.5	Krebs cycle	2	E-Resources
UNIT - V			
5.1	Factors affecting vegetation	4	Chalk & Talk
5.2	Adaptation in Hydrophytes	3	E-Resources
5.3	Adaptation in Xerophytes	3	Discussion
	Total	**60**	

Course Designer
Ms. A. M. Rashida Banu
Assistant Professor of Botany

Course Code	Course Title	Category	Total Hours	Credits
20UZYA11	General Zoology	Allied – I	60	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the studentsacquire knowledge on general characteristics, classification of Invertebrates and chordate

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Find and characteristic features, morphology and classification the classify aceolomates.	**K1**
CO2	Explain and classify pseudocoelomates.	**K1, K2**
CO3	Outline the economic importance and evolutionary significance of Phylum Arthropoda, Mollusca and Echinodermata.	**K1, K2**
CO4	Illustrate the Identify Prochordates, Pisces and Amphibians.	**K1, K2**
CO5	Compare poisonous and non-poisonous snakes and explain the adaptive features in Aves and Mammalia.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**2**	**2**	**3**
CO2	**2**	**2**	**3**	**3**	**1**
CO3	**3**	**3**	**3**	**3**	**2**
CO4	**2**	**3**	**1**	**3**	**1**
CO5	**3**	**1**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	2	2	3	3	1
CO3	3	3	3	3	2
CO4	2	3	1	3	1
CO5	3	1	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Acoelomata: Levels of organization – Outline classification up to phylum with examples- General characteristics – Protozoa - *Amoeba* sp. - life cycle of *Plasmodium* sp. - protozoan diseases – Porifera - canal system – Coelenterata - *Hydra* sp. - biology of corals and coral reefs.

UNIT II 12 Hours

Pseudocoelomata: Platyhelminthes - general characters - classification - *Taeniasolium*–Life cycle of *Ascarislumbricoides* - Helminth parasites in man.

UNIT III 12 Hours

Coelomata: General characteristics - Arthropoda, Mollusca and Echinodermata–*Periplaneta*sp. – Economic importance of insects – *Pila*sp. – torsion – *Asterias*sp. –watervascular system – larval forms.

UNIT IV 12 Hours

Prochordata: Pisces and Amphibia-General characters of *Amphioxus*, *Balanoglossus*and *ascidia* – General characters of Pisces - *Scoliodon*sp. - accessory respiratory organsin fishes – economic importance of fishes – Amphibia - general Characters - *Rana*sp.

UNIT V 12 Hours

Reptilia, Aves and Mammals: General characters – Identification of poisonous and nonpoisonous snakes – *Columba livia* - flight adaptations in birds - migration in birds-adaptive radiation of beak and feet – *Oryctolagus*sp. - dentition in mammals - aquatic mammals - economic importance of mammals.

Text Books

Chaki, KK, Kundu, G and Sarkar, S (2005) ***Introduction to General Zoology. Vol-1,*** New Central Book Agency Pvt. Ltd., Kolkata, India.

Jordan EL and Verma PS (2013) ***Chordate Zoology***, S.Chand & Co Ltd., New Delhi.

Reference Books

Iyer, E (2016) ***Manual of Zoology Vol. II***. Viswanathan (Printers & Publishers),Chennai.

Pedagogy

Digi frog virtual dissection software,YouTube videos, websites, Chalk and talk, Group Discussion, PPT, Preserved animals and Field visit

Teaching aids

Green Board, LCD Projector, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Acoelomata -Levels of organization – Outline classification up to phylum with examples	2	Discussion
1.2	General characteristics – Protozoa - *Amoeba* sp.	2	Chalk & Talk
1.3	life cycle of *Plasmodium* sp. - protozoan diseases	2	Chalk & Talk
1.4	Porifera - canal system	2	Chalk & Talk
1.5	Coelenterata - *Hydra* sp.	2	E-Resources
1.6	biology of corals and coral reefs.	2	Discussion
UNIT - II			
2.1	Pseudocoelomata - Platyhelminthes - general characters – classification	3	Chalk & Talk
2.2	*Taeniasolium* – Life cycle of *Ascarislum bricoides*	5	E-Resources
2.3	Helminth parasites in man.	4	Discussion
UNIT - III			
3.1	Coelomata-General characteristics	1	Chalk & Talk
3.2	General characteristics Arthropoda, Mollusca and Echinodermata	3	E-Resources
3.3	Type study*Periplaneta*sp.	2	Discussion
3.4	Economic importance of insects	1	Chalk & Talk
3.5	Type study- *Pila*sp. – torsion	2	E-Resources

3.6	Type study-*Asterias*sp. –watervascular system – larval forms.	3	Chalk & Talk
UNIT - IV			
4.1	Prochordata, Pisces and Amphibia-General characters of *Amphioxus*,	1	Discussion
4.2	General characters- *Balanoglossus* and *ascidia*	2	E-Resources
4.3	General characters of Pisces	1	Chalk & Talk
4.4	*Scoliodon*sp - accessory respiratory organs in fishes	4	Discussion
4.5	Economic importance of fishes	1	E-Resources
4.6	Amphibia - general Characters - *Rana*sp.	3	Chalk & Talk
UNIT - V			
5.1	Reptilia, Aves and Mammals-General characters	2	E-Resources
5.2	Identification of poisonous and nonpoisonous snakes	2	Chalk & Talk
5.3	*Columba livia*	2	Discussion
5.4	Flight adaptations in birds - migration in birds -adaptive radiation of beak and feet	2	E-Resources
5.5	*Oryctolagus*sp - dentition in mammals – aquatic mammals	3	Chalk & Talk
5.6	Economic importance of mammals	1	Discussion
Total		**60**	

Course Designer
Dr. P. Raja
Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20UCHC21	General Chemistry - II	Core - II	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To delineate reaction intermediates, types of organic reactions, ionic equilibria, liquid state of matters and periodic properties of elements.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Explain the Kinetic theory of gases, molecular velocities, Maxwell-Boltzmann distribution and viscosity.	**K1, K2**
CO2	Make use of the ideal and real gas concepts and the Critical phenomenon.	**K1, K2, K3**
CO3	Identify the preparation, properties and uses of hydrides, oxides and outline the redox reactions.	**K1, K2, K3**
CO4	Utilize the fundamental concepts and theories of electrochemistry.	**K1, K2, K3**
CO5	Find the reaction mechanism in relation to nucleophilic substitution, elimination, rearrangement and polymerisation reactions	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**1**	**2**	**3**	**2**
CO2	**3**	**1**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**2**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**1**	**2**	**2**
CO2	**3**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 18 Hours

Gaseous state-I: Kinetic theory of gases – Postulates – Kinetic gas equation – Derivation – gas laws and their derivations – Types of molecular velocities – Average, Most probable and root mean square velocities – their relationships - calculation of molecular velocities – Maxwell-Boltzmann distribution of molecular velocities (no derivation) – Graphical representation and its significance – effect of temperature on velocity distribution. Collision diameter – collision number – collision frequency – mean free path – thermal conductivity – viscosity of gases definition only – principle of equipartition of energy.

UNIT II 22 Hours

Gaseous state-II: Real gases – Deviation of real gases from ideal behavior – Boyle temperature – Explanation for deviations – Vander Waals gas equation of states – derivation – how Vander Waal's equation explain the behavior of real gases – other equations of states – Dieterici, Berthelot, Clausius equation and Radlich - Kwong equation (no derivation). Critical phenomenon of gases - Critical constants – definition – determination of critical constants – PV Isotherms – Andrews experiment – significance of critical constants – compressibility factor for ideal and real gases – Relationship between Vander Waals constants and critical constants – The principle of corresponding states and derivation of reduced equation of state – Joule-Thomson effect – Inversion temperature – Liquefaction of gases – Linde's and Claude's methods.

UNIT III 10 Hours

Hydrogen: Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen. Hydrides: definition – classification – examples. Oxides: Definition – classification – examples.Concepts of oxidation-reduction in terms of oxidation number – calculation of oxidation number – redox reactions – half reactions – Balancing ionic equations by ion electron method (half reaction) - Reactions involving - $Cr_2O_7^{2-}$ and Fe^{2+} - MnO_4^- and Fe^{2+} - $Cr_2O_7^{2-}$ in acid medium - CrO_4^{2-} and SO_3^{2-}.

UNIT IV 13 Hours

Ionic Equilibria: Strong, weak and moderate electrolytes – ionic product of water, common ion effect. pH scale – buffer solutions – calculation of pH using Henderson Hasselbalch equation, hydrolysis of salts – hydrolysis constant and degree of hydrolysis of salts of strong acid and strong base, weak acid and strong base, strong acid and weak base, weak acid and weak base. Acid base indicators - solubility product –applications in qualitative analysis.

UNIT V 12 Hours

Types of organic reactions: Substitution, addition, elimination, rearrangement and polymerisation reactions – their mechanisms – S_N1, S_N2, S_Ni, E_1, E_2 and E_1CB, Hofmann's rule, Saytzeff rule, Markownikoff's rule & Anti – Markownikoff's rule.

Reference Book

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

B.R. Puri and L. R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

R.D. Madan, ***Modern Inorganic Chemistry***, S. Chand, 2013, revised edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Kinetic theory of gases – Postulates – Kinetic gas equation – Derivation – gas laws and their derivations.	3	Chalk & Talk
1.2	Types of molecular velocities – Average, most probable and root mean square velocities – their relationships.	3	E-Resources
1.3	Calculation of molecular velocities – Maxwell-Boltzmann distribution of molecular velocities (no derivation).	3	E-Resources
1.4	Graphical representation and its significance – effect of temperature on velocity distribution.	3	Chalk & Talk
1.5	Collision diameter – collision number – collision frequency – mean free path .	3	E-Resources
1.6	Thermal conductivity––viscosity of gases definition only – principle of equipartition of energy.	3	E-Resources
	UNIT - II		
2.1	Real gases – Deviation of real gases from ideal behavior – Boyle temperature – Explanation for deviations.	3	E-Resources
2.2	Vander Waals gas equation of states – derivation – how Vander Waal's equation explain the behavior of real gases.	3	Chalk & Talk
2.3	Dieterici, Berthelot, Clausius equation and Radlich - Kwong equation (no derivation).	3	E-Resources
2.4	Critical phenomenon of gases - Critical constants – definition – determination of critical constants – PV Isotherms – Andrews experiment – significance of critical constants.	4	E-Resources
2.5	Compressibility factor for ideal and real gases – Relationship between Vander Waals constants and critical constants.	4	E-Resources

2.6	The principle of corresponding states and derivation of reduced equation of state – Joule-Thomson effect – Inversion temperature – Liquefaction of gases – Linde's and Claude's methods.	5	Chalk & Talk
UNIT - III			
3.1	Hydrogen: Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen.	2	E-Resources
3.2	Hydrides and Oxides - definition – classification – examples.	2	E-Resources
3.3	Concepts of oxidation-reduction in terms of oxidation number – calculation of oxidation number.	2	Chalk & Talk
3.4	Redox reactions – half reactions – Balancing ionic equations by ion electron method.	2	E-Resources
3.5	Reactions involving - $Cr_2O_7^{2-}$ and Fe^{2+} - MnO_4^- and Fe^{2+} - $Cr_2O_7^{2-}$ in acid medium - CrO_4^{2-} and SO_3^{2-}.	2	E-Resources
UNIT - IV			
4.1	Strong, weak and moderate electrolytes – ionic product of water, common ion effect.	3	E-Resources
4.2	pH scale – buffer solutions – calculation of pH using Henderson Hasselbalch equation.	3	Chalk & Talk
4.3	Hydrolysis of salts, degree of hydrolysis of salts - strong acid and strong base, weak acid and strong base, strong acid and weak base, weak acid and weak base.	4	Chalk & Talk
4.4	Acid base indicators - solubility product – applications in qualitative analysis.	3	E-Resources

UNIT - V			
5.1	Substitution and addition reactions and their mechanisms- S_N1, S_N2, S_Ni	3	E-Resources
5.2	Elimination reactions and their mechanisms- E_1, E_2 and E_1CB	3	Chalk & Talk
5.3	Rearrangement and polymerisation reactions	2	E-Resources
5.4	Hofmann's rule, Saytzeff rule, Markownikoff's rule & anti – Markownikoff's rule.	4	E-Resources
	Total	**75**	

Course Designer
Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC2P	**Inorganic Semi Micro Qualitative Analysis**	**Core - III**	**90**	**4**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students to develop analytical skills in inorganic qualitative analysis and appreciate the various colored chemical reactions of metal ions.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Find the acid radicals present in any given inorganic salt	**K1,K2, K3**
CO2	Plan to eliminate the interfering acid radicals	**K1,K2, K3**
CO3	Identify the basic radical and its group	**K1,K2, K3**
CO4	Identify various colored chemical reactions of metal ions	**K1, K2, K3**
CO5	Develop analytical skills in inorganic qualitative analysis and Laboratory safety	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**1**	**3**	**3**	**1**	**2**
CO2	**1**	**3**	**3**	**1**	**2**
CO3	**1**	**3**	**3**	**1**	**2**
CO4	**1**	**3**	**3**	**1**	**2**
CO5	**1**	**3**	**3**	**1**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**3**	**3**	**1**
CO2	**2**	**2**	**3**	**3**	**1**
CO3	**2**	**2**	**3**	**3**	**1**
CO4	**2**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**3**	**3**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

Analysis of a mixture containing two anions of which one is an interfering ion and two cations by semi-micro method.

Anions: Carbonate, Sulphate, Nitrate, Fluoride, Chloride, Iodide, Oxalate, Borate, Phosphate and Chromate.

Cations: Lead, Bismuth, Copper, Cadmium, Antimony, Iron (II & III), Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Strontium, Calcium, Magnesium and Ammonium.

Reference Book

V.V. Ramanujam, ***Inorganic Semi Micro Qualitative Analysis, 3rd edition***, The National Publishing Company, Chennai, 1974.

Vogel's ***Text Book of Inorganic Qualitative Analysis, 4th edition***, ELBS, London, 1974.

Course Designer

Dr. K. Shahul Hameed

Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UBYA21	**Taxonomy of Angiosperms, Cell Biology, Anatomy & Embryology of Angiosperms & Biotechnology**	**Allied - II**	**60**	**3**

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students acquire knowledge on classification, economic importance, anatomy and embryology, plant cell organelles, genetics with medicinal uses of flowering plants and the area of plant tissue culture, Biodiesel and Biogas.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Outline the Classification of flowering plants with its Economic importance and medicinal uses of Medicinal plants	**K1, K2,K3**
CO2	Illustrate the Ultra structure of Plant cell and its organelles and solve Mendelian genetics	**K1, K2, K3**
CO3	Interpret the structure of Simple and Complex permanent tissues and compare the primary structure of Dicot plants with Monocot plants.	**K1, K2**
CO4	Explain the Structure of Anther, Male Gametophyte, Female Gametophyte and Dicot embryo and extend the knowledge on the Pollination, Fertilization and types of Ovules.	**K1, K2**
CO5	Build Plant Tissue Culture methods and production of Biodiesel and Biogas.	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low 2-Medium 3-Strong

Syllabus

UNIT I 15 Hours

Taxonomy: Outline the Bentham and Hookers' system of classification. Study of the following families and its economic importance: Euphorbiaceae, Asclepiadaceae and Poaceae. Study the medicinal uses of the following plants- *Phyllanthus, Azadirachta* and *Ocimum*, Introduction to Botanical survey of India.

UNIT II 11 Hours

Cell Biology: Ultra structure of plant cell and brief outline of the following organelles: Cell wall, Nucleus, Chloroplast, Mitochondria. Genetics- Mendel's mono and dihybrid cross. Incomplete dominance in monohybrid.

UNIT III 13 Hours

Anatomy: Simple and permanent tissues: Parenchyma, collenchyma, sclerenchyma. Complex permanent tissues: Xylem and phloem. Primary structure of dicot stem, monocot stem, dicot root and monocot root. Structure of mesophytic dicot leaf only.

UNIT IV 11 Hours

Embryology: Structure of anther, Structure of male gametophyte. Types of ovule. Structure of female gametophyte (Polygonum type), Pollination and Fertilization. Structure and development of dicot embryo (Capsella type – *bursa pastoris*), Parthenogenesis.

UNIT V 10 Hours

Plant Biotechnology: Introduction to Plant Tissue Culture, Callus culture, Anther culture and Embryo culture. Sterilization methods. Production of Bio diesel (Jatropha) and Biogas (Cow dung).

Text Books

Sambamurthy, A.V.S.S & Subramanian. N.S. ***A Textbook of Modern Economic Botany***, I K International Publishing House, New Delhi, 2008.

Sambamurthy, A.V.S.S ***Taxonomy of angiosperms***, I K International Publishing House, New Delhi, 2005.

Verma P.S. and Agarwal V.K, ***Genetics, Molecular Biology, Evolution & Ecology***, S. Chand Publishing, New Delhi, 2004.

B.P. Pandey, ***Taxonomy of Angiosperms*****,** S. Chand & Co., New Delhi, 2001.

Reference Books

Annie Roland, ***Taxonomy of angiosperms*****,** Saras Publication, Nagercoil, 2005.

Bhojwani, S. S. and Bhatnagar, S. P. ***The Embryology of Angiosperms***. Vikas Publishing House Pvt., Ltd., New Delhi, 1981.

Sambamurthy, A.V.S.S. ***Genetics***, Narosa Publishing House, New Delhi, 1999.

Pandey B. P. ***Plant anatomy***, S. Chand & Co., New Delhi, 1978.

Davis, P.H. and Heywood, V.M, ***Principles of Angiosperm Taxonomy***, Oliver and Boyd Edinburgh. London, 1965.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, Collected Plants specimens, Permanent Slides, Specimens & LCD projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Introduction - Bentham and Hookers' system of classification	3	Chalk & Talk
1.2	Euphorbiaceae - Economic importance	3	Plants specimens
1.3	Asclepiadaceae - Economic importance	3	Discussion

1.4	Poaceae- Economic importance	3	Plants specimens,
1.5	*llanthus* – Medicinal uses	1	E-Resources
1.6	*Azadirachta* - – Medicinal uses	1	Discussion
1.7	*Ocimum* – Medicinal uses	1	Plants specimens
UNIT - II			
2.1	Ultra Structure of Plant Cell	2	Permanent Slides
2.2	Cell wall	2	Chalk & Talk
2.3	Nucleus	1	Permanent Slides
2.4	Chloroplast	1	E-Resources
2.5	Introduction to genetics	2	Plants specimens
2.6	Monohybrid Cross	1	E-Resources
2.7	Dihybrid Cross	1	Discussion
2.8	Incomplete Dominance in monohybrid	1	Discussion
UNIT - III			
3.1	Simple and Permanent tissues: Parenchyma, collenchyma, sclerenchyma.	3	Permanent Slides
3.2	Complex permanent tissues: Xylem and Phloem	4	Permanent Slides
3.3	Primary anatomical structure of dicot stem	1	Discussion,
3.4	Primary anatomical structure of dicot root and monocot root	2	E-Resources
3.5	Comparison of Primary anatomical structure of monocot stem with dicot stem	2	Permanent Slides
3.6	Primary anatomical structure of dicot leaf	1	E- Resources
UNIT - IV			
4.1	Introduction to embryology and Structure of anther	2	E-Resources
4.2	Structure of male gametophyte	2	Chalk & Talk
4.3	Types of ovule	1	Permanent Slides
4.4	Structure of female gametophyte	2	Discussion

4.5	Fertilization	1	E-Resources
4.6	Structure and development of dicot embryo	3	E-Resources
UNIT - V			
5.1	Introduction to Plant Biotechnology	1	Chalk & Talk
5.2	Introduction to Plant Tissue Culture	1	E -Resources
5.3	Callus culture, Anther Culture, Embryo Culture	3	Discussion
5.4	Sterilization methods	1	E -Resources
5.5	Bio diesel	1	E-Resources
5.6	Biogas	3	Discussion
	Total	**60**	

Course Designer
Dr. A. Maajitha Begam,
Assistant Professor of Botany

Course Code	Course Title	Category	Total Hours	Credits
20UZYA21	Animal Organization	Allied - II	60	3

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the studentsacquire knowledge on *basic understanding of biology ofinvertebrate and chordate.*

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Recall that provides basic understanding of principles of animal taxonomy	**K1**
CO2	Explain invertebrate and chordates organ systems	**K1, K2**
CO3	Illustrate the adaptations invertebrate and chordate animals	**K1, K2**
CO4	Experiment with nerve co-ordination on different animals sensory organs	**K1, K2, K3**
CO5	Analyze and classify invertebrate and chordates excretion systems	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**1**	**3**
CO2	**3**	**2**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**3**	**2**	**1**	**2**
CO5	**3**	**2**	**1**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**1**	**3**
CO2	**3**	**2**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**3**	**2**	**1**	**2**
CO5	**3**	**2**	**1**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

a. **Principles of Taxonomy**: Binomial nomenclature – Animal Organization – body types – protozoa – metazoa – types of coelom – types of symmetry.

b. Outline classification of Invertebrates and the salient features of the Phyla with examples.

c. Outline classification of Chordates upto classes giving examples

UNIT II 12 Hours

a. Feeding and digestion in Amoeba, Hydra and Frog.

b. Respiration in Amoeba, Cockroach

c. Gills in Fish and Lungs in bird.

UNIT III 12 Hours

a. Circulatory system in Paramecium, Earthworm and Calotes.

b. Locomotion in Amoeba, Paramecium and Earthworm

c. Flight mechanism in Pigeon.

UNIT IV 12 Hours

a. Nervous system of Earthworm

b. Human brain and ear

c. Receptors – photoreceptors of Euglena, insects and man

UNIT V 12 Hours

a. Excretion in Amoeba and Earthworm

b. Excretion in Man-Structure of kidney and urine formation.

c. Reproductive system of Rabbit.

Text Books

Jordan E. L and Verma P. S, ***Chordate Zoology***, S.Chand & Co Ltd., New Delhi. 2013.

Jordan E. L and P. S Verma, ***Invertebrate Zoology,*** S. Chand & Co Ltd., New Delhi, 2013.

Reference Books

Jordan & Verma, ***Chordate Zoology***, S. Chand & Co Ltd. 2011.
Kotpal R.L, ***Invertebrates, Rastogi Publications***. 2011.

Pedagogy

E-Resources, Chalk & Talk, Group Discussion

Teaching aids

LCD Projector, Chart models, Interactive White Board

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Principles of taxonomy – Binomial nomenclature – Animal Organisation	4	Discussion
1.2	Outline classification of Invertebrates and the salient features of the Phyla with examples	4	Chalk & Talk
1.3	Outline classification of Chordates upto classes giving examples	4	Chalk & Talk
UNIT - II			
2.1	Feeding and digestion in Amoeba, Hydra and Frog	4	Chalk & Talk
2.2	Respiration in Amoeba, Cockroach	4	E-Resources
2.3	Gills in Fish and Lungs in bird	4	Discussion
UNIT - III			
3.1	Circulatory system in Paramecium, Earthworm and Calotes	4	Chalk & Talk
3.2	Locomotion in Amoeba, Paramecium and Earthworm	4	E-Resources
3.3	Flight mechanism in Pigeon	4	Discussion
UNIT - IV			
4.1	Nervous system of Earthworm	4	Discussion
4.2	Human brain and ear	3	E-Resources
4.3	Receptors – photoreceptors of Euglena, insects and man	5	Chalk & Talk

UNIT - V			
5.1	Excretion in Amoeba and Earthworm	4	E-Resources
5.2	Excretion in Man-Structure of kidney and urine formation.	4	Chalk & Talk
5.3	Reproductive system of Rabbit	4	Discussion
Total		**60**	

Course Designer
Dr. P. Raja
Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20UBYA2P	**Allied Practical – I Botany**	**Allied – III**	**60**	**1**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students acquire practical knowledge of Thallophyta, Bryophyta, Pteridophyta, Gymnospermae and demonstrate the Plant physiology setup and to identify Ecological adaptations of plants.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Observe the morphology and anatomy of Thallophyta, Bryophyta, Pteridophyta and Gymnospermae	**K1,K2, K3**
CO2	Define the floral characters of Angiosperm plants and find them with suitable locally available plants	**K1,K2, K3**
CO3	Compare anatomy of Dicot stem with Monocot stem	**K1,K2, K3**
CO4	Recall the structure of cell organelles, show how to solve Mendelian genetics and find the tools used in Plant tissue culture	**K1,K2**
CO5	Demonstrate the Physiology setup and identify Ecological adaptations of plants	**K1,K2**

K1-Knowledge **K2-Understand** **K3-Apply**

Syllabus

UNIT I 14 Hours

Thallophyta - Study of morphology of the vegetative and reproductive organs. **Bryophyta -** Study of morphology of the vegetative and reproductive organs. **Pteridophyta -** Study of morphology and anatomy of the vegetative and reproductive organs. **Gymnospermae -** Study of morphology and anatomy of the vegetative and reproductive organs

UNIT II 20 Hours

Morphology and Taxonomy: To describe in technical terms plants belonging to any of the families prescribed in the syllabus and to identify the family. **Economic Importance:** To identify the genus, family and morphology of the parts used for the following plant specimens

Ricinus– Seeds	*Manihot* – Tuber
Phyllanthusembilica- Fruit	*Phyllanthusniruri* – Whole plant
Calotropis- Leaf with Latex	*Hemidesmus* – Dried Root
Bambusa – Stem	*Sorghum* – Seed
Zea– Cereal Grain	*Oryza*– Husk and Hay
Saccharum- Stem, Jaggery	*Cymbopogon*- Aromatic Oil
Azadirachta– Leaf, Seeds, Oil	*Ocimum*– Plant, Oil

UNIT III 10 Hours

Anatomy: Study the anatomical characters of Dicot and Monocot stem. **Embryology:** Observation of permanent slides of reproductive parts of Angiosperms.

UNIT IV 8 Hours

Cytology: Observation of Electron micrographs of sub-cellular structures.
Genetics: To Study the Monohybrid, Dihybrid and Incomplete dominance.
Biotechnology: To study the tools used in Plant Tissue Culture

UNIT V 8 Hours

Plant physiology: Describe simple experimental setup in plant physiology
Ecology: Study the Plant Adaptations among the various habitats.

Reference Books

Dr. Ashok Bendre, ***C.B.C.S.: B.Sc 1st Year PRACTICAL BOTANY***, Rastogi Publications, 2018.

Dr. Ashok Bendre, ***C.B.C.S.: B.Sc., 2nd Year PRACTICAL BOTANY***, Rastogi Publications, 2018.

Pandey B.P, ***Modern Practical Botany - Vol. 1***. S. Chand Limited, 2011.

Pandey B.P, ***Modern Practical Botany - Vol. I1*.** S. Chand Limited, 2011.

Pandey B.P, ***Modern Practical Botany - Vol. II1***. S. Chand Limited, 2011.

Pedagogy

Sectioning, Dissection, Demonstration and Chalk & talk.

Teaching Aids

Blackboard, Collected fresh plants samples, Specimens, Charts and Permanent Slides.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	To prepare a temporary slide of *Nostoc*	2	Plants specimens
1.2	To prepare a temporary slide of S*argassum*Stem	2	Plants specimens
1.3	To prepare a temporary slide of *Saccharomyces*	2	Plants specimens
1.4	To prepare a temporary slide of *Agaricus*gills	2	Plants specimens
1.5	To observe a Permanent slide of *Funaria* capsule, *Selaginella*cone, stem	2	Permanent slide
1.6	To prepare a temporary slide of *Pinus* needle	2	Plants specimens
1.7	To prepare a temporary slide of *Selaginella* stem	2	Permanent slide
UNIT - II			
2.1	Morphology of leaf and phyllotaxy	4	Plants specimens
2.2	Inflorescence and its types	4	Plants specimens
2.3	Dissection and taxonomic description of plants	4	Plants specimens
2.4	Economic importance of plant specimens	4	Plants specimens
2.5	Study of medicinal plants	4	Plants specimens
UNIT - III			
3.1	T.S of dicot stem and monocot stem	4	Plants specimens
3.2	To observe permanent slides of different types of cells	2	Permanent slide
3.3	T.S of Anther	2	Permanent slide
3.4	L.S of Ovule	2	Permanent slide

UNIT - IV			
4.1	Monohybrid cross	2	Demonstration
4.2	Dihybrid cross	2	Demonstration
4.3	Incomplete Dominance cross	2	Demonstration
4.4	Tools of Plant Tissue Culture	2	Demonstration
UNIT - V			
5.1	Ganong's Potometer experiment	2	Experiment Demonstration
5.2	Mohl's Half Leaf experiment	2	Experiment Demonstration
5.3	Morphological Adaptations in Xerophytes and Hydrophytes	4	Permanent slide
	Total	**60**	

Course Designer
Dr. A. Maajitha Begam,
Assistant Professor of Botany

Course Code	Course Title	Category	Total Hours	Credits
20UZYA2P	General Zoology & Animal Organisation	Allied - III	60	1

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students acquire knowledge on general characteristics, classification of Invertebrates and Vertebrates and also study the structure and functions of various organs and organ systems.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Acquire knowledge on structural organization and skeletal system in Invertebrates and Chordates.	K1, K2, K3
CO2	Identify and classify Protozoa, Porifera and Coelenterata.	K1, K2
CO3	Assess the importance of phyla, Arthropoda - Mollusca and Echinoderms.	K1, K2
CO4	Knowledge on morphological and anatomical features of edible fishes.	K1, K2, K3
CO5	Explain the architecture of skull, girdles and vertebrae in Chordates.	K1, K2, K3

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	3	3
CO2	3	3	1	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**1**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

1. Anatomical observation and Comments on the following systems using CDROM animal alternatives / Models/ Charts / Bio Visual aids and Transparency.
2. Earth worm: Nerve ring and nerve cord - Body setae.
3. Prawn: Cephalic appendages - Thoracic appendages - Abdominal appendages.
4. Honey bee: Mouth parts and sting of Honey bee.
5. Frog: Arterial system - Venous system and Brain.

List of spotters:

INVERTEBRATA:

1. Protozoa: Amoeba- Paramecium- Euglena and Plasmodium.
2. Porifera: Simple sponge - Sponge Gemmule - Sponge Spicules.
3. Coelenterata: Hydra - Obelia – colony, Obelia – Medusa - Jelly fish and sea anemone.
4. Platyhelminthes: Tape worm, Liver fluke, Redia and cercaria.
5. Nematoda: Ascaris and Wuchereria.
6. Annelida: Nereis, Earth worm and Leech.
7. Arthropoda: Honey bee – Queen, Drone and workers, Silk worm – Moth, Larva and cocoon,
8. Paddy pest: Tryphoryza and Leptocorisa, Coconut pest – Oryctes rhinoceros and Nephantis.
9. Mollusca: Pila and Pearl oyster.
10. Echinodermata: Starfish – oral and aboral view.

CHORDATA:

1. Amphioxus- Balanoglossus- Sea Ascidians- Any five edible fishes- Cobra-Kriat- Viper-Dryophis-Ptyas- Eryx.
2. Osteology: Rabbit skull-Atlas-Pectoral girdle-Pelvic girdle-Fore limbs and Hind limbs.

Text Books

Barnes, R.D. ***Invertebrate Zoology,*** Cengage Learning, India. 2006, VII Edition.

Pechenik, J. A. ***Biology of the Invertebrates.***, McGraw-Hill Education, 2015, VII Edition.

Course Designer

Ms. A. Syedali Fathima
Assistant Professor of Zoology

Course Code	Course Title	Category	Total Hours	Credits
20UCHC31	**Organic and Inorganic Chemistry**	**Core-IV**	**75**	**5**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To delineate the preparation, properties and mechanism of alcohols, ethers, thioalcohols, thioethers and aromatic compounds and explore the concepts of chemical bonding and nuclear chemistry.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Describe the preparation, properties and mechanism of alcohols, ethers, thioalcohols and thioethers.	**K1**
CO2	Explain the aromaticity of organic molecules and predict the reactivity and orientation of electrophiles and nucleophiles during the chemical reactions	**K1, K2**
CO3	Outline the preparation, properties and uses of aromatic hydrocarbons and aromatic halogen compounds	**K1, K2**
CO4	Determine the hybridization and geometry of molecules based on VB and VSEPR theories and explain the molecular orbital theory(MOT) of homo and heteronuclear diatomic molecules	**K1, K2, K3**
CO5	Identify the basic concepts of nuclear chemistry.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	2	3
CO2	3	3	2	2	3
CO3	3	3	1	2	3
CO4	3	1	2	1	3
CO5	3	1	1	3	2

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	2	3
CO2	2	3	2	3	2
CO3	2	3	1	1	1
CO4	3	3	3	2	2
CO5	3	2	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Alcohols: Preparation by hydroboration, reduction of carbonyl compounds, acids and esters, by using Grignard reagents – Reaction with metals – Mechanism and reactivity towards HX, dehydration – rearrangement – Ascending and descending the alcohol series – estimation of number of hydroxyl groups. Ethers: Mechanism of Williamson's synthesis, mechanism of cleavage by HX - estimation of methoxy group by Zeisel method - Applications of crown ethers. Thioalcohols and thioethers: Preparation and properties of sulphonal, mustard gas and Phosphorous ylides.

UNIT II 15 Hours

Aromatic Compounds-I: Introduction – general characteristics of aromatic compounds – Aromaticity and Huckel's rule - Structure of benzene – M.O. Model – Mechanism of aromatic electrophilic substitution (Halogenations, nitration, Sulphonation and Friedel – Crafts reactions – Directive influence of substituents based on electronic effects (detailed study) – Trisubstituted benzenes – steric hindrance and rules for trisubstitution in benzene – Mechanism of aromatic nucleophilic substitution: Unimolecular, bimolecular and benzyne mechanisms.

UNIT III 12 Hours

Aromatic hydrocarbons: Preparation, Properties and uses of toluene, Xylene and Mesitylene.Aromatic halogen compounds: Preparation, properties and uses of bromobenzene and benzyl bromide – reactivity of aryl halides, distinction between nuclear and side chain halogenated derivatives.

UNIT IV 18 Hours

Chemical bonding – valence bond approach – types of overlapping and orbital diagrams – sigma and pi bonds. Hybridization and geometry of molecules – sp, sp^2, sp^3, sp^3d and d^2sp^3 with examples – VSEPR theory – shapes of molecules – molecular orbital theory– Molecular Orbital Theory (MOT) – bonding and antibonding orbitals – relative order of energies of molecular orbitals – MOT applied to homonuclear molecules – H_2, O_2 and F_2 – heteronuclear molecules – HF, CO and NO – comparative study of VB and MOT.

UNIT V 15 Hours

Nuclear chemistry: Composition of the nucleus – nuclear forces – mass defect – binding energy – nuclear stability. Soddy's group displacement law – illustration – Law of radioactive disintegration. Nuclear fission: Definition – the principle of atom bomb. Nuclear fusion: Definition – emission of energy – Stellar energy – hydrogen bomb. Application of radioactivity: In medicine, agriculture, industry and analytical fields – carbon dating.

Reference Book

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

B.R. Puri and L.R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

P. L. Soni, O. P. Dharmarha and U. N. Dash, ***Textbook of Physical Chemistry***, Sulthan & Sons Publication, 2001, 22nd revised edition.

R.D. Madan, ***Modern Inorganic Chemistry***, S. Chand, 2013, revised edition,

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Preparation by hydroboration, reduction of carbonyl compounds, acids and esters, by using Grignard reagents	4	E-Resources
1.2	Reaction with metals – Mechanism and reactivity towards HX, dehydration – rearrangement – Ascending and descending the alcohol series – estimation of number of hydroxyl groups.	4	E-Resources
1.3	Mechanism of Williamson's synthesis, mechanism of cleavage by HX - estimation of methoxy group by Zeisel method - Applications of crown ethers.	4	Chalk & Talk
1.4	Preparation and properties of sulphonal, mustard gas and Phosphorous ylides.	3	E-Resources
UNIT - II			
2.1	Introduction – general characteristics of aromatic compounds – Aromaticity and Huckel's rule -	5	E-Resources
2.2	Structure of benzene – M.O. Model – Mechanism of aromatic electrophilic substitution (Halogenations, nitration, Sulphonation and Friedel – Crafts reactions – Directive influence of substituents based on electronic effects (detailed study)	5	Chalk & Talk
2.3	Trisubstituted benzenes – steric hindrance and rules for trisubstitution in benzene – Mechanism of aromatic nucleophilic substitution: Unimolecular, bimolecular and benzyne mechanisms.	5	E-Resources
UNIT - III			
3.1	Aromatic hydrocarbons – Preparation, Properties and uses of toluene, Xylene and Mesitylene.	4	E-Resources

3.2	Aromatic halogen compounds: Preparation, properties and uses of bromobenzene and benzyl bromide	4	E-Resources
3.3	reactivity of aryl halides, distinction between nuclear and side chain halogenated derivatives	4	Chalk & Talk
UNIT - IV			
4.1	Chemical bonding – valence bond approach – types of overlapping and orbital diagrams – sigma and pi bonds.	4	E-Resources
4.2	Hybridization and geometry of molecules – sp, sp^2, sp^3d and d^2sp^3 with examples – VSEPR theory –	4	Chalk & Talk
4.3	shapes of molecules – molecular orbital theory– Molecular Orbital Theory (MOT) – bonding and antibonding orbitals –	4	Chalk & Talk
4.4	relative order of energies of molecular orbitals – MOT applied to homonuclear molecules – H_2, O_2, F_2 and Cl_2	3	E-Resources
4.5	heteronuclear molecules – HF, CO and NO – comparative study of VB and MOT.	3	E-Resources
UNIT - V			
5.1	Composition of the nucleus – nuclear forces – mass defect – binding energy – nuclear stability.	3	E-Resources
5.2	Soddy's group displacement law – illustration – Law of radioactive disintegration.	3	Chalk & Talk
5.3	Nuclear fission: Definition – the principle of atom bomb.	3	E-Resources
5.4	Nuclear fusion: Definition – emission of energy – Stellar energy – hydrogen bomb.	3	E-Resources
5.5	Application of radioactivity: In medicine, agriculture, industry and analytical fields – carbon dating.	3	Chalk & Talk
	Total	**75**	

Course Designer
Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC32	Physical Chemistry - I	Core - V	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course enables the students to gain knowledge ofthe structure of solids, kinetics of chemical reactions, surface phenomena, structure and properties of liquids.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Recognize the structure and defects of solids	**K1, K2, K3**
CO2	Predict chemical reaction orders using kinetics	**K1, K2, K3**
CO3	Describe the theories of chemical reaction rate	**K1**
CO4	Summarize the different categories of surface phenomena and catalysis	**K1, K2**
CO5	Explain the physical and chemical properties of liquids	**K1, K2**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**1**	**1**	**2**	**2**
CO4	**3**	**1**	**1**	**3**	**3**
CO5	**3**	**2**	**1**	**2**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	1	3	2	2
CO3	1	2	1	1	1
CO4	3	2	2	2	2
CO5	3	3	2	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Solid State: Crystalline and amorphous solids – differences. symmetry in crystal system - elements of symmetry, space lattice and unit cell – Bravais lattices – seven crystal systems – law of rational indices – Miller indices. X-ray diffraction – Bragg's equation – derivation, rotating crystal technique and powder technique, Types of crystals – ionic, molecular, covalent, and metallic crystals - Ionic crystals: Analysis of NaCℓ, KCℓ, CsCℓ – determination of Avogadro number- Molecular crystals – Water and ammonia - Covalent crystals – Diamond and graphite - Metallic crystals – Metallic bond in metals – Band Theory- Conductors, semiconductors and insulators – Frenkel and Schottky defects.

UNIT II 12 Hours

Chemical Kinetics-I: Fundamental concepts – concentration versus time curves to determine rate – rate laws for zero, first, second and third order reactions – rate constant – unit of rate constants – order and molecularity – derivation of expressions for integrated rate constants and half – life period for zero, first, second and third order reactions – problems - pseudo first order reaction, methods of determination of order of reactions - integration, graphical, half-life and Ostwald's isolation methods.

UNIT III 12 Hours

Chemical Kinetics-II: Factors affecting rate of reaction – Temperature dependence of reaction rate – Arrhenius parameters and calculations – Theories of reaction rate - collision theory – limitations– Steady state approximation– Lindemann's hypothesis of unimolecular reactions ARRT – thermodynamic derivation of rate constant. Kinetics of fast reactions - relaxation techniques and flash photolysis.

UNIT IV 12 Hours

Surface chemistry and catalysis: Adsorption – fundamental concepts - factors influencing adsorption – physisorption – chemisorption – adsorption of gaseous on the surface of the solid - adsorption isotherms - Fruendlich and Langmuir adsorption isotherms - applications of surface chemistry. Catalysis - Types of catalysis – intermediate complex and adsorption theories of catalysis- factors affecting the catalytic reactions – promoters and poisons – acid-base catalysis – Enzyme catalysis – Michaelis – Menten equation.

UNIT V 12 Hours

Liquid State: Structure of liquids – physical properties of liquids – vapour pressure, heat of vapourisation – Trouton's rule - Surface tension - definition – surface energy. Viscosity – definition – coefficient of viscosity, effect of temperature and pressure. Refraction – refractive index – specific and molar refraction (definition only).Physical properties and chemical constitution – additive and constitutive properties – molar volume and chemical constitution, parachor and chemical constitution, viscosity and chemical constitution.

Reference Books

B.R. Puri, L.R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

Gurdeep Raj, ***Advanced Physical Chemistry***, Goel Publishing House, Merrut, 2000.

B. S. Bahl, Arun Bahl and G.D. Tuli ***Essentials of physical chemistry***, S. Chand and Company Pvt. Ltd.

Pedagogy

Chalk & Talk, Group discussion & E-Resources

Teaching aids

Black Board, LCD Projector, Crystal models

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Crystalline and amorphous solids – differences. symmetry in crystal system - elements of symmetry, space lattice and unit cell – Bravais lattices – seven crystal systems – law of rational indices – Miller indices.	3	E-Resources
1.2	X-ray diffraction – Bragg's equation – derivation, rotating crystal technique and powder technique.	2	Chalk & Talk
1.3	Types of crystals – ionic, molecular, covalent, and metallic crystals - Ionic crystals: Analysis of NaCℓ, KCℓ, CsCℓ – determination of Avogadro number.	3	E-Resources
1.4	Molecular crystals – Water and ammonia - Covalent crystals – Diamond and graphite.	1	E-Resources
1.5	Metallic crystals – Metallic bond in metals – Band Theory- Conductors, semiconductors and insulators – Frenkel and Schottky defects.	3	Chalk & Talk
UNIT - II			
2.1	Fundamental concepts – concentration versus time curves to determine rate.	2	Chalk & Talk
2.2	Rate laws for zero, first, second and third order reactions – rate constant – unit of rate constants – order and molecularity.	3	E-Resources
2.3	Derivation of expressions for integrated rate constants and half – life period for zero, first, second and third order reactions – problems.	4	E-Resources
2.4	Pseudo first order reaction, methods of determination of order of reactions - integration, graphical, half-life and Ostwald's isolation methods.	3	Chalk & Talk

UNIT - III			
3.1	Factors affecting rate of reaction – Temperature dependence of reaction rate – Arrhenius parameters and calculations.	2	E-Resources
3.2	Theories of reaction rate - collision theory – limitations - Steady state approximation- Lindemann's hypothesis of unimolecular reactions.	5	Chalk & Talk
3.3	ARRT – thermodynamic derivation of rate constant. Kinetics of fast reactions - relaxation techniques and flash photolysis.	5	E-Resources
UNIT - IV			
4.1	Adsorption – fundamental concepts - factors influencing adsorption – physisorption – chemisorption.	3	E-Resources
4.2	Adsorption of gaseous on the surface of the solid - adsorption isotherms - Fruendlich and Langmuir adsorption isotherms - applications of surface chemistry.	3	Chalk & Talk
4.3	Catalysis - Types of catalysis – intermediate complex and adsorption theories of catalysis	2	Chalk & Talk
4.4	Factors affecting the catalytic reactions – promoters and poisons.	1	E-Resources
4.5	Acid-base catalysis–enzyme catalysis – Michaelis – Menten equation.	3	E-Resources
UNIT - V			
5.1	Liquid state – structure of liquids – physical properties of liquids – vapour pressure, heat of vapourisation – Trouton's rule.	3	E-Resources
5.2	Surface tension - definition – surface energy. Viscosity – definition – coefficient of viscosity, effect of temperature and pressure.	3	Chalk & Talk

5.3	Refraction – refractive index – specific and molar refraction (definition only).	2	E-Resources
5.4	Physical properties and chemical constitution – additive and constitutive properties – molar volume and chemical constitution, parachor and chemical constitution, viscosity and chemical constitution.	4	E-Resources
	Total	**60**	

Course Designer
Dr. N. M. Abdul Khadar Jailani
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UPHA11	Ancillary Physics-I	Allied – IV	60	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

This course deals with the motion of objects, aspects of basic properties of matter such as elasticity, viscosity, surface tension, diffusion and the effects of gravitation on objects. The course is designed to enable students to measure physical quantities associated with the above properties through experiments during laboratory sessions

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Analyze the laws of motion and central force	**K1**
CO2	Discuss the center of mass of a rigid body-motion	**K1, K2**
CO3	Discuss the variation of acceleration due to gravity	**K1**
CO4	Understand the properties of matter like elasticity and viscosity	**K1,K2,K3**
CO5	Discuss the Properties of Sound Waves	**K1,K2,K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**3**	**3**	**2**	**1**
CO2	**3**	**1**	**2**	**3**	**1**
CO3	**3**	**3**	**3**	**1**	**2**
CO4	**3**	**2**	**3**	**3**	**1**
CO5	**2**	**2**	**1**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	1
CO2	3	1	2	3	1
CO3	2	3	2	1	2
CO4	3	2	3	3	1
CO5	2	2	1	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Basic forces in nature – Types of forces – Gravitational force, Electromagnetic force and nuclear forces – Conservative and Non conservative forces – Laws of Friction – Limiting, Coefficient and Angle of friction – Motion of bodies along an inclined plane – Work – Work done by varying force – Expression for kinetic energy and potential energy – Power.

UNIT II 12 Hours

Angular velocity – Normal acceleration (no derivation) – Centrifugal and centripetal forces – Torque and angular momentum – Expression for Torque in rotational motion – Expression for angular momentum of a rotating rigid body – K.E of rotation-work and power rotational motion – Moment of inertia – Laws of parallel and perpendicular axes theorems – M.I of ring, circular discs, solid cylinder and solid sphere.

UNIT III 12 Hours

Kepler's laws of planetary motion – Law of gravitation – Mass and density of Earth – Boy's method for G – Compound pendulum –Expression for period – Experiment to find g – Variation of g with latitude, altitude and Depth – Satellites–Orbital and escape velocity –Period of revolution – Polar and Geo – Stationary satellites.

UNIT IV 12 Hours

Elastic moduli – Poisson's ratio – Beams – Expression for bending moment – Determination of Young's modulus by uniform and non-uniform bending – I section of girders – Torsion – Expression for couple per unit twist – Work done in twisting – Torsional pendulum – Derivation of Poisiuille's formula (analytical method) – Bernoulli's theorem proof- Applications – Venturimeter – Pitot tube.

UNIT V 12 Hours

Simple harmonic motions – Progressive waves properties – Composition of two S.H.M. and beats stationary waves – Properties – Melde's experiment for the frequency of electrical maintained tuning fork –Transverse and longitudinal modes – Acoustics – Ultrasonic – Properties and application.

Text Books:

Mechanics, Properties of Matter and Sound - R. Murugeshan, Shantha publications, 2002.

Reference Books:

A Text book of sound, N. Subrahmanyam and Brijlal, Vikas Publishing House, 2009.

Elements of Properties of Matter D.S.Mathur, S.Chand and Company Ltd., 2007.

Properties of matter, Brijlal and Subramanian S. Chand & Co., 2004.

Pedagogy

Chalk and Talk Lecture, Seminar, Group discussion, LMS, PPT

Teaching Aids

Black board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Basic forces in nature, Types of forces, gravitational force, Electromagnetic force and nuclear forces	2	Chalk and Talk
1.2	Conservative and Non conservative forces	2	E-Resources
1.3	Laws of Friction, Limiting, Coefficient and Angle of friction	1	E-Resources
1.4	Motion of bodies along an inclined plane	2	Chalk and Talk
1.5	Work, work done by varying force	2	E-Resources
1.6	Expression for kinetic energy and potential energy	2	E-Resources
1.7	Power	1	Discussion

UNIT - II			
2.1	Angular velocity, Normal acceleration(no derivation), Centrifugal and centripetal forces	2	Chalk and Talk
2.2	Torque and angular momentum	2	Discussion
2.3	Expression for Torque in rotational motion	2	E-Resources
2.4	Expression for angular momentum of a rotating rigid body	2	Discussion
2.5	K.E of rotation-work and power rotational motion	2	Chalk and Talk
2.6	Moment of inertia, Laws of parallel and perpendicular axes theorems	2	E-Resources
UNIT - III			
3.1	Kepler's laws of planetary motion	1	Chalk and Talk
3.2	Law of gravitation	2	E-Resources
3.3	Mass and density of Earth-	1	Discussion
3.4	Boy's method for G, Compound pendulum, expression for period	1	E-Resources
3.5	Experiment to find g	1	Chalk and Talk
3.6	Variation of g with latitude, altitude and depth	2	Discussion
3.7	Satellites, orbital and escape velocity	2	E-Resources
3.8	Period of revolution, Polar and Geo-stationary satellites	2	Discussion
UNIT - IV			
4.1	Elastic moduli, Poisson's ratio	2	Chalk and Talk
4.2	Beams, expression for bending moment	1	E-Resources
4.3	Determination of Young's modulus by uniform and non-uniform bending	2	E-Resources
4.4	I section of girders, Torsion	1	Discussion
4.5	Expression for couple per unit twist–work done in twisting	2	Chalk and Talk
4.6	Torsional pendulum, Derivation of Poisiuille's formula (analytical method)	2	E-Resources
4.7	Bernoulli's theorem proof, applications	1	E-Resources
4.8	Venturimeter, Pitot tube	1	Discussion

UNIT - V			
5.1	Simple harmonic motions	1	Chalk and Talk
5.2	Progressive waves properties	1	E-Resources
5.3	Composition of two S.H.M	2	E-Resources
5.4	Beats stationary waves, Properties	2	Chalk and Talk
5.5	Melde's experiment for the frequency of electrical maintained tuning fork Transverse and longitudinal modes	2	E-Resources
5.6	Acoustics	2	E-Resources
5.7	Ultrasonic, Properties and application	2	Discussion
Total		**60**	

Course Designer
Dr. T.K. Thirumalaisamy
Associate Professor of Physics

Course Code	Course Title	Category	Total Hours	Credits
20UCHC41	Organic and Physical Chemistry	Core - VI	75	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course gives the knowledge on the phase transition properties of chemical compounds and first law of thermodynamics.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Explain the concept, grasp the preparation, properties and applications of aromatic nitro and amino compounds	**K1, K2**
CO2	Outline the some advanced organic name reactions and various factors influencing the acidity of phenols	**K1, K2**
CO3	Discuss the effect of substituents on acidic character of aromatic acids	**K1, K2**
CO4	Find the phase diagram of different chemical systems	**K1, K2, K3**
CO5	Apply the fundamentals of first law of thermodynamics	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**2**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**2**	**1**	**3**
CO5	**3**	**2**	**1**	**1**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**1**
CO4	**3**	**3**	**2**	**2**	**1**
CO5	**3**	**3**	**2**	**2**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Aromatic nitro compounds: Preparation and properties of nitrotoluenes and nitrobenzene. Aromatic amino compounds: Preparation by reduction of nitro compounds and from chlorobenzene - Effect of substituents on the basic character of aromatic amines – Comparison between aliphatic and aromatic amines. Estimation of aniline. Preparation of sulphanilic acid, nitroanilines and phenylenediamines. Preparation and synthetic applications of benzene diazonium chloride.

UNIT II 15 Hours

Aromatic Compounds – IV: Aromatic aldehydes: Benzaldehyde – Mechanism of Cannizaro, Perkins, Claisen, Knoevenagel reaction and benzoin condensation - Preparation & Properties of cinnamaldehyde & vanillin - Phenols: Acidity of phenols – effect of substituents on the acidity of phenol, mechanism of Reimer-Tiemann, Gattermann, Fries and Kolbe's reactions.

UNIT III 15 Hours

Aromatic compounds – V: Effect of substituents on acidic character - Substituted acids: Preparation, Properties of salicylic acid and anthranilic acid - Aromatic sulphonic acids: preparation, Properties and uses of benzene sulphonic acid, saccharin, chloramine–T and dichloramine–T.

UNIT IV 15 Hours

Phase Rule: Meaning of the terms – phase, component and degree of freedom- derivation of Gibb's phase rule. Phase equilibria of one component systems – CO_2, water and sulphur systems. Phase equilibria of two component systems – simple eutectic systems – (Pb – Ag) – Freezing mixtures (NaCl – water). Partially miscible liquid pairs - phenol-water, triethylamine – water and nicotine-water systems (systems with lower and upper CST), influence of impurities on CST and applications –immiscible liquids – principle and application to steam distillation, Salt hydrates:

Efflorescence, Deliquescence and hygroscopic –dehydration of copper sulphate crystals. Nernst distribution law (thermodynamic derivation) and its applications.

UNIT V 15 Hours

First Law; statement – mathematical formulation – internal energy – enthalpy or heat content – heat changes at constant volume and at constant pressure conditions – relationship between C_P and C_V – work done, heat change and enthalpy change for reversible isothermal expansion and compression of an ideal gas – calculation of q, w, ΔE, ΔH for reversible adiabatic expansion of an ideal gas – relation between T, V and P of an ideal gas undergoing adiabatic reversible expansion - comparison of work done in isothermal and adiabatic reversible expansion of an ideal gas – application of I law to non-ideal gas undergoing reversible isothermal and adiabatic expansion – Joule effect – Joule-Thomson effect – Joule Thomson coefficient in the case of ideal and real gases – inversion temperature.

Reference Book

B.R. Puri, L.R. Sharma and Madan S. Pathania, ***Principles of Physical Chemistry***, Vishal Publishing Co., Jalandhar, 2005.

Gurdeep Raj, ***Advanced Physical Chemistry***, Goel Publishing House, Merrut, 2000.

B. S. Bahl, Arun Bahl and G.D. Tuli – ***Essentials of physical chemistry,*** S. Chand and Company Pvt. Ltd.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Preparation and properties of nitrotoluenes and nitrobenzene	3	Chalk & Talk
1.2	Preparation by reduction of nitro compounds and from chlorobenzene - Effect of substituents on the basic character of aromatic amines	4	E-Resources

1.3	Comparison between aliphatic and aromatic amines. Estimation of aniline	3	E-Resources
1.4	Preparation of sulphanilic acid, nitroanilines and phenylenediamines. Preparation and synthetic applications of benzene diazonium chloride.	5	Chalk & Talk
UNIT - II			
2.1	Benzaldehyde – Mechanism of Cannizaro, Perkins, Claisen, Knoevenagel reaction and benzoin condensation	6	E-Resources
2.2	Preparation & Properties of cinnamaldehyde & vanillin	3	Chalk & Talk
2.3	Acidity of phenols – effect of substituents on the acidity of phenol	3	E-Resources
2.4	Mechanism of Reimer - Tiemann, Gattermann, Fries and Kolbe's reactions	3	Discussion
UNIT - III			
3.1	Effect of substituents on acidic character - Substituted acids	4	E-Resources
3.2	Preparation, Properties of salicylic acid and anthranilic acid	4	Discussion
3.3	Aromatic sulphonic acids: preparation, Properties and uses of benzene sulphonic acid	3	Chalk & Talk
3.4	preparation, Properties and uses of saccharin, chloramine–T and dichloramine–T	4	E-Resources
UNIT - IV			
4.1	Meaning of the terms – phase, component and degree of freedom- derivation of Gibb's phase rule.	2	E-Resources
4.2	Phase equilibria of one component systems – CO_2, water and sulphur systems	4	Chalk & Talk
4.3	Phase equilibria of two component systems – simple eutectic systems – (Pb – Ag) – Freezing mixtures (NaCl – water)	3	Chalk & Talk

4.4	Partially miscible liquid pairs - phenol-water, tri methylamine – water and nicotine-water systems (systems with lower and upper CST), influence of impurities on CST and applications – immiscible liquids.	3	E-Resources
4.5	Principle and application to steam distillation, Salt hydrates: Efflorescence, Deliquescence and hygroscopic – dehydration of copper sulphate crystals	2	Discussion
4.6	Nernst distribution law (thermodynamic derivation) and its applications.	1	Discussion
UNIT - V			
5.1	First Law; statement – mathematical formulation – internal energy – enthalpy or heat content	2	E-Resources
5.2	Heat changes at constant volume and at constant pressure conditions – relationship between C_P and C_V – work done, heat change and enthalpy change for reversible isothermal expansion and compression of an ideal gas	3	Chalk & Talk
5.3	Calculation of q, w, ΔE, ΔH for reversible adiabatic expansion of an ideal gas.	3	Discussion
5.4	Relation between T, V and P of an ideal gas undergoing adiabatic reversible expansion - comparison of work done in isothermal and adiabatic reversible expansion of an ideal gas	3	E-Resources
5.5	Application of I law to non-ideal gas undergoing reversible isothermal and adiabatic expansion – Joule effect – Joule-Thomson effect – Joule Thomson coefficient in the case of ideal and real gases – inversion temperature.	4	Chalk & Talk
	Total	**75**	

Course Designer

Dr. N. M. Abdul Khadar Jailani

Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC42	Inorganic Chemistry-I	Core - VII	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course explains extraction of metals, properties of carbon and nitrogen compounds, theories of acids and bases, coordination compounds and functions of hemoglobin and myoglobin.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Explain the various metallurgical processes involved in the metal extraction	**K1, K2**
CO2	Apply the basic concepts and theories of acids and bases and their properties.	**K1, K2, K3**
CO3	Describe the properties and structure of allotropes of carbon, silicates and carbon compounds and preparation, properties and uses of nitrogen compounds	**K1**
CO4	Name the basic terms, nomenclature involved in coordination compounds and explain the theories of coordination compounds	**K1, K2**
CO5	Construct the structure and functions of hemoglobin and myoglobin	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**2**	**3**
CO2	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**1**	**2**	**3**
CO4	**3**	**3**	**1**	**1**	**3**
CO5	**3**	**3**	**2**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	2	3	2
CO4	3	3	1	1	1
CO5	3	3	2	1	1

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 10 Hours

Metallurgy: Occurrence of metals – minerals and ores – mineral wealth of India – refining of metals – zone refining – electrolytic refining – van Arkel – de Boer process – important ores and extraction of the following metals – titanium, thorium and platinum – their important alloys and applications.

UNIT II 12 Hours

Acids and bases:Arrhenius concept, proton transfer theory – concept of Lowry and Bronsted - conjugate acid – base pairs – relative strengths of acids and bases – Luxflood concept – the solvent system concept – Lewis concept – Classification of solvents. Relative strength of acids and bases – effect of solvent – leveling effect – effect of polarity and dielectric constant – effect of substituents – factors influencing relative strengths of acids and bases– Usanovich concept – HSAB concept (fundamentals only).

UNIT III 10 Hours

General Discussion of group IV and V elements: General discussion of group IV elements - Comparison between carbon and silicon, silicon hydrides, and silicates – structure(ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates) - preparation of carbonyl chloride – lead monoxide – red lead – white lead – General discussion of group V elements – active nitrogen – preparation, properties structure and uses of hydrazine, hydrazoic acid and hydroxylamine

UNIT IV 16 Hours

Coordination compounds:Introduction – Nomenclature – Werner's theory – Sidgwick theory - EAN rule applied to Ni and Co carbonyls - Valence bond theory - low spin and high spin complexes of Fe and Co – Colour and magnetic properties of co-ordination complexes- Limitations of VB theory - Crystal field theory – Octahedral, tetrahedral and square planar complexes - Modified CFT – ligand field theory - bonding in metal carbonyls.

UNIT V 12 Hours

Bioinorganic chemistry:Metalloporphyrins – Chlorophyll – structure and work function (photo system I & II) -- Vitamin B_{12} – structural features only - Myoglobin and hemoglobin – Structure - Their role in biological systems - Hill constant, co-operativity effect, Bohr Effect - Explanation for co-operativity effect in hemoglobin - Role of Na^+, K^+, $Ca^{2+}$and Mg^{2+} ions in biological system.

Text Books

P. L. Soni and M. Katyal, ***Text book of Inorganic Chemistry***, Sultan Chand and Sons, NewDelhi.

Reference Books

B.R. Puri, L.R. Sharma and K.C. Kalia, ***Principles of Inorganic Chemistry***, Milestone Publishers, 2010, (Unit I & II).

R. D. Madan, ***Modern Inorganic Chemistry***, S.Chand & Co., New Delhi, 2005. (Unit III & IV).

Chatwal and Bhagi, ***Bio-inorganic Chemistry***, Himalaya Publishing House, 2010, 2nd edition (Unit V).

Pedagogy

Chalk & Talk, E-Resources, Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Occurrence of metals – minerals and ores – mineral wealth of India	3	Chalk & Talk
1.2	refining of metals – zone refining – electrolytic refining – van Arkel – de Boer process	3	E-Resources

1.3	Important ores and extraction of the following metals – titanium, thorium and platinum – their important alloys and applications.	4	Discussion
UNIT – II			
2.1	Arrehenius concept, proton transfer theory – concept of Lowry and Bronsted - conjugate acid – base pairs – relative strengths of acids and bases	3	Discussion
2.2	Luxflood concept – the solvent system concept – Lewis concept – Classification of solvents.	3	Chalk & Talk
2.3	Relative strength of acids and bases – effect of solvent – leveling effect – effect of polarity and dielectric constant – effect of substituents	3	E-Resources
2.4	Factors influencing relative strengths of acids and bases– Usanovich concept – HSAB concept (fundamentals only).	3	E-Resources
UNIT – III			
3.1	General discussion of group IV elements - Comparison between carbon and silicon, silicon hydrides, and silicates	2	E-Resources
3.2	Structure(ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates)	2	Chalk & Talk
3.3	preparation of carbonyl chloride – lead monoxide – red lead – white lead	2	Discussion
3.4	General discussion of group V elements – active nitrogen	2	Discussion
3.5	preparation, properties structure and uses of hydrazine, hydrazoic acid and hydroxylamine	2	Chalk & Talk
UNIT – IV			
4.1	Introduction – Nomenclature – Werner's theory – Sidgwick theory - EAN rule applied to Ni and Co carbonyls	4	Discussion

4.2	Valence bond theory - low spin and high spin complexes of Fe and Co – Colour and magnetic properties of co-ordination complexes- Limitations of VB theory	4	E-Resources
4.3	Crystal field theory – Octahedral, tetrahedral and square planar complexes	4	Chalk & Talk
4.4	Modified CFT – ligand field theory - bonding in metal carbonyls.	4	E-Resources
UNIT – V			
5.1	Metalloporphyrins – Chlorophyll – structure and work function (photo system I & II)	3	E-Resources
5.2	Vitamin B_{12} – structural features only - Myoglobin and hemoglobin – Structure - Their role in biological systems -	3	Chalk & Talk
5.3	Hill constant, co-operativity effect, Bohr Effect - Explanation for co- operativity effect in hemoglobin	3	Discussion
5.4	Role of Na^+, K^+, $Ca^{2+}$and Mg^{2+} ions in biological system.	3	E-Resources
	Total	**60**	

Course Designer
Dr. K. Shahul Hameed
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC4P	Volumetric Analysis	Core - VIII	90	3

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students to acquire the quantitative skills in volumetric analysis and to calibrate chemical balance, burette, pipette and standard flask.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Apply acidimetric and alkali metric method for the quantitative volumetric estimation of acids and bases	**K1,K2, K3**
CO2	Estimate the amount of sample by permanganometry and Dichrometry	**K1,K2, K3**
CO3	Estimate the amount of sample by Iodometry	**K1,K2, K3**
CO4	Demonstrate the quantitative estimation of analyze by precipitation titration	**K1,K2, K3**
CO5	Estimate the hardness of water by Complexometric Tltratlons	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**3**	**3**	**2**	**3**
CO2	**1**	**3**	**3**	**2**	**3**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**1**	**3**	**3**	**3**	**2**
CO5	**1**	**3**	**3**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**1**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**1**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**3**
CO5	**3**	**2**	**1**	**3**	**2**

1-Low **2-Medium** **3-Strong**

Syllabus

A double titration involving preparation of primary standard by weighing using chemical balance and making up of the solution to be estimated.

List of Experiments

I. Acidimetry and Alkalimetry

1) Estimation of Na_2CO_3
2) Estimation of NaOH /KOH
3) Estimation of oxalic acid.

II. Redox Titrations

a. Permanganimetry

1) Estimation of ferrous ion
2) Estimation of oxalic acid
3) Estimation of calcium (direct method)

b. Dichrometry

1) Estimation of ferrous ion
2) Estimation of ferric ion using external indicator

III. Iodometry

1) Estimation of potassium dichromate
2) Estimation of potassium permanganate
3) Estimation of copper

IV. Precipitation Titrations

1) Estimation of chloride ion

V. Complexometric Titrations

1) Estimation of hardness of water using EDTA.

Reference Book

Sundaram, Krishnan, Raghavan, ***Practical Chemistry (Part II),*** S. Viswanathan Co. Pvt., 1996.

B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, ***Vogel's Text Book of Practical Organic Chemistry***. 5th Edition, Pearson Education, 2005.

Course Designer

Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UPHA21	**Ancillary Physics - II**	**Allied – V**	**60**	**3**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

This course deals with the geometrical and physical optics in day to day life. It deals with the physics behind semiconductors and the working of rectifiers in depth, the basics of transistors and their characteristics. Acquire the skill of computing addition, subtraction, multiplication and division using binary numbers. Learn the working of basic as well as universal logic gates and their characteristics.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Know the different types of lenses, principal points, cardinal points and the equivalent focal length of the lens system.	**K1,K2,K3**
CO2	Learn the principles of Interference, Diffraction and polarization and the experiments related to them.	**K1,K2,K3**
CO3	Understand the concept of optical rotation	**K1**
CO4	Gain a sound knowledge in semiconductor Physics, types of diodes, working of rectifiers and filters.	**K1,K2,K3**
CO5	Construct logic gates using discrete components and IC`s and to calculate their output voltage.	**K1,K2,K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	3	2
CO2	2	1	3	2	1
CO3	2	3	2	2	1
CO4	3	3	1	2	2
CO5	3	2	2	1	2

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	1
CO2	2	1	3	3	1
CO3	3	2	3	1	2
CO4	3	3	3	3	1
CO5	2	2	1	3	2

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Deviation produced by thin lens – Focal length of two thin lenses in and out of contact – Cardinal points – Refraction through a thin prism – Dispersion – Dispersive power – Combination of thin prisms to produce i) Deviation without dispersion and ii) Dispersion without deviation – Direct vision spectroscope – Chromatic aberration in lenses and its removal-Spherical aberration and its removal.

UNIT II 12 Hours

Interference in thin films – Air wedge-Newton's rings– Determination of wavelength-Jamin's Interferometer – Principle and uses – Diffraction – Theory of plane transmission grating (normal incidence only) – Experiment to determine wavelength.

UNIT III 12 Hours

Double refraction – Nicol prisms, constructions, action and uses –QWP and HWP – Optical activity – Biot's laws-Specific rotator power – Half shade polarimeter – Determination of specific rotator power – Fiber optics – Light propagation in fibers – Fiber optic communication system.

UNIT IV 12 Hours

Junction diodes – Forward and Reverse bias – Diode characteristics – Types of diodes (LED and Zener) – Bridge rectifier using diodes (π filter) – Transistors-Characteristics (CE mode only) – Biasing and action of a transistor-Single stage (CE) amplifier – Frequency response – Hartley oscillator – Modulation (qualitative study).

UNIT V 12 Hours

Binary number system – Reason for using binary numbers – Binary to decimal and decimal to binary conversions – Addition and subtraction of binary numbers – Logic circuits-Boolean algebra – De Morgan's theorem – OR,AND,NOT,NOR and NAND gates – NOR and NAND gates as universal building blocks – XOR gates.

Text Books

R. Murugeshan, ***Electricity and Electronics***, Shantha publications, 2007

R. Murugeshan, ***Optics and Spectroscopy***, Vivekananda Press, Madurai, 2004.

Reference Books

Brijlal & N. Subramanayan, ***A textbook of optics,*** S. Chand, 2002.

A. Ubald Raj & G. Jose Robin, ***Basic Electronics***, Indira Publications, 1998.

Malvino & Leech, ***Digital principles and applications 6th edition***, Tata Mc-Graw Hill, 1996.

Kakani & Bhandari, ***Optics and Spectroscopy***, Sultan Chand & Sons, 2002.

Pedagogy:

Chalk and Talk Lecture, Seminar, Group discussion, LMS, PPT

Teaching Aids:

Black board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Deviation produced by thin lens	1	Chalk and Talk
1.2	Focal length of two thin lenses in and out of contact, Cardinal points	2	E-Resources
1.3	Refraction through a thin prism, Dispersion, Dispersive power	2	E-Resources

1.4	Combination of thin prisms to produce i) Deviation without dispersion and ii) Dispersion without deviation	2	Chalk and Talk
1.5	Direct vision spectroscope	1	E-Resources
1.6	Chromatic aberration in lenses and its removal	2	E-Resources
1.7	Spherical aberration and its removal	2	Discussion
UNIT - II			
2.1	Interference in thin films	2	Chalk and Talk
2.2	Air wedge – Newton's rings – Determination of wavelength	3	E-Resources
2.3	Jamin's Interferometer – Principle and use	2	E-Resources
2.4	Diffraction, Theory of plane transmission grating (normal incidence only)	3	Chalk and Talk
2.5	Experiment to determine wavelength	2	E-Resources
UNIT - III			
3.1	Double refraction	1	Chalk and Talk
3.2	Nicol prisms, constructions, action and uses	2	E-Resources
3.3	QWP and HWP	2	E-Resources
3.4	Optical activity, Biot's laws	1	Chalk and Talk
3.5	Specific rotator power, Half shade polarimeter	2	E-Resources
3.6	Determination of specific rotator power	1	E-Resources
3.7	Fiber optics, Light propagation in fibers	2	Chalk and Talk
3.8	Fiber optic communication system	1	Discussion
UNIT - IV			
4.1	Junction diodes, Forward and Reverse bias	2	Chalk and Talk
4.2	Diode characteristics, Types of diodes (LED and Zener)	2	E-Resources
4.3	Bridge rectifier using diodes (π filter)	1	E-Resources
4.4	Transistors, Characteristics (CE) mode only	2	Chalk and Talk

4.5	Biasing and action of a transistor	1	E-Resources
4.6	Single stage (CE) amplifier, Frequency response	2	E-Resources
4.7	Hartley oscillator	1	Chalk and Talk
4.8	Modulation (qualitative study)	1	Discussion
UNIT - V			
5.1	Binary number system	2	Chalk and Talk
5.2	Reason for using binary numbers	2	E-Resources
5.3	Binary to decimal and decimal to binary conversions	1	E-Resources
5.4	Addition and subtraction of binary numbers	1	Chalk and Talk
5.5	Logic circuits, Boolean algebra	1	E-Resources
5.6	De Morgan's theorem	1	E-Resources
5.7	OR,AND,NOT,NOR and NAND gates	2	Chalk and Talk
5.8	NOR and NAND gates as universal building blocks	1	Discussion
5.9	XOR gates	1	Discussion
	Total	**60**	

Course designer:
Dr. T.K. Thirumalaisamy
Associate Professor of Physics

Course Code	Course Title	Category	Total Hours	Credits
20UPHA2P	Ancillary Physics Practical - I	Allied - VI	60	2

Nature of Course	
Knowledge Oriented	
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To enable the students to develop practical skills and verify the various basic concepts of Physics in mechanical, optical experiments and electronics

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Estimate the value of Young's modulus of a given wooden scale, the value of Rigidity modulus of a given wire and determine acceleration due to gravity.	**K1, K2, K3**
CO2	Estimate the viscosity of a given liquid and Comparison of capacitances using B.G and Owen's bridge	**K1, K2, K3**
CO3	Demonstration of interference patterns	**K1, K2, K3**
CO4	Experiments related to sound and light	**K1, K2, K3**
CO5	Verification of some simple digital circuits	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**1**	**2**	**3**
CO2	**2**	**3**	**3**	**3**	**1**
CO3	**3**	**1**	**3**	**2**	**3**
CO4	**2**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**3**	**2**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	1
CO2	3	1	2	3	1
CO3	3	3	3	1	2
CO4	3	2	3	3	1
CO5	2	2	1	3	2

1-Low **2-Medium** **3-Strong**

Syllabus

List of experiments (Any 12 experiments from the list)

Compound Pendulum-Determination of g
Torsional Pendulum-Determination of I and G
Young's Modulus – Uniform bending – Pin and Microscope
Comparison of Capacitances-Ballistic Galvanometer
Spectrometer-Determination of μ
Coefficient of Viscosity-Stokes Method
Sonometer-Verification of Laws
Air Wedge – Thickness of wire
Determination of Dispersive power of a prism-Spectrometer
Determination of self-inductance- LCR Series resonance
Bridge rectifier – π filter
Logic gates – AND, OR, NOT- discrete components
Logic gates – NAND, NOR - discrete components
Owen's bridge (AC) - comparison of capacitances

Reference Books

R. Murugeshan, M. Shantha Kiruthiga Sivaprasath, ***Allied Physics Paper I & II***, S. Chand & Company Pvt. Ltd. New Delhi, Revised Edition, Reprint 2014.

R. Murugeshan, ***Electricity and Electronics Practical***, Shantha Publications, 2007.

Course Designer:

Dr. T.K. Thirumalaisamy
Associate Professor of Physics

Course Code	Course Title	Category	Total Hours	Credits
20UCHC51	Organic Chemistry-I	Core - IX	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To acquire knowledge about aromatic hydrocarbons, stereoisomerism, carbohydrates, dyes and active methylene compounds.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Explain the preparation, properties and list the uses of isolated and condensed systems in polynuclear hydrocarbons.	**K1, K2**
CO2	Outline the geometrical isomerism, E - Z notations, optical isomerism, chirality, R-S notations - Optical activity of compounds.	**K1, K2**
CO3	Classify carbohydrates and construct the structure and properties of monosaccharides, disaccharides and polysaccharides.	**K1, K2**
CO4	Prepare picric acid- bismark brown- malachite green- Alizarin- indigo.	**K1, K2, K3**
CO5	Find the preparation methods and acidity of active methylene group.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**1**	**2**	**2**
CO2	**3**	**2**	**2**	**3**	**2**
CO3	**3**	**2**	**1**	**3**	**2**
CO4	**2**	**2**	**3**	**3**	**3**
CO5	**2**	**1**	**2**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	1	1	2
CO2	2	3	2	2	1
CO3	2	2	2	L	2
CO4	3	3	2	2	2
CO5	2	2	3	2	1

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Polynuclear hydrocarbons: Isolated systems: Preparation and properties of diphenyl, benzidine, diphenic acid, diphenyl methane, triphenyl methane and stilbene. Condensed systems: Preparation, properties and uses of Naphthalene, anthracene, and phenanthrene.

UNIT II 12 Hours

Stereoisomerism: Geometrical isomerism of maleic and fumaric acids and aldoximes and ketoximes –determination of configuration of geometrical isomers – E - Z notations - Optical isomerism: optical activity – specific rotation and polarimetric determination – definition of optical isomerism- elements of symmetry – optical activity of compounds containing asymmetric carbon atom – lactic and tartaric acids – enantiomers and diastereomers – racemic and meso forms – racemization and resolution of racemic mixtures – Walden inversion – asymmetric synthesis. Chirality – specifications of absolute configuration by R-S notations.

UNIT III 12 Hours

Carbohydrates: Definition- classification –monosaccharides – preparation and properties of glucose and fructose – Haworth structure (glucose only) – mutarotation – epimerization – difference between glucose and fructose – conversion of glucose into fructose and vice versa. Disaccharides: structure and properties of sucrose – inversion of sucrose – difference between monosaccharides and disaccharides – Polysaccharides: structure of starch and cellulose- uses of cellulose.

UNIT IV 12 Hours

Dyes: Definition - color sensation – Theories of colour and constitution- Witt's chromophore – auxochrome theory- bathochromic group – red shift – hypsochromic groups – blue shift - and valence bond theory – requirements of a dye – classification of dyes based on chemical structure and based on method of application. Preparation and uses of Nitro dye -

picric acid, Azo dye - Bismarck brown, triphenyl methane dye - malachite green, Anthraquinone dye - Alizarin, Indigo dye - indigo.

UNIT V 12 Hours

Active methylene compounds: Ethyl acetoacetate – preparation – tautomerism of ethyl acetoacetate. reactions of active methylene group, ketonic hydrolysis and acid hydrolysis - synthesis of n-butyl ethyl acetoacetate, succinic acid, α, β – unsaturated acids – crotonoic acid and methyl ethyl ketone from ethyl acetoacetate. Diethyl malonate, preparation, reactions of active methylene group - synthesis of alkyl acetic acid, succinic acid, α, β – unsaturated acids –crotonoic acid, α – amino acid – glycine and barbituric acid from diethyl malonate.

Text Books

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

P. L. Soni & H. M. Chawla, ***Text book of Organic Chemistry***, Sulthan Chand & Sons, New Delhi, 2012, Twenty ninth edition.

Reference Book

I.L. Finar, ***Organic Chemistry, Volumen1: The Fundamental Principles*****,** ELBS, Singapore, 1994, Sixth Edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Isolated systems: Preparation and properties of diphenyl, benzidine, diphenic acid, diphenyl methane, triphenyl methane and stilbene.	6	E-Resources
1.2	Condensed systems: Preparation, properties and uses of Naphthalene, anthracene, and phenanthrene.	6	E-Resources

UNIT - II			
2.1	Geometrical isomerism of maleic and fumaric acids and aldoximes and ketoximes – determination of configuration of geometrical isomers – E - Z notations	3	E-Resources
2.2	Optical isomerism: optical activity – specific rotation and polarimetric determination.	2	Chalk & Talk
2.3	Definition of optical isomerism- elements of symmetry – optical activity of compounds containing asymmetric carbon atom – lactic and tartaric acids	3	E-Resources
2.4	Enantiomers and diastereomers – racemic and meso forms – racemization and resolution of racemic mixtures – Walden inversion – asymmetric synthesis.	2	E-Resources
2.5	Chirality – specifications of absolute configuration by R-S notations.	2	Discussion
UNIT - III			
3.1	Definition – classification – monosaccharides – preparation and properties of glucose and fructose – Haworth structure (glucose only) – mutarotation – epimerization – difference between glucose and fructose – conversion of glucose into fructose and vice versa.	7	E-Resources
3.2	Disaccharides: structure and properties of sucrose – inversion of sucrose – difference between monosaccharides and disaccharides – Polysaccharides: structure of starch and cellulose- uses of cellulose.	5	E-Resources

UNIT - IV			
4.1	Definition - color sensation – Theories of colour and constitution - Witt's chromophore – auxochrome theory- bathochromic group – red shift – hypsochromic groups – blue shift and valence bond theory.	4	E-Resources
4.2	Requirements of a dye – classification of dyes based on chemical structure and based on method of application.	4	E-Resources
4.3	Preparation and uses of Nitro dye- picric acid, Azo dye- Bismarck brown, triphenyl methane dye - malachite green, Anthraquinone dye - Alizarin, Indigo dye - indigo.	4	Chalk & Talk
UNIT - V			
5.1	Ethyl acetoacetate – preparation – tautomerism of ethyl acetoacetate. reactions of active methylene group, ketonic hydrolysis and acid hydrolysis - synthesis of n-butyl ethyl acetoacetate, succinic acid, α, β – unsaturated acids – crotonoic acid and methyl ethyl ketone from ethyl acetoacetate.	6	E-Resources
5.2	Diethyl malonate, preparation, reactions of active methylene group - synthesis of alkyl acetic acid, succinic acid, α, β – unsaturated acids –crotonoic acid, α – amino acid – glycine and barbituric acid from diethyl malonate.	6	Chalk & Talk
	Total	**60**	

Course Designer
Hajee Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC52	Physical Chemistry – II	Core – X	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course enables the students to cognizant the concepts of thermodynamics and apply it to physical and chemical systems and study the fundamentals of photochemistry and group theory.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Describe the concepts of second law of thermodynamics and its applications.	**K1**
CO2	Summarize the free energy relationships and significance of partial molar quantities.	**K1, K2**
CO3	Illustrate the applications of thermodynamics to various types of equilibria and explanation of third law of thermodynamics.	**K1, K2**
CO4	Construct the modern concepts of photochemistry.	**K1, K2, K3**
CO5	Apply the rules of Group theory in the point group assignment of molecules.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**1**	**3**	**2**	**3**
CO2	**3**	**1**	**2**	**2**	**3**
CO3	**3**	**2**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**3**
CO5	**3**	**1**	**3**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	2	3	3
CO5	1	3	1	2	1

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Thermodynamics-II: Hess' law of heat summation – Kirchoff's equation. Limitations of I law of thermodynamics – spontaneous process – statement of II law – conversion of heat into work - thermodynamic efficiency – Carnot cycle – refrigeration cycle – Carnot theorem – Kelvin scale of temperature. Entropy: definition and significance – derivation of the concept of entropy – entropy changes in reversible and irreversible (spontaneous) processes. Entropy as thermodynamic function – dependence of entropy on the variables of the system for ideal gases – entropy of mixing of gases – entropy and probability.

UNIT II 15 Hours

Thermodynamics-III: Free energy function – Helmholtz free energy (A) – definition and its temperature dependence – Gibbs free energy (G) – definition, variation of Gibbs free energy with temperature and pressure. Gibbs – Helmholtz equation and its applications – Maxwell's relationships – criteria for reversible and irreversible processes in terms of entropy and free energy changes. Partial molar quantities – Definition and significance of chemical potential – Gibbs – Duhem equation – variation of chemical potential with temperature and pressure – chemical potential in the case of system of ideal gases. Clausius – Clapeyron equation – derivation and applications – thermodynamic properties of real gases – fugacity and activity concepts.

UNIT III 15 Hours

Thermodynamics-IV: Applications of thermodynamics to various type of equilibria – equilibrium constant and free energy changes – Van't Hoff reaction isotherm and Van't Hoff isochore – thermodynamic interpretation of law of mass action and Lechatelier principle. Thermodynamics of ideal solution – free energy change of mixing, enthalpy changes of mixing and entropy changes of mixing – thermodynamic derivation – relation between the depression of freezing point and concentration – elevation of boiling

point and concentration – thermodynamic derivations. Thermodynamics III – Nernst heat theorem and its applications third law of Thermodynamics.

UNIT IV 15 Hours

Photochemistry: Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, Reason for low and high quantum yields with examples. Jablonski energy level diagram – primary and secondary photochemical processes. Radiation less transition – internal conversion and inter system crossing. Radiative transitions – fluorescence - Phosphorescence –and their differences. Chemiluminescence. Experimental techniques of photochemical reactions – chemical actinometers–quantum yield. Photosensitization -Mechanism of photosynthesis. Photochemical kinetics- Kinetics of photochemical reactions between hydrogen and chlorine and bromine.

UNIT V 15 Hours

Group Theory: Symmetry elements and symmetry operations – definition of identity, proper rotational axis – mirror plane – inversion center and rotation reflection axis. Symmetry operations generated by symmetry elements- H_2O, NH_3, BF_3, $[PtCl_4]^{2-}$, H_2O_2 (Planar, cis and trans) and CH_4 as examples. Group postulates – abelian and cyclic group – group multiplication table – molecular point groups – assignment of point groups to simple molecules like H_2O, NH_3 and CO_2.

Text Books

B.R. Puri, L.R. Sharma and M.S. Pathania, ***Principles of Physical Chemistry***, ShobanlalNagin Chand and Co. Jalendhar, 2001, 41stEdn.

B. S. Bahl, G. D. Tuli and ArunBahl, ***Essentials of Physical Chemistry***, S. Chand & Co. Ltd, New Delhi, 2011, 12th Edn.

Reference Books

P. Atkins, ***Physical Chemistry***, Oxford University Press, UK, 2002, 7th Edition. (UNIT – I, II & III)

D. Van Samuel Glasstone, ***Thermodynamics***, Eastern Wiley Publication, London, UK, 2002, 5th edition. (UNIT – I, II & III)

Rahatgi Mukherjee, ***Fundamentals of Photochemistry***, Willey Eastern Ltd., New York, USA, 1994. (UNIT – IV)

F. A. Cotton, ***Chemical applications of group theory***, Wiley eastern Ltd., UK, 1971, 3rd edition. (UNIT – V)

K. V. Raman, ***Group theory***, Tata McGraw Hill Publishing Limited, New Delhi, India, 1990, 1st edition. (UNIT – V)

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Hess' law of heat summation – Kirchoff's equation. Limitations of I law of thermodynamics – spontaneous process.	3	Chalk & Talk
1.2	Statement of II law – conversion of heat into work - thermodynamic efficiency – Carnot cycle – refrigeration cycle – Carnot theorem – Kelvin scale of temperature.	4	E-Resources
1.3	Entropy – definition and significance – derivation of the concept of entropy – entropy changes in reversible and irreversible (spontaneous) processes.	4	Discussion
1.4	Entropy as a thermodynamic function – dependence of entropy on the variables of the system for ideal gases – entropy of mixing of gases – entropy and probability.	4	E-Resources
UNIT - II			
2.1	Free energy function – Helmholtz free energy (A) – definition and its temperature dependence – Gibbs free energy (G) – definition, variation of Gibbs free energy with temperature and pressure.	4	Discussion
2.2	Gibbs – Helmholtz equation and its applications – Maxwell's relationships – criteria for reversible and irreversible processes in terms of entropy and free energy changes.	4	E-Resources

2.3	Partial molar quantities – Definition and significance of chemical potential – Gibbs – Duhem equation – variation of chemical potential with temperature and pressure – chemical potential in the case of system of ideal gases.	4	E-Resources
2.4	Clausius – Clapeyron equation – derivation and applications – thermodynamic properties of real gases – fugacity and activity concepts.	3	Chalk & Talk
UNIT - III			
3.1	Application of thermodynamics to various type of equilibria – equilibrium constant and free energy changes – Van't Hoff reaction isotherm and Van't Hoff isochore – thermodynamic interpretation of law of mass action and Lechatelier principle.	5	E-Resources
3.2	Thermodynamics of ideal solution – free energy change of mixing, enthalpy changes of mixing and entropy changes of mixing	3	Chalk & Talk
3.3	thermodynamic derivation – relation between the depression of freezing point and concentration – elevation of boiling point and concentration – thermodynamic derivations.	5	E-Resources
3.4	Thermodynamics III – Nernst heat theorem and its applications third law of Thermodynamics.	2	Discussion
UNIT - IV			
4.1	Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, Reason for low and high quantum yields with examples.	3	Discussion

4.2	Jablonski energy level diagram – primary and secondary photochemical processes. Radiation less transition – internal conversion and inter system crossing. Radiative transitions – fluorescence - Phosphorescence –and their differences.	3	E-Resources
4.3	Chemiluminescence. Experimental techniques of photochemical reactions – chemical actinometers–quantum yield. Photosensitization - Mechanism of photosynthesis.	5	E-Resources
4.4	Photochemical kinetics- Kinetics of photochemical reactions between hydrogen and chlorine and bromine	4	Chalk & Talk
UNIT - V			
5.1	Symmetry elements and symmetry operations – definition of identity, proper rotational axis – mirror plane – inversion center and rotation reflection axis.	3	E-Resources
5.2	Symmetry operations generated by symmetry elements- H_2O, NH_3, BF_3, $[PtCl_4]^{2-}$, H_2O_2 (Planar, cis and trans) and CH4 as examples.	6	Discussion
5.3	Group postulates – abelian and cyclic group – group multiplication table – molecular point groups – assignment of point groups to simple molecules like H_2O, NH_3 and CO_2.	6	Chalk & Talk
	Total	**75**	

Course Designer
Dr. N. M. Abdul Khader Jailani
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC53	Inorganic Chemistry – II	Core - XI	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course explains the chemistry of halogens, metal carbonyls, and f-block elements and also describes the fundamental knowledge on Chromatographic techniques and gravimetric analysis.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Describe the properties and uses of halogens, oxy acids of halogens and interhalogen compounds.	**K1**
CO2	Classify the periodic variations, separation, applications of lanthanide and actinides.	**K1, K2**
CO3	Summarize the preparation, general properties and application of various inorganic polymers and metal carbonyls	**K1, K2**
CO4	Determine the various errors occurred in experiments	**K1, K2, K3**
CO5	Apply suitable chromatographic techniques to identify and separate the compounds	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**1**	**1**	**3**	**2**
CO2	**3**	**1**	**2**	**3**	**2**
CO3	**3**	**2**	**3**	**3**	**3**
CO4	**1**	**2**	**3**	**3**	**2**
CO5	**1**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**2**	**2**	**2**	**2**
CO2	**1**	**2**	**2**	**2**	**2**
CO3	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Group VII elements (Halogens): Comparative study of halogens – Preparation, properties and structure of OF_2, Cl_2O, Cl_2O_7, BrO_2 and I_2O_5 – Oxyacids of halogens: oxidation state of halogens in acids – preparation, uses and structure of hypochlorous acid, chloric acid, perchloric acid and periodic acid. Bleaching powder – preparation, properties and uses. Relative strength of oxyacids of halogens - Interhalogen compounds: Types and general methods of preparation properties and structures of ClF, ICl; ClF_3, BrF_3; ClF_5, BrF_5, IF_5 and IF_7 - Psuedohalogens compounds - Examples and uses.

UNIT II 12 Hours

f-Block elements: Lanthanide series - electronic configuration - oxidation states - atomic and ionic radii of M^{3+}ions - Lanthanide contraction: Causes and consequences - colour of M^{3+} cations - occurrence, extraction of lanthanides from monazite sand – Separation by ion exchange method. Actinide series: occurrence - electronic configuration - oxidation states - atomic and ionic radii of M^{3+} ions - Actinide contraction - colour of M^{3+} cations. Uranium: occurrence - Properties of Uranyl nitrate and Uranyl acetate - Comparison between lanthanides and actinides.

UNIT III 12 Hours

Inorganic Polymers: General properties of inorganic polymers – glass transition temperature - Various types of silicones, preparation, properties and uses of silicones - Sulphur based polymers – polymeric sulphur – polymeric sulphur nitride – preparation, properties and uses. Metal Carbonyls: Classifications of metal carbonyls - EAN rule applied to metal carbonyls. Bonding in metal carbonyls – Identification of metal carbonyls by IR spectroscopy. General methods of preparation, properties and structures of $Cr(CO)_6$, $Ni(CO)_4$, $Fe(CO)_5$, $Mn_2(CO)_{10}$ and $Fe_3(CO)_{12}$.

UNIT IV 12 Hours

Gravimetry and Error analysis: Principle- theories of precipitation- solubility product and precipitation - factors affecting solubility - Conditions of precipitation- co-precipitation & post precipitation, reduction of errors. Precipitation from homogeneous solution- washing and drying of precipitate. Choice of the precipitant- Specific and Selective precipitants. Data analysis: idea of significant figures- its importance accuracy- methods of expressing accuracy- error analysis- types of errors- minimizing errors- precision- methods of expressing precision-mean, median, mean deviation, standard deviation and confidence limits.

UNIT V 12 Hours

Chromatographic Techniques: Column Chromatography- principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications. TLC- principle, choice of adsorbent and solvent, preparation of chromatoplates, Rf -values, factors affecting the Rf-values, Significance of Rf-values. Paper Chromatography- principle, solvents used development of chromatogram, ascending, descending and radial paper chromatography. Ion-exchange chromatography- principle- types of resins- requirements of a good resin- action of resins- experimental techniques- separation of Na-K, Ca-Mg, Co-Ni, and Chloride- bromide. Gas Chromatography (GC)- principle- experimental techniques- instrumentation and applications.

Text Book

P. L. Soni and M. Katyal, ***Textbook of Inorganic Chemistry***, Sultan Chand and Sons, NewDelhi.

Reference Books

B.R. Puri, L.R. Sharma and K.C. Kalia, ***Principles of Inorganic Chemistry***, Milestone Publishers, 2010.

R. Gopalan and V. Ramalingam, ***Concise Coordination Chemistry***, Vikas Publishing House Private Limited, New Delhi, 2010.

Sathya Prakash's ***Modern Inorganic Chemistry***, R. D. Madan, S. Chand & Co., New Delhi, 2005.

Sathya Prakash, ***Advanced Inorganic Chemistry***, Volume I and II, S. Chand & Co., New Delhi, Revised reprint 2013.

Albert Cotton, F.A., ***Advanced Inorganic Chemistry***, Geofferey Wilkinson, Carlos, Murillo, Manfred Bochmann, John Wiley & Sons, Inc. New York, 1998.

Sharma, B. K., *Instrumental methods of chemical analysis*, Goel Publishing House, Merrut (1997).

Gopalan R, Subramanian PS and Rengarajan K ***Elements of analytical chemistry*** Sultan Chand, 1993, second revised edition.

Gurdeep R Chatwal, Sham K. Anand ***Instrumental methods of chemical analysis,*** Himalaya publishing house (2005).

Huheey, J. E. Keiter, Ellen A. Keiter, Richard L ***Inorganic Chemistry***, Pearson Education Pvt Ltd, Harper Collins College Publishers, Singapore, 4th Edn, 2004.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Comparative study of halogens – Preparation, properties and structure of OF_2, Cl_2O, Cl_2O_7, BrO_2 and I_2O_5 – Oxyacids of halogens: oxidation state of halogens in acids – preparation, uses and structure of hypochlorous acid, chloric acid, perchloric acid and periodic acid.	4	E-Resources
1.2	Bleaching powder – preparation, properties and uses. Relative strength of oxyacids of halogens	3	E-Resources
1.3	Interhalogen compounds: Types and general methods of preparation properties and structures of ClF, ICl, ClF_3, BrF_3, ClF_5, BrF_5, IF_5 and IF_7 - Psuedohalogens compounds - Examples and uses.	5	Chalk & Talk
	UNIT - II		
2.1	Lanthanide series - electronic configuration - oxidation states - atomic and ionic radii of M^{3+}ions - Lanthanide contraction: Causes and consequences - colour of M^{3+} cations - occurrence, extraction of lanthanides from monazite sand – Separation by ion exchange method.	4	E-Resources

2.2	Actinide series: occurrence - electronic configuration - oxidation states - atomic and ionic radii of M^{3+} ions - Actinide contraction - colour of M^{3+} cations.	4	Chalk & Talk
2.3	Uranium: occurrence - Properties of Uranyl nitrate and Uranyl acetate. Comparison between lanthanides and actinides.	4	Discussion
UNIT - III			
3.1	General properties of inorganic polymers – glass transition temperature - Various types of silicones, preparation, properties and uses of silicones - Sulphur based polymers – polymeric sulphur – polymeric sulphur nitride – preparation, properties and uses.	4	E-Resources
3.2	Classifications of metal carbonyls - EAN rule applied to metal carbonyls. Bonding in metal carbonyls – Identification of metal carbonyls by IR spectroscopy.	4	Chalk & Talk
3.3	General methods of preparation, properties and structures of $Cr(CO)_6$, $Ni(CO)_4$, $Fe(CO)_5$, $Mn_2(CO)_{10}$ and $Fe_3(CO)_{12}$.	4	Discussion
UNIT - IV			
4.1	Principle- theories of precipitation- solubility product and precipitation - factors affecting solubility - Conditions of precipitation- co-precipitation & post precipitation, reduction of errors.	4	Discussion
4.2	Precipitation from homogeneous solution- washing and drying of precipitate. Choice of the precipitant- Specific and Selective precipitants. Data analysis: idea of significant figures - its importance accuracy- methods of expressing accuracy	4	E-Resources
4.3	Error analysis- types of errors- minimizing errors- precision- methods of expressing precision-mean, median, mean deviation, standard deviation and confidence limits.	4	Chalk & Talk

UNIT - V			
5.1	Column Chromatography- principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications. TLC- principle, choice of adsorbent and solvent, preparation of chromatoplates, Rf -values, factors affecting the Rf-values. Significance of Rf-values	5	E-Resources
5.2	Paper Chromatography - principle, solvents used development of chromatogram, ascending, descending and radial paper chromatography. Ion-exchange chromatography- principle- types of resins- requirements of a good resin- action of resins- experimental techniques- separation of Na-K, Ca-Mg, Co-Ni, and Chloride- bromide.	5	Chalk & Talk
5.3	Gas Chromatography (GC) - principle- experimental techniques- instrumentation and applications.	2	Discussion
	Total	**60**	

Course Designer
Dr. K. Shahul Hameed
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHE51	Polymer Chemistry	Elective - I	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	✓
Global	✓

Preamble

The course enables the students to gain knowledge about polymers, types, properties, polymerization and its applications.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Describe the polymers and its various classification.	**K1**
CO2	Classify the Kinetics and mechanism of polymerization.	**K1, K2**
CO3	Illustrate the distribution of molecular weight and properties of the polymers.	**K1, K2**
CO4	Apply their knowledge to prepare various polymers.	**K2, K2, K3**
CO5	Find the polymers based on their applications.	**K2, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**2**	**3**	**1**	**3**
CO2	**3**	**3**	**3**	**1**	**2**
CO3	**2**	**2**	**3**	**2**	**1**
CO4	**3**	**1**	**2**	**3**	**3**
CO5	**3**	**2**	**2**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	2	3
CO2	3	3	2	3	2
CO3	2	3	2	3	1
CO4	3	2	3	2	3
CO5	3	1	3	2	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Introduction to Polymers: Introduction - polymers- monomers and polymers-degree of polymerization- definition - Classification of polymer based on sources, intermolecular forces, shapes: Natural synthetic, linear, cross linked and network, plastics, elastomers, fibres, Homopolymers and Copolymers. General methods of preparation of polymers - Polymerization through functional groups- polymerization through multiple bonds- polymerization through ring opening- Stereochemistry of polymers - Isotactic, syndiotactic and atactic.

UNIT II 12 Hours

Kinetics and mechanism of polymerization: Types of polymerization reactions: Chain growth polymerization –mechanism and kinetics of free radical, Cationic, anionic polymerization – Step growth polymerization: Polycondensation reaction -non catalysed, acid catalysed polymerization- Stereo regular polymers: Ziegler Natta polymers- Copolymerization.

UNIT III 12 Hours

Molecular weight Distribution: Number average molecular weight-weight average molecular weight- Method of Determination of molecular weight- Solution method- precipitation method- End group Analysis method - Vapour pressure osmometry method. Properties of polymers: The crystalline melting point- glassy state and glass transition temperature.

UNIT IV 12 Hours

Industrial Polymers: General methods of preparation, properties and uses of the following polymers: Polyethylene (LDPE & HDPE), polypropylene, PVC, Polystyrene, PAN, Polyurethanes, polymethyl methacrylate and PTFE, nylon and terylene. Natural rubber – isoprene unit – vulcanization of rubber – Preparation, properties and uses of Synthetic rubber- Neoprene, SBR (Buna-S-rubber), Buna-N.

UNIT V 12 Hours

Plastics and Resins: Definition - differences between thermoplastic and thermosetting resins - Constituents of plastics, fillers, dyes, pigments, plasticizers, lubricants and Catalyst-urea-formaldehyde resins, phenol - formaldehyde resins, Teflon, epoxy resins, silicon resins, Adhesives. Biopolymers: Polypeptides-polynucleotide-polysaccharides- Cellulose derivatives: rayon-cellophane-cellulose nitrate-cellulose acetate-methyl & ethyl cellulose.

Reference Books

V. R. Gowarikar, N.V. Viswanathan, Jayadev Sreedhar, ***Polymer Science***, Wiley Eastern Limited, New Delhi, 1986, 2nd edition.

P. Bahadur and N.V. Sastry, ***Principles of Polymer Science***, Narosa publishing house, New Delhi, 2012, 2nd edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Introduction - polymers- monomers and polymers-degree of polymerization-definition.	2	Chalk & Talk
1.2	Classification of polymer based on sources, intermolecular forces, shapes: Natural synthetic, linear, cross linked and network, plastics, elastomers, fibres, Homopolymers and Copolymers.	4	E-Resources
1.3	General methods of preparation of polymers-Polymerization through functional groups- polymerization through multiple bonds- polymerization through ring opening-	3	Discussion

1.4	Stereochemistry of polymers-Isotactic, Syndiotactic and Atactic.	3	E-Resources
UNIT - II			
2.1	Types of polymerization reactions: Chain growth polymerization – mechanism and kinetics of free radical, Cationic, anionic polymerization.	5	Discussion
2.2	Step growth polymerization: Polycondensation reaction -non catalysed, acid catalysed polymerization.	3	Chalk & Talk
2.3	Stereo regular polymers: Ziegler Natta polymers.	2	E-Resources
2.4	Copolymerization.	2	E-Resources
UNIT - III			
3.1	Number average molecular weight-weight average molecular weight- Method of Determination of molecular weight-Solution method.	4	E-Resources
3.2	Precipitation method- End group Analysis method- Vapour pressure osmometry method.	4	Chalk & Talk
3.3	Properties of polymers: The crystalline melting point- glassy state and glass transition temperature.	4	Discussion
UNIT - IV			
4.1	General methods of preparation, properties and uses of the following polymers: Polyethylene (LDPE & HDPE), polypropylene, PVC, Polystyrene.	4	Discussion
4.2	General methods of preparation, properties and uses of the following polymers: PAN, Polyurethanes, polymethyl methacrylate and PTFE, nylon and terylene.	4	E-Resources

4.3	Natural rubber – isoprene unit – vulcanization of rubber –– Preparation, properties and uses of Synthetic rubber-Neoprene, SBR (Buna-S-rubber), Buna-N.	4	Chalk & Talk
UNIT - V			
5.1	Definition- differences between thermoplastic and thermo setting resins-Constituents of plastics fillers, dyes, pigments, plasticizers, lubricants and Catalyst.	4	E-Resources
5.2	Urea-formaldehyde resins, phenol-formaldehyde resins, Teflon, epoxy resins, silicon resins, - Adhesives.	4	Chalk & Talk
5.3	Biopolymers: polypeptides-polynucleotide-polysaccharides- Cellulose derivatives rayon-cellophane-cellulose nitrate-cellulose acetate-methyl & ethyl cellulose.	4	Discussion
	Total	**60**	

Course Designer
Dr. S. Sivakumar
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHE52	Applied Chemistry	Elective - I	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	✓
Regional	✓
National	✓
Global	✓

Preamble

To gain the knowledge about the applications of chemistry in the various fields.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Illustrate the hardness of water and its purification methods.	**K1, K2**
CO2	Outline the significance of green manuring over the various chemical fertilizers in plants growth.	**K1, K2**
CO3	Apply the preservation methods in food storage.	**K1, K2, K3**
CO4	Summarize the preparation of cosmetic and cleaning agents.	**K1, K2**
CO5	Find the preparation methods of various polymers and dyes.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**2**	**1**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**2**	**2**	**3**	**1**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	2	2	2
CO3	2	3	2	2	1
CO4	2	3	2	2	1
CO5	3	3	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 10 Hours

Water Chemistry: Water – Characteristics of water, soft water and hard water- Removal of hardness – Purification of water by ion exchange and reverse - osmosis methods-Water pollution: Sources and effects of water pollution (Domestic, Industrial, Agricultural) –Eutrophication.

UNIT II 14 Hours

Agricultural Chemistry: Plant nutrients –Requisites of good fertilizers - Effect of Nitrogen, Phosphorous and potassium on plant growth, deficiency symptoms - examples for nitrogenous, phosphatic and potassium fertilizers: - Functions of secondary and micro nutrients. Manures: Farm yard manure–Compost making – Green manuring -Concentrated organic manures: Oil cakes- Difference between fertilizer and manure – Superiority of manure over fertilizer - Biofertilizers: Rhizobium, Azetobacter, Cyanobacteria.

UNIT III 12 Hours

Food Chemistry: Food classification and functions- Digestion in mouth, stomach and intestine. Absorption- spoilages, preservation techniques (canning, dehydration, freeze, drying. salting, pickling, pasteurizing, fermenting and carbonating). Minerals and water as food–role of water in physiology –water balance –water sources, major and trace minerals – biological functions of Ca, P, Fe, Cu, I and Zn.

UNIT IV 12 Hours

Cosmetic and Other Materials: Cosmetics – Face powder – constituents, uses, side effects. Nail polish, hair dye – composition and side effects - Tooth powder – composition and manufacture. Lotions- Preparation of phenyl, liquid blue and incense sticks- cleaning agents: Soaps- types and cleaning action – detergents – types – merits and demerits of soap and detergents –chemical definitions of shampoo, washing powder and bleaching powder.

UNIT V 12 Hours

Material Chemistry: Polymers: Explanations, uses and examples for thermo setting and thermo plastic polymers – natural rubber- vulcanization of rubber- Rayon -Synthetic rubber (Polyester, and Nylon) – Dyes: classification of dyes based on application (Direct, Vat, Acid, Reactive, Mordant and Disperse).

Text Books

K. Bagavathi Sundari, ***Applied Chemistry***, MJP Publishers, Chennai, 2006, First edition. (Unit- I-II)

A Thankamma Jacob, ***A Text Book of Applied Chemistry***, McMillan India Ltd., 1979, First edition. (Unit- III, IV).

Arun Bahl and B.S. Bahl, ***Text Book of Organic Chemistry***, S. Chand, New Delhi, 2006, 11th and 18th Edition. (Unit- V).

Reference Books

B. K. Sharma, ***Industrial Chemistry***, Goel Publishing House, Meerut, 1995, Seventh Edition.

Jayashree Ghosh, ***Fundamental Concepts of Applied Chemistry***, S. Chand Company Ltd, New Delhi, 2006, First Edition

R. K. Kaleeswari, R. Rajeswari, J. Prabhaharan and C. Bharathi, ***Elements of Agricultural Chemistry***, Satish Serial Publishing House, 2014.

Alex Ramani, ***Food Chemistry***, MJP publishers, Chennai, 2009.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	Water – Characteristics of water, soft water and hard water- Removal of hardness.	3	E-Resources
1.2	Purification of water by ion exchange and reverse - osmosis methods	3	E-Resources

1.3	Water pollution: Sources and effects of water pollution -Eutrophication.	4	Discussion
UNIT - II			
2.1	Plant nutrients – Requisites of good fertilizers - Effect of Nitrogen, Phosphorous and potassium on plant growth	3	E-Resources
2.2	Deficiency symptoms - examples for nitrogenous, phosphatic and potassium fertilizers, Functions of secondary and micro nutrients.	4	E-Resources
2.3	Manures: Farm yard manure - Compost making – Green manuring -Concentrated organic manures: Oil cakes	3	E-Resources
2.4	Difference between fertilizer and manure – Superiority of manure over fertilizer. Biofertilizers: Rhizobium, Azetobacter, Cyanobacteria.	4	Discussion
UNIT - III			
3.1	Food classification and functions- Digestion in mouth, stomach and intestine- absorption.	3	E-Resources
3.2	Spoilages, preservation techniques (canning, dehydration, freeze–drying. salting, pickling, pasteurizing, fermenting and carbonating).	3	Discussion
3.3	Minerals and water as food–role of water in physiology –water balance - water sources, major and trace minerals –water sources, major and trace minerals	3	E-Resources
3.4	Biological functions of Ca, P, Fe, Cu, I and Zn.	3	E-Resources
UNIT - IV			
4.1	Cosmetics – Face powder – constituents, uses, side effects. Nail polish, hair dye – composition and side effects.	3	Discussion

4.2	Tooth powder – composition and manufacture. Lotions- Preparation of phenyl, liquid blue and incense sticks.	3	E-Resources
4.3	Cleaning agents: Soaps- types and cleaning action – detergents – types – merits and demerits of soap and detergents	3	E-Resources
4.4	Chemical definitions of shampoo, washing powder and bleaching powder.	3	Discussion
UNIT - V			
5.1	Polymers: Explanations, uses and examples for thermo setting and thermo plastic polymer.	4	E-Resources
5.2	Natural rubber- vulcanization of rubber- Rayon -Synthetic rubber (Polyester, and Nylon)	4	E-Resources
5.3	Dyes: classification of dyes based on application (Direct, Vat, Acid, Reactive, Mordant and Disperse).	4	E-Resources
	Total	**60**	

Course Designer
Dr. S. Sivakumar
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHE53	**Computational Chemistry & Cheminformatics**	**Elective - I**	**60**	**4**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	✓
Regional	
National	
Global	✓

Preamble

To acquire knowledge about programming languages, MS office and drug receptor interaction using molecular docking.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Demonstrate the components of a computer and programming languages.	**K1, K2**
CO2	Apply 'C' language in Chemistry.	**K1, K2, K3**
CO3	Demonstrate how to work in Microsoft word, excel and Power Point.	**K1, K2**
CO4	Construct mol and sd files for the target structures using docking softwares.	**K1, K2, K3**
CO5	Identify the drug-receptor interaction using docking procedures.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**1**
CO2	**3**	**2**	**2**	**2**	**1**
CO3	**3**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**1**
CO5	**2**	**3**	**2**	**2**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Importance of Computer: Importance of computer: definition of a computer – organization of components of a computer – hardware – input unit – central processing unit (CPU) and output unit – Generation of computers - secondary storage devices –magnetic disk – floppy disk – software – system and application software. Types of computers: mainframe, mini, super and micro- computers: programming languages – low level languages, machine languages – assembly level languages – high level languages – BASIC (FORTAN, C, C+, LINUX).

UNIT II 12 Hours

Computers in Chemistry: Application of 'C' language in Chemistry – Introduction of 'C' language – Character set – 'C' tokens – Keywords and Identifiers – Constants, variables, Data types and operators – Computation of some simple problems in Chemistry such as 1) Half-life period, 2) Normality, Molality and Molarity of a solution, 3) Root mean square velocity, 4) Ionic strength of an electrolyte and 5) Beer-Lamberts law.

UNIT III 12 Hours

Microsoft Office: Microsoft Word: Introduction – Opening, Creating and Saving a new Document - Printing a Document - Formatting Text - Working with Shapes and Lists - Line and Paragraph Spacing- Working with Tables, Pictures, Headers and Footers - Microsoft Excel: Introduction - Opening, Creating and Saving a new worksheet - Columns, Rows, and Cells - Arithmetic Calculations & Formulas - Calculate with Functions - Graphs and Charts - Printing the Document. Microsoft Power point: Starting PowerPoint - Working with Slides - Applying Theme - Animation- Transitions – Views.

UNIT IV 12 Hours

Cheminformatics: Introduction, History, Evolution, Prospects and Use of cheminformatics- Molecular Modeling and Structure Elucidation- Representation of molecules and Chemical Reactions: Nomenclature; Different types of notations; SMILES coding; Matrix Representations; Structure of Mol files and Sd files- Libraries tool kits and Different electronics effects- Representing 2D and 3D structures.

UNIT V 12 Hours

Molecular docking: Molecular Dynamics – Introduction – basic principles, drug likeliness and compound filters-Prediction of ADME properties- Lipinski's rule of five – Mechanics and Dynamics of bio-macromolecules- Principles of Protein structure – Structural databases- PDB, CATH, SCOP; Chemical Databases – ZINC, Pubchem, Chembl. Docking procedures – Rigid docking, Flexible docking and scoring functions-Structure-based and Ligand based drug design –Molecular Docking, Active Site characterization- Drug-receptor interaction- Case study of designing HIV I protease Inhibitor.

Text Books

Ramesh Kumari, ***Computers and their Applications to Chemistry***, Narosa Publishing House, 2005, Second edition. (Unit – I & II)

P.K. Sinha, ***Computer Fundamentals***, BPB Publications, New Delhi, 2004. (Unit-III)

Andrew R. Leach, Valerie J. Gillet, ***An Introduction to Cheminformatics***, Springer, Netherland, 2007, revised edition. (Unit – IV & V)

Reference Books

K.V Raman, ***Computers in Chemistry***, Tata McGraw-Hill Publishing Company, New Delhi, 1993, First edition.

Leach A. R, ***Molecular Modelling: Principles and applications***, New Delhi, Prentice Hall, 2001, Second edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Importance of computer: definition of a computer – organization of components of a computer – hardware – input unit – central processing unit (CPU) and output unit	3	Discussion
1.2	Generation of computers - secondary storage devices –magnetic disk – floppy disk – software – system and application software.	3	E-Resources
1.3	Types of computers: mainframe, mini, super and micro- computers: programming languages – low level languages, machine languages.	3	E-Resources
1.4	Assembly level languages – high level languages – BASIC (FORTAN, C, C+, LINUX).	3	E-Resources
UNIT - II			
2.1	Application of 'C' language in Chemistry – Introduction of 'C' language – Character set – 'C' tokens – Keywords and Identifiers	3	E-Resources
2.2	Constants, variables, Data types and operators	2	E-Resources
2.3	Computation of some simple problems in Chemistry such as 1) Half-life period, 2) Normality, Molality and Molarity of a solution	4	E-Resources
2.4	3) Root mean square velocity, 4) Ionic strength of an electrolyte and 5) Beer-Lamberts law.	3	E-Resources

UNIT - III			
3.1	Microsoft Word: Introduction – Opening, Creating and Saving a new Document - Printing a Document - Formatting Text - Working with Shapes and Lists - Line and Paragraph Spacing.	3	Discussion
3.2	Working with Tables, Pictures, Headers and Footers - Microsoft Excel: Introduction - Opening, Creating and Saving a new worksheet	3	E-Resources
3.3	Columns, Rows, and Cells - Arithmetic Calculations & Formulas - Calculate with Functions - Graphs and Charts - Printing the Document –water sources, major and trace minerals	3	E-Resources
3.4	Microsoft Power point: Starting PowerPoint - Working with Slides - Applying Theme – Animation - Transitions – Views.	3	Discussion
UNIT - IV			
4.1	Introduction, History, Evolution, Prospects and Use of cheminformatics - Molecular Modeling and Structure Elucidation	4	E-Resources
4.2	Representation of molecules and Chemical Reactions: Nomenclature; Different types of notations; SMILES coding; Matrix Representations	4	E-Resources
4.3	Structure of Molfiles and Sd files- Libraries toolkits and Different electronics effects- Representing 2D and 3D structures.	4	E-Resources

UNIT - V			
5.1	Molecular Dynamics – Introduction – basic principles, drug likeliness and compound filters-Prediction of ADME properties- Lipinski's rule of five	4	E-Resources
5.2	Mechanics and Dynamics of bio-macromolecules- Principles of Protein structure – Structural databases- PDB, CATH, SCOP; Chemical Databases – ZINC, Pubchem, Chembl.	4	E-Resources
5.3	Docking procedures – Rigid docking, Flexible docking and scoring functions- Structure-based and Ligand based drug design –Molecular Docking, Active Site characterization- Drug-receptor interaction- Case study of designing HIV I protease Inhibitor.	4	E-Resources
	Total	**60**	

Course Designer
Dr. M. Jannathul Firdhouse
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHS51	Pharmaceutical Chemistry	SBS - I	30	2

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To ascertain fundamental concepts of pharmacology, chemotherapy, antibiotics and anaesthetics.

Syllabus

UNIT I 6 Hours

Pharmaceutical chemistry Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment) Metabolites and Anti metabolites.

UNIT II 6 Hours

Drugs: Nomenclature, Chemical name, Generic name and trade names with examples Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs.

UNIT III 6 Hours

Anti-inflammatory, Analgesics and Antipyretics - Narcotic analgesics - Morphine and derivatives – totally synthetic analgesics - pethidine and methadones – Antipyretic analgesics- Salicylic acid derivatives – Aspirin Indole derivatives- Ibuprofenand p-amino phenol derivatives – paracetamol - Synthetic drugs- naproxen (Medicinal uses & Structure only).

UNIT IV 6 Hours

Chemotherapy and applications of a few drugs (Elementary study): Sulphadrugs-Sulphadiazine, prontosil and prontosil-S – Antimalarials - Quinine and its derivatives - Arsenical drugs - Salvarasan-606 - Neosalvarsan. Antibiotics: Definition, penicillin – ampicillin - amoxicillin - tetracycline (Aureomycin and Tetramycin) - chloramphenicol - ciprofloxacin- Streptomycin and Chloromycetin - drug action and uses. Hormones and Vitamins: Definition and classifications – Testosterone, Progesterone, Thyroxine, Vitamin-C, Structure only (Structural elucidation not necessary).

UNIT V 6 Hours

Gaseous anaesthetics- Vinyl ether – Cyclopropane – Halohydrocarbons – Chloroform – Halothane – Trichloroethylene - Intravenous anaesthetics - Thiopental sodium- Local anaesthetics - Cocaine and its derivatives (Therapeutic use only).

- Visit to an industry and submission of report.
- For industrial visit/Assignment = 5 marks (Internal).
- Contact District industrial center (DIC for Visit).

Reference Books

Ashutoshkar, ***Medicinal Chemistry*** (Unit-I & II)

J. Ghosh, ***Fundamental concepts of Applied Chemistry***, S. Chand & Co.

(Unit-III, IV & V)

Varley, ***Clinical Bio-Chemistry***, Sulthan Chand, 2005.

Mukherjee, ***Text Book of Medical Laboratory Technology***, Volumes, I, II & III

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Pharmaceutical chemistry Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics,	2	E-Resources
1.2	Pharmacokinetics (ADME, Receptors - brief treatment)	2	E-Resources
1.3	Metabolites and Anti metabolites.	2	Group Discussion
UNIT - II			
2.1	Drugs: Nomenclature: Chemical name, Generic name and trade names with examples.	3	E-Resources
2.2	Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs.	3	E-Resources

UNIT - III			
3.1	Narcotic analgesics- Morphine and derivatives – totally synthetic analgesics- pethidine and methadones.	2	E-Resources
3.2	Antipyreticanalgesics- Salicylic acid derivatives – Aspirin Indole derivatives- Ibuprofenand p-amino phenol derivatives- paracetamol.	2	Group Discussion
3.3	Synthetic drugs- naproxen (Medicinal uses & Structure only).	2	Group Discussion
UNIT - IV			
4.1	Sulphadrugs-Sulphadiazine, prontosil and prontosil-S – Antimalarials - Quinine and its derivatives - Arsenical drugs- Salvarasan-606- Neosalvarsan.	2	Group Discussion
4.2	Antibiotics: Definition, penicillin- ampicillin- amoxicillin - tetracycline (Aureomycin and Tetramycin) - chloramphenicol -ciprofloxacin- Streptomycin and Chloromycetin - drug action and uses.	2	E-Resources
4.3	Definition and classifications – Testosterone, Progesterone, Thyroxine, Vitamin-C, Structure only (Structural elucidation not necessary).	2	E-Resources
UNIT - V			
5.1	Gaseous anaesthetics - Vinyl ether- Cyclopropane – Halohydrocarbons – Chloroform – Halothane - Trichloroethylene (Therapeutic use only).	3	E-Resources
5.2	Trichloroethylene- Intravenous anaesthetics- Thiopental sodium- Local anaesthetics- Cocaine and its derivatives (Therapeutic use only).	3	Discussion
	Total	**30**	

Course Designer
Dr. M. Jannathul Firdhouse
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHS52	Competitive Examination Skills in Chemistry –I	SBS - II	30	2

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	✓
National	✓
Global	

Preamble

Objective's type of questions in Chemistry is provided to the students.

Syllabus

UNIT I 6 Hours

Chemical periodicity & Structure and bonding in homo and heteronuclear molecules, including shapes of molecules (VSEPR Theory).

UNIT II 6 Hours

Colloids: Stability and properties of colloids.

UNIT III 6 Hours

Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

UNIT IV 6 Hours

Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species.

UNIT V 6 Hours

Common named reactions and rearrangements

Reference Books

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

P. L. Soni & H. M. Chawla, ***Text book of Organic Chemistry***, Sulthan Chand & Sons, New Delhi, 2012, Twenty 9th edition.

B.R. Puri, L.R. Sharma and M.S. Pathania, ***Principles of Physical Chemistry***, ShobanlalNagin Chand and Co. Jalendhar, 2001, 41stEdn.

B. S. Bahl, G. D. Tuli and ArunBahl, ***Essentials of Physical Chemistry***, S. Chand & Co. Ltd, New Delhi, 2011, 12th Edn.

P. L. Soni and M. Katyal, ***Textbook of Inorganic Chemistry***, Sultan Chand and Sons, NewDelhi.

B.R. Puri, L.R. Sharma and K.C. Kalia, ***Principles of Inorganic Chemistry***, Milestone Publishers, 2010.

Dr. Hemant Kulshrestha & Dr. Ajay Taneja, ***Upkar's CSIR-UGC NET/JRF/SET Chemical Sciences***, Agra.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Chemical periodicity	2	Chalk & Talk
1.2	Structure and bonding in homo and heteronuclear molecules, including shapes of molecules	2	E-Resources
1.3	VSEPR Theory	2	E-Resources
UNIT - II			
2.1	Colloids: Stability	3	E-Resources
2.2	Properties of colloids	3	E-Resources
UNIT - III			
3.1	Solid state: Crystal structures;	2	E-Resources
3.2	Bragg's law and applications;	2	E-Resources
3.3	Band structure of solids.	2	Discussion
UNIT - IV			
4.1	Organic reaction mechanisms involving addition, elimination and substitution reactions	3	E-Resources
4.2	Electrophilic, nucleophilic or radical species.	3	Chalk & Talk
UNIT - V			
5.1	Common named reactions	3	E-Resources
5.2	Rearrangements	3	Chalk & Talk
	Total	**30**	

Course Designer
Hajee Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC61	Organic Chemistry-II	Core - XII	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course enables the students to gain the knowledge on alicyclic compounds, chromatography, heterocyclic compounds, alkaloids, molecular rearrangements, organometallic compounds and synthesis of terpenes, proteins, polypeptides and amino acids.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Examine conformational analysis and various chromatographic techniques.	**K1**
CO2	Summarize the chemistry of heterocyclic compounds and alkaloids.	**K1, K2**
CO3	Outline the detailed mechanism of molecular rearrangement reactions.	**K1, K2**
CO4	Apply the synthetic applications of organometallic compounds.	**K1, K2, K3**
CO5	Determine the synthesis of proteins, polypeptides and amino acids.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**3**	**3**	**1**	**3**
CO2	**3**	**1**	**2**	**2**	**2**
CO3	**3**	**1**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**3**	**3**
CO5	**2**	**2**	**1**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	3	2	1	2	2
CO3	3	3	1	2	3
CO4	2	3	3	3	2
CO5	2	2	3	1	1

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Alicyclic compounds: General methods of preparation and properties of cycloalkanes – Baeyer's strain theory and its modification - Conformational analysis: Difference between configuration and conformation - Fischer, Sawhorse and Newmann projection formulae – Conformational analysis of ethane, n-butane, 1, 2-dichloroethane, cyclohexane and monosubstituted cyclohexane - Civetone and Muscone: Structure only (no Structural elucidation).

UNIT II 12 Hours

Heterocyclic compounds: Synthesis and properties of pyrrole, pyridine, quinoline and isoquinine. Alkaloids: Definition- Occurrence and extraction of alkaloids – general methods for determining the structure of alkaloids – classification of alkaloids – structure and synthesis of following alkaloids – coniine, piperine, nicotine and papavarine.

UNIT III 12 Hours

Molecular rearrangements: Intermolecular and Intramolecular Rearrangements-Detailed mechanism of the following: Pinacol-pinacolone, Hofmann, Curtius, benzyl – benzilic acid, Claisen, benzidine, Beckmann, Fries and Wagner – Meerwein - McLafferty, Favorsky, Lossen, Wallach rearrangements.

UNIT IV 12 Hours

Organometallic Compounds: Definition – examples -Grignard reagents – preparation, general characteristics and synthetic applications– organolithium compounds organolead compound (tetraethyl lead) – preparation, properties and used as an anti-knock.

UNIT V 12 Hours

Amino acids: Classification – synthesis – properties of amino acids – action of heat, dipolar ion, iso-electric point, Zwitter ion and Ruhemann's purple. Polypeptides and Proteins: Definition – classification and biological functions of proteins – color reactions of proteins – primary, Secondary, tertiary and quaternary structure of proteins (An elementary idea only). Nucleic acids: Definition – nucleosides – nucleotides – RNA and DNA (General structure).

Text Books

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

P. L. Soni & H. M. Chawla, ***Text book of Organic Chemistry***, Sulthan Chand & Sons, New Delhi, 2012, Twenty ninth edition.

Reference Book

I.L. Finar, ***Organic Chemistry, Volume 1: The Fundamental Principles*****,** ELBS, Singapore, 1994, Sixth Edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
	UNIT - I		
1.1	General methods of preparation and properties of cycloalkanes – Baeyer's strain theory and its modification.	4	Chalk & Talk
1.2	Conformational analysis: Difference between configuration and conformation - Fischer, Sawhorse and Newmann projection formulae – Conformational analysis of ethane, n-butane, 1, 2-dichloroethane, cyclohexane and monosubstituted cyclohexane - Civetone and Muscone: Structure only (no Structural elucidation).	8	E-Resources

UNIT - II			
2.1	Heterocyclic compounds: Synthesis and properties of pyrrole, pyridine, quinoline and isoquinine.	5	Chalk & Talk
2.2	Alkaloids: Definition- Occurrence and extraction of alkaloids – general methods for determining the structure of alkaloids – classification of alkaloids – structure and synthesis of following alkaloids – coniine, piperine, nicotine and papavarine.	7	E-Resources
UNIT - III			
3.1	Intermolecular and Intramolecular Rearrangements-Detailed mechanism of the following: Pinacol-pinacolone, Hofmann, Curtius, benzyl – benzilic acid, Claisen, rearrangements.	6	E-Resources,
3.2	Benzidine, Beckmann, Fries Wagner – Meerwein - McLafferty, Favorsky, Lossen, Wallach rearrangements.	6	Chalk & Talk
UNIT - IV			
4.1	Definition – examples - Grignard reagents – preparation, general characteristics and synthetic applications.	6	Chalk & Talk
4.2	Organolithium compounds - Organolead compound (tetraethyl lead) – preparation, properties and used as an anti-knock.	6	E-Resources
UNIT - V			
5.1	Classification – synthesis – properties of amino acids – action of heat, dipolar ion, iso-electric point, Zwitter ion and Ruhemann's purple.	4	E-Resources
5.2	Definition – classification and biological functions of proteins – color reactions of proteins – primary, Secondary, tertiary and quaternary structure of proteins (An elementary idea only).	4	Chalk & Talk
5.3	Definition – nucleosides – nucleotides – RNA and DNA (General structure).	4	E-Resources
	Total	**60**	

Course Designer
Hajee Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC62	Physical Chemistry - III	Core - XIII	75	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

The course enables the students to understand the concepts of electrochemistry and the fundamentals of molecular spectroscopies.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Explain the fundamental terms and theories of Electrochemistry.	**K1, K2**
CO2	Utilize the concepts of electrochemistry for the study of electrochemical cells, EMF calculations and different type of electrodes.	**K1, K2, K3**
CO3	Illustrate the technical explanation of commercial cells and their applications.	**K1, K2**
CO4	Define the essential concepts of microwave and UV-Vis spectroscopy.	**K1**
CO5	Make use of theory of infrared and Raman spectroscopy.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**2**	**1**	**2**
CO2	**2**	**1**	**2**	**3**	**3**
CO3	**1**	**3**	**1**	**2**	**2**
CO4	**2**	**1**	**3**	**3**	**1**
CO5	**3**	**2**	**1**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**2**	**1**	**3**
CO2	**2**	**2**	**3**	**3**	**1**
CO3	**1**	**3**	**1**	**2**	**2**
CO4	**3**	**3**	**1**	**2**	**3**
CO5	**2**	**1**	**2**	**3**	**2**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 15 Hours

Electrochemistry–I: Definition – conductance, specific conductance, equivalent conductance and molar conductance – factors affecting conductance of a solution. Strong and weak electrolytes – variation of equivalent conductance with dilution, Debye-Huckel theory of strong electrolytes – Debye-Huckel Onsager equation. Kohlrausch's law of independent migration of ions and its applications. Transport number – determination of transport number by Hittorf's method and moving boundary method.

UNIT II 15 Hours

Electrochemistry-II: Electrolytic and galvanic cells–Reversible and irreversible cells.Conventional representation of electrochemical cells. Electromotive force of a cell and its measurements – Computation of cell e.m.f.- Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH, ΔS and K) problems. Derivation of Nernst equation, single electrode potential and Applications of Nernst equation standard electrode potentials-Electrochemical series and its significance. Types of reversible electrodes – construction- cell reaction with Nernst equation - Reference electrodes-standard hydrogen electrode and calomel electrode-Western Cadmium cell.

UNIT III 15 Hours

Electrochemistry-III: Concentration cells – emf of concentration cells with and without transference and its derivation – liquid junction potential and its derivation. Commercial cells - primary and secondary cells – dry cell – lead storage cell – Ni-Cd cell – fuel cell – H_2O_2 cell - Applications of emf measurements - Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode - Determination of transport number - Potentiometric titrations – acid, base, redox and precipitation titrations.

UNIT IV 15 Hours

Molecular Spectroscopy–I: Definition of spectrum. Electromagnetic radiation, quantization of different forms of energies in molecules (translational, rotational vibrational and electronic). Microwave spectroscopy: Rotational spectra of diatomic molecules treated as rigid rotator, condition for a molecule to be active in microwave region, rotational constants (B), and selection rules for rotational transition. Frequency of spectral lines, calculation of inter - nuclear distance in diatomic molecules. UV-Visible spectroscopy: Types of electronic transitions – Franck Condon principle-pre dissociation spectra and dissociation energy. Applications related to concentration determination.

UNIT V 15 Hours

Molecular Spectroscopy–II: Infrared spectroscopy – modes of vibration of diatomic, tri-atomic linear (CO_2) and non- linear tri-atomic (H_2O) molecules. Stretching and bending vibrations - selection rules, expression for vibrational frequency (derivation not needed). Calculation of force constant. Raman spectroscopy: conditions -Rayleigh and Raman scattering, selection rules - Classical and quantum theory - Stokes and Antistokes lines. Differences between Raman and IR spectroscopy - Rotational Raman spectra of non-centrosymmetric molecule (HCl only). Mutual exclusion principle (CO_2 and N_2O).

Text Books

B.R. Puri, L.R. Sharma and M.S. Pathania, ***Principles of Physical Chemistry***, ShobanlalNagin Chand and Co. Jalendhar, 2001, 41stEdn.

B. S. Bahl, G. D. Tuli and ArunBahl, ***Essentials of Physical Chemistry***, S. Chand & Co. Ltd, New Delhi, 2011, 12th Edn.

Reference Books

J. O. M. Bokris and A. K. N. Reddy, ***Modern Electrochemistry***, Vol I and Vol II, Plenum Press, New York, USA, 1998. (UNIT – I, II & III)

R. Venkataraman, K. Rengarajan, P. S. Raghavan, ***Electrochemistry***, 2007, First edition. (UNIT – I, II & III)

S. Glasstone, ***An Introduction to Electrochemistry***, Von Nostrand Co. Inc., Toronto,2002. (UNIT – I, II & III)

C. M. Banwell, ***Fundamentals of Molecular spectroscopy***, TMH company limited, 2005, 4th edition. (UNIT – IV & V)

R. Gurudeep Chatwal, S. K. Anand, ***Spectroscopy***, Himalaya Publications, New Delhi, India, 2002, 5th edition. (UNIT – IV & V)

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Definition – conductance, specific conductance, equivalent conductance and molar conductance – factors affecting conductance of a solution.	4	E-Resources
1.2	Strong and weak electrolytes – variation of equivalent conductance with dilution. Debye-Huckel theory of strong electrolytes –Debye-Huckel Onsager equation.	6	Chalk & Talk
1.3	Kohlrausch's law of independent migration of ions and its applications.	2	Discussion
1.4	Transport number – determination of transport number by Hittorf's method and moving boundary method.	3	E-Resources
UNIT - II			
2.1	Electrolytic and galvanic cells–Reversible and irreversible cells. Conventional representation of electrochemical cells.	3	E-Resources
2.2	Electromotive force of a cell and its measurements – Computation of cell e.m.f.- Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH, ΔS and K) problems.	4	Chalk & Talk
2.3	Derivation of Nernst equation, single electrode potential and Applications of Nernst equation standard electrode potentials- Electrochemical series and its significance.	3	E-Resources

2.4	Types of reversible electrodes – construction- cell reaction with Nernst equation - Reference electrodes- standard hydrogen electrode and calomel electrode-Western Cadmium cell.	5	Discussion
UNIT - III			
3.1	Concentration cells – e.m.f of concentration cells with and without transference and its derivation – liquid junction potential and its derivation.	4	Discussion
3.2	Commercial cells - primary and secondary cells – dry cell – lead storage cell – Ni-Cd cell – fuel cell – H_2O_2 cell.	5	E-Resources
3.3	Applications of emf measurements - Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode - Determination of transport number - Potentiometric titrations – acid, base and redox titrations.	6	Chalk & Talk
UNIT - IV			
4.1	Definition of spectrum. Electromagnetic radiation, quantization of different forms of energies in molecules (translational, rotational vibrational and electronic).	3	Discussion
4.2	Microwave spectroscopy: Rotational spectra of diatomic molecules treated as rigid rotator, condition for a molecule to be active in microwave region, rotational constants (B), and selection rules for rotational transition. Frequency of spectral lines, calculation of inter - nuclear distance in diatomic molecules.	6	Chalk & Talk
4.3	UV-Visible spectroscopy – types of electronic transitions – Franck Condon principle-pre dissociation spectra and dissociation energy. Applications related to concentration determination.	6	E-Resources

UNIT - V			
5.1	Infrared spectroscopy – modes of vibration of diatomic, tri-atomic linear (CO_2) and non- linear tri-atomic (H_2O) molecules.	3	E-Resources
5.2	Stretching and bending vibrations - selection rules, expression for vibrational frequency (derivation not needed). Calculation of force constant.	3	Chalk & Talk
5.3	Raman spectroscopy-conditions -Rayleigh and Raman scattering, selection rules Classical and quantum theory - Stokes and Antistokes lines. Differences between Raman and IR spectroscopy.	5	E-Resources
5.4	Rotational Raman spectra of non-centrosymmetric molecule (HCl only). Mutual exclusion principle (CO_2 and N_2O).	4	Discussion
	Total	**75**	

Course Designer
Dr. N. M. Abdul Khader Jailani
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC63	**Spectroscopy and its Applications**	**Core - XIV**	**60**	**4**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To acquire knowledge about UV Spectroscopy, IR Spectroscopy, $_1H^1$ NMR Spectroscopy and Mass spectrometry.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Examine the fundamentals of UV spectroscopy and Woodward-Fisher rule.	**K1**
CO2	Outline the Mode of vibration, finger print region, Number of vibrational modes for linear and non-linear molecules.	**K1, K2**
CO3	Explain the principles of NMR and relate the chemical shift and splitting of signals of NMR.	**K1, K2**
CO4	Apply their knowledge of NMR and list the factors influencing coupling constants, first and second order spectra and Nuclear Overhauser effect.	**K1, K2, K3**
CO5	Explain the principle of Mass spectrometry and solve Simple Problems of UV, IR, $_1H^1$ NMR spectroscopy and Mass Spectrometry.	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	2	2	3	3	3
CO3	3	2	3	2	3
CO4	2	2	3	2	3
CO5	3	2	3	3	3

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	2	2
CO3	3	2	3	2	1
CO4	3	2	3	2	1
CO5	3	3	3	3	2

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Introduction to spectroscopy: Regions of spectroscopy. UV Spectroscopy: Introduction, Type of electronic transitions – absorption law – Lamberts-Beer's law – bathochromic shift and hypsochromic shift –hyper chromic and hypochromic effect – applications of UV to organic compounds – Woodward-Fisher rule – Calculation of λ_{max} for dienes and α, β-unsaturated carbonyl compounds.

UNIT II 12 Hours

IR Spectroscopy: Introduction, Instrumentation – Mode of vibration – Fundamental, Overtone, combination bands, Difference bands and Fermi resonance – finger print region – applications of IR to organic compounds – effect of hydrogen bond, Geometrical isomers, Determination of bond length and ring strain - Number of vibrational modes for linear and non-linear molecules.

UNIT III 12 Hours

$_1H^1$ NMR Spectroscopy-I: Introduction – Nuclear spin - Principles of NMR-Spin angular momentum -Larmour frequency -chemical shift–TMS used as standard - shielding and deshielding effects – factors influencing chemical shift – solvent used – splitting of signals – spin-spin splitting–Pascal's triangle.

UNIT IV 12 Hours

$_1H^1$ NMR Spectroscopy-II: Coupling constants –Vicinal, Geminal and Long-range coupling - factors influencing coupling constants - NMR spectra of ethanol and anisole – first and second order spectra – conversion of second order spectra to first order spectra -spin decoupling, chemical shift reagents, increasing the field strength, deuterium exchange - Nuclear Overhauser effect.

UNIT V 12 Hours

Mass Spectrometry: Basic principle – theory – determination of molecular formula – general fragmentation modes – simple cleavage – homolytic and heterolytic cleavage – presence of sulphur, nitrogen and halogens– mass spectrum of ethanol, n-hexane, methyl salicylate – ortho effect. Simple Problems involving the application of UV, IR, $_1H^1$ NMR spectroscopy and Mass Spectrometry.

Text Book

P. L. Soni and Chawla, ***Text book of Organic Chemistry,*** S. Chand Publications, 2012

Reference Books

Y.R. Sharma, ***Elementary Organic spectroscopy***, S. Chand & company Ltd, New Delhi 1992.

G. Aruldhas, ***Molecular Structure and Spectroscopy***, Prentice Hall of India, 2005.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Introduction: Type of electronic transitions – absorption law – Lamberts-Beer's law – bathochromic shift and hypsochromic shift – hyper chromic and hypochromic effect.	6	E-Resources

1.2	Applications of UV to organic compounds – Woodward-Fisher rule – Calculation of $\lambda_{max}$for dienes and α, β-unsaturated carbonyl compounds.	6	Chalk & Talk
UNIT - II			
2.1	Introduction: Instrumentation – Mode of vibration – Fundamental, Overtone, combination bands, Difference bands and Fermi resonance – finger print region.	4	Chalk & Talk
2.2	Applications of IR to organic compounds – effect of hydrogen bond, Geometrical isomers.	4	Chalk & Talk
2.3	Determination of bond length and ring strain - Number of vibrational modes for linear and non-linear molecules.	4	E-Resources
UNIT - III			
3.1	Introduction – Nuclear spin - Principles of NMR - Spin angular momentum - Larmour frequency.	4	Chalk & Talk
3.2	Chemical shift – TMS used as standard - shielding and deshielding effects – factors influencing chemical shift.	4	Chalk & Talk
3.3	Solvent used – splitting of signals – spin-spin splitting–Pascals triangle.	4	Discussion
UNIT - IV			
4.1	Coupling constants – Vicinal, Geminal and Long-range coupling- factors influencing coupling constants - NMR spectra of ethanol and anisole.	5	E-Resources
4.2	First and second order spectra – conversion of second order spectra to first order spectra - spin decoupling.	3	Chalk & Talk
4.3	Chemical shift reagents, increasing the field strength, deuterium exchange - Nuclear Overhauser effect.	4	Chalk & Talk

UNIT - V			
5.1	Basic principle – theory – determination of molecular formula - general fragmentation modes – simple cleavage – homolytic and heterolytic cleavage.	4	E-Resources
5.2	Presence of sulphur, nitrogen and halogens– mass spectrum of ethanol, n-hexane, methyl salicylate – ortho effect.	4	Chalk & Talk
5.3	Simple Problems involving the application of UV, IR, $_1H^1$ NMR Spectroscopy and Mass Spectrometry.	4	Discussion
	Total	**60**	

Course Designer
Dr. S.A. Noor Mohamed
Head & Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC6P	Gravimetric Estimation and Organic Preparation	Core - XV	90	5

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

This lab course enables the students to acquire practical knowledge on quantitative estimation of inorganic metal ions by gravimetric methods. Also enhances the laboratory skills of preparing organic compounds.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Make use of gravimetric analysis the inorganic metal ions such as lead and barium are estimated.	**K1, K2, K3**
CO2	Experiment with gravimetric estimation of calcium, copper and nickel ions.	**K1, K2, K3**
CO3	Demonstrate the various types of chemical reactions viz., nitration, bromination, hydrolysis, oxidation, benzoylation and acetylation.	**K1, K2, K3**
CO4	Make use of organic synthesis methods.	**K1, K2, K3**
CO5	Utilize the practical skills in estimating the given metal ions and preparation of organic compounds.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**3**	**3**	**2**	**3**
CO2	**2**	**3**	**3**	**2**	**3**
CO3	**2**	**3**	**3**	**2**	**3**
CO4	**2**	**3**	**3**	**2**	**3**
CO5	**1**	**3**	**3**	**2**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**2**	**3**	**3**	**3**	**2**
CO2	**2**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**1**	**3**
CO4	**3**	**3**	**3**	**1**	**3**
CO5	**3**	**3**	**3**	**1**	**3**

1-Low **2-Medium** **3-Strong**

Syllabus

I. Gravimetric Analysis

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of copper as cuprous thiocyanate
5. Estimation of nickel as NiDMG.

II. Organic Preparation / Separation

1. Nitration
   a) m-dinitrobenzene from nitrobenzene
   b) Picric acid from phenol
2. Bromination: p-bromoacetanilide from acetanilide
3. Hydrolysis: Aromatic acid from (a) an ester (b) anamide
4. Oxidation: Benzoic acid from benzaldehyde.
5. Benzoylation: (a) Amine (b)phenols
6. Acetylation: (a) Amine (b)phenols

Reference Books

G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, ***Vogel's textbook of quantitative chemical analysis***, 1989, 5th edition.

B.S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, ***Vogel's Text Book of Practical Organic Chemistry***, Pearson Education, 2005, 5th edition.

Course Designer

Hajee Dr. M. Kamal Nasar
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC6Q	**Organic Analysis and Estimation**	**Core-XVI**	**90**	**5**

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

This lab course enables the students to acquire practical skill on organic qualitative analysis and estimation of organic compounds.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Illustrate the analytical and estimation procedure for the organic compounds	**K1, K2**
CO2	Identify the one or two functional groups present in the given organic compounds.	**K1, K2, K3**
CO3	Apply the principle to prepare suitable derivatives for the given organic compounds.	**K1, K2, K3**
CO4	Make use of brominating method to estimate Phenol and aniline.	**K1, K2, K3**
CO5	Utilize Lane and Eynon method for the estimation of glucose.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**2**	**2**
CO2	**3**	**3**	**3**	**3**	**3**
CO3	**1**	**3**	**3**	**2**	**2**
CO4	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**1**	**3**	**1**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**3**
CO3	**1**	**2**	**3**	**2**	**2**
CO4	**3**	**2**	**3**	**2**	**2**
CO5	**2**	**3**	**1**	**2**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

I. Organic Analysis

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative - acids, phenols, aldehydes, ketones, esters, nitro compounds, amines (primary, secondary and tertiary), amides, anilides, aliphatic diamide, side chain and nuclear halogen compounds, aliphatic diamide containing Sulphur and monosaccharides.

II. Organic Estimation

a. Estimation of phenol
b. Estimation of aniline
c. Estimation of glucose.

Reference Books

Sundaram, Krishnan, Raghavan, ***Practical Chemistry (Part II)***, S. Viswanathan Co. Pvt., 1996.

B. S. Furniss, A. J. Hannaford, P.W. G. Smith, A.R. Tatchell, ***Vogel's Text Book of Practical Organic Chemistry***, Pearson Education, 2005, 5th Edn.

Course Designer

Dr. K. Shahul Hameed
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHC6R	**Physical Chemistry Practical**	**Core-XVII**	**90**	**5**

Nature of Course	
Knowledge Oriented	
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

This practical course enables the students to acquire knowledge on physical chemistry experiments which includes electrical and non -electrical experiments.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Apply the physical chemistry principle of depression in freezing point to gain the knowledge on molecular weight determination.	**K1,K2, K3**
CO2	Construct the phase diagram of a binary system (eutectic) and compound formation.	**K1,K2, K3**
CO3	Choose the concept of Critical Solution Temperature to find out the composition of phenol water system and study of the effect of impurities on it.	**K1,K2, K3**
CO4	Make use of the principles of solubility product, first order kinetics and distribution law to find out the solubility of the solute, first order kinetics of an ester and association factor of benzene.	**K1,K2, K3**
CO5	Experiment with the principles of electrochemistry to find out the concentration of the unknown solution by using conductometric and potentiometric methods.	**K1,K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3
CO2	3	2	3	2	3
CO3	2	3	2	2	3
CO4	3	2	3	2	3
CO5	2	3	2	3	3

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	2	2
CO2	1	2	3	3	2
CO3	2	3	3	3	2
CO4	1	1	3	2	2
CO5	2	3	2	3	2

1-Low **2-Medium** **3-Strong**

Syllabus

1. Determination of molecular weight by

a. Transition temperature method – sodium thiosulphate pentahydrate, strontium chloride hexahydrate and sodium acetate trihydrate.
b. Cryoscopic method – Rast method – camphor and naphthalene.

2. Phase diagram involving

a. Simple eutectic and
b. Compound formation

3. Critical solution temperature

Determination of CST of phenol – water system and effect of impurity on CST - strength of Sodium chloride.

4. Thermochemistry

Heat of solution –potassium dichromate, ammonium oxalate and oxalic acid.

5. Viscosity

Determination of the composition of an unknown mixture.

6. Partition co-efficient experiments:

a. Study of the equilibrium constant for the reaction

$$KI + I_2 \rightleftharpoons KI_3,$$

By determining the partition co-efficient of iodine between water and carbon tetrachloride.

b. Determination of strength of given KI

c. Determination of association factor of benzoic acid in benzene.

7. Kinetics

Determination of relative strength of acids by

a) Acid catalyzed hydrolysis of ester.

b) Inversion of cane sugar.

8. Electrochemistry

a. Conductivity

i. Determination of cell constant of the cell and equivalent conductance of solution.

ii. Conductivity titration between an acid and a base (HCl Vs NaOH)

b. Potentiometric titrations

i. $KMnO_4$ Vs $FeSO_4$

ii. $K_2Cr_2O_7$ Vs $FeSO_4$

iii. HCl Vs NaOH.

Reference Book

B. Viswanathan, P. S. Raghavan, ***Practical Physical Chemistry***, Viva Books Private Limited, (2005)

Course Designer

Dr. N. M. Abdul Khader Jailani,
Associate Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHE61	Green Chemistry	Elective - II	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	
National	
Global	✓

Preamble

To comprehend the principles, synthesis and applications of green chemistry, green catalysts, microwave and ultrasonic - assisted reactions.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	List the basic principles of green chemistry, Planning a green synthesis and calculations of atom economy of various reactions.	**K1**
CO2	Classify the green solvent and methods of green synthesis.	**K1, K2**
CO3	Write the role of green catalysts.	**K1, K2**
CO4	Determine the microwave assisted reactions in water and organic solvents.	**K1, K2, K3**
CO5	Find the synthesis routes of ultrasonic assisted reactions.	**K1, K2, K3**

K1-Knowledge **K2-Understand** **K3-Apply**

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**1**	**3**	**3**	**3**
CO4	**2**	**1**	**3**	**3**	**3**
CO5	**2**	**1**	**3**	**3**	**3**

1-Low **2-Medium** **3-Strong**

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	3	3
CO2	1	2	2	3	3
CO3	2	3	3	3	3
CO4	2	1	3	3	3
CO5	3	3	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Green Chemistry: Definition- need of green chemistry- planning a green synthesis in a chemical laboratory-Solvent-less reaction- Selection of appropriate solvent- Prevention of Waste/ byproducts- Evolution of the types of green reactions- Atom Economy- calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.

UNIT II 12 Hours

Principles of Green Chemistry: Twelve basic principles of green chemistry- control keys- using alternative starting material, reagents, solvents- changing target products- process monitoring- alternating green catalysis. Water as green solvent- reactions in ionic-liquid- solid support organic synthesis.

UNIT III 12 Hours

Green catalysis: Heterogeneous catalysis-use of zeolites, silica, alumina, supported catalysis- biocatalysis: Enzymes, microbes. Homogeneous catalysis- Phase transfer catalysis (micellar/surfactant), hydroformylation, metathesis (Applications only).

UNIT IV 12 Hours

Microwave-assisted green synthesis: Uses of microwaves- Fundamentals of closed-vessel heating - green synthesis of the following compounds: adipic acid, catechol, disodium imino diacetate (alternative Strecker's synthesis). Microwave assisted reaction in water – Hoffmann elimination – oxidation of toluene and alcohols. Microwave assisted reactions in organic solvents: Diels-Alder reactions and decarboxylation reaction.

UNIT V 12 Hours

Ultrasound-assisted green synthesis: Uses of sonication - ultrasound assisted reactions – Saponification, Substitution and Addition reactions, Oxidation, Diels-Alder Reaction and Simmons–Smith reaction.

Text book

S. S. Dara, ***A Text Book in Engineering Chemistry***, S. Chand & Company Ltd, New Delhi. 1992, Third Edition.

Reference books

V. K. Ahluwalia and Kidwai, ***New trends in Green Chemistry***, Anamaya publishers, New Delhi, 2007, 2nd edition.

R. Sanghi and M. M. Srivastava, ***Green Chemistry***, Narosa publishing House, New Delhi, 2012, 2nd edition.

M. C. Cann and M. E. Connelly, ***Real world cases in Green Chemistry*.** American Chemical Society, Washington, 2000, 1st edition.

M. Lancaster, ***Green Chemistry: Introductory Text,*** Royal Society of Chemistry, London, 2010, 2nd edition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Definition- need of green chemistry- planning a green synthesis in a chemical laboratory-	3	Chalk & Talk
1.2	Solvent-less reaction- Selection of appropriate solvent- Prevention of Waste/ by-products	3	E-Resources
1.3	Evolution of the types of green reactions- Atom Economy- calculation of atom economy of the rearrangement	3	Discussion
1.4	Addition, substitution and elimination reactions.	3	E-Resources
UNIT - II			
2.1	Twelve basic principles of green chemistry- control keys	3	Discussion
2.2	Using alternative starting material, reagents, solvents- changing target products- process monitoring- alternating green catalysis.	3	Chalk & Talk

2.3	Water as green solvent- reactions in ionic liquid- solid support organic synthesis.	6	E-Resources
UNIT - III			
3.1	Heterogeneous catalysis-use of zeolites, silica, alumina, supported catalysis	3	E-Resources
3.2	Bio catalysis: Enzymes, microbes.	3	Chalk & Talk
3.3	Homogeneous catalysis- Phase transfer catalysis (micellar/surfactant), hydroformylation, metathesis	6	Discussion
UNIT - IV			
4.1	Uses of microwaves- Fundamentals of closed-vessel heating - green synthesis of the following compounds: adipic acid, catechol, disodium imino diacetate (alternative Strecker's synthesis).	6	Chalk & Talk
4.2	Microwave assisted reaction in water – Hoffmann elimination – oxidation of toluene and alcohols. Microwave assisted reactions in organic solvents: Diels-Alder reactions and decarboxylation reaction.	6	E-Resources
UNIT - V			
5.1	Uses of sonication - ultrasound assisted reactions – Saponification, Substitution and Addition reactions,	6	E-Resources
5.2	Ultrasound assisted reactions - Oxidation, Diels-Alder Reaction and Simmons–Smith reaction.	6	Chalk & Talk
	Total	**60**	

Course Designer
Dr. S. Sivakumar
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHE62	Nanochemistry	Elective - II	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	✓
Regional	
National	✓
Global	✓

Preamble

To understands the concept of nanoscience and to study synthesis and applications of nanomaterials.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	Describe the history, classification and properties of nanomaterials.	**K1**
CO2	Illustrate the occurrence of nanostructure in the biological systems and its super properties in day to-day life.	**K1, K2**
CO3	Outline the preparation of Carbon nanotubes, fullerenes and their applications.	**K1, K2**
CO4	Develop the methods of approaches used for the nanomaterial synthesis.	**K1, K2, K3**
CO5	Utilize the exquisiteness of nanoproducts in the various fields such as Catalysis, agriculture industry and Drug delivery.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**2**	**1**
CO3	**2**	**3**	**3**	**3**	**2**
CO4	**2**	**2**	**2**	**3**	**1**
CO5	**3**	**3**	**3**	**3**	**3**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	2	2	2
CO3	2	3	2	2	2
CO4	2	3	2	2	2
CO5	3	3	3	3	3

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Fundamentals of nanoscience and nanotechnology: Historical perspectives (ancient, medieval and modern periods) in nanoscience and nanotechnology; terms and definitions; scale of materials: macro, micro and nanoscale; size dependent properties of materials: surface and volume, surface energy, (bulk vs nano), Surface Plasmon resonance, classification of nanomaterials; importance of nanoscience- recent discoveries in nanoscience and technology.

UNIT II 12 Hours

Bio-inspired nanotechnology: Nanotechnology in the following natural systems: lotus leaves, moth eye, gecko foot, water strider, spider silk, and butterfly wings. Nano products fabricated based on inspirations from nature- self-cleaning paints, antireflective coatings - water resistant fabrics - strong and stretchy nanocomposites - tear resistant fabrics and packaging materials.

UNIT III 12 Hours

Carbon- based nanomaterials: Fullerenes- synthesis, properties, chemical reactions and its applications - Carbon nanotubes-SWCNT and MWCNT, growth mechanism – chemical modification of carbon nanotubes and its applications.

UNIT IV 12 Hours

Synthetic tools for nanomaterials: Nanostructured materials- Nanorods, nanowires, quantum dots and nanocomposites- Bottom up and Top-down Approaches- Methods for synthesis of nanomaterials - Chemical vapour deposition, Physical vapour deposition, Electro deposition, Sol-gel synthesis, Ball-milling, Chemical reduction.

UNIT V 12 Hours

Applications of nanomaterials: Applications of nanomaterials - Catalysis, textiles, cosmetics, food and agriculture industry, automotive, water treatment and environment- Medical (Drug delivery) applications – protocol for non-drug administrations- nanotechnology in diagnostic applications- molecular devices.

Text Book

T. Pradeep, ***Nano: the essentials, understanding nanoscience and nanotechnology***, Tata McGraw-Hill publishing company Ltd., New Delhi, 2007. (Unit-I-V)

Reference Books

B.S. Murthy, ***Textbook of Nanoscience and Nanotechnology***, University Press, India, 2012.

P. Poole, ***Introduction to Nanotechnology***. John Wiley and sons (Asia) Pvt. Ltd., New Delhi, 2010.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Historical perspectives (ancient, medieval and modern periods) in nanoscience and nanotechnology; terms and definitions;	3	Chalk & Talk
1.2	scale of materials: macro, micro and nanoscale; size dependent properties of materials: surface and volume, surface energy, (bulk vs nano), Surface Plasmon resonance	3	E-Resources
1.3	classification of nanomaterials; importance of nanoscience	3	Discussion
1.4	recent discoveries in nanoscience and technology.	3	Discussion
UNIT - II			
2.1	Nanotechnology in the natural systems such as lotus leaves, moth eye, gecko foot, water strider, spider silk, and butterfly wings.	4	Discussion
2.2	Nano products fabricated based on inspirations from nature- self-cleaning paints, antireflective coatings.	4	E-Resources

2.3	Water resistant fabrics - strong and stretchy nanocomposites - tear resistant fabrics and packaging materials.	4	E-Resources
UNIT - III			
3.1	Fullerenes- synthesis, properties, chemical reactions and its applications -	6	Discussion
3.2	Carbon nanotubes-SWCNT and MWCNT, growth mechanism – chemical modification of carbon nanotubes and its applications.	6	E-Resources
UNIT - IV			
4.1	Nanostructured materials- Nanorods, nanowires, quantum dots and nanocomposites	3	E-Resources
4.2	Bottom up and Top-down Approaches-Methods for synthesis of nanomaterials.	3	E-Resources
4.3	Chemical vapour deposition, Physical vapour deposition, Electro deposition.	3	E-Resources
4.4	Sol-gel synthesis, Ball-milling, Chemical reduction.	3	E-Resources
UNIT - V			
5.1	Applications of nanomaterials - Catalysis, textiles, cosmetics, food and agriculture industry	3	E-Resources
5.2	automotive, water treatment and environment	3	E-Resources
5.3	Medical (Drug delivery) applications – protocol for non-drug administrations	3	E-Resources
5.4	nanotechnology in diagnostic applications- molecular devices.	3	E-Resources
	Total	**60**	

Course Designer
Dr. M. Jannathul Firdhouse
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHE63	Forensic Chemistry	Elective - II	60	4

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	✓
Regional	
National	✓
Global	✓

Preamble

To analyze the evidences, fingerprints, adulteration in different fields viz., crime detection, forgery and toxicology.

Course Outcomes (CO)

On the successful completion of the course the students will be able to

No.	Course Outcome	Knowledge Level
CO1	List the types of evidences and fingerprint patterns.	**K1**
CO2	Outline the adulteration materials in food and its detection methods.	**K1, K2**
CO3	Interpret the types of toxic compounds in biological fluids and to characterize blood stains.	**K1, K2**
CO4	Relate the types of accidental & bomb explosions and use of metal detectors.	**K1, K2, K3**
CO5	Identify the forged document, counterfeit currencies and purity of jewellery.	**K1, K2, K3**

K1-Knowledge K2-Understand K3-Apply

Mapping of CO with PO

	PO1	PO2	PO3	PO4	PO5
CO1	**3**	**3**	**3**	**3**	**1**
CO2	**3**	**2**	**2**	**2**	**1**
CO3	**3**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**3**	**3**	**2**

1-Low 2-Medium 3-Strong

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**2**	**2**	**2**
CO3	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**2**	**1**
CO5	**2**	**3**	**2**	**2**	**1**

1-Low **2-Medium** **3-Strong**

Syllabus

UNIT I 12 Hours

Introduction of Forensic science: Forensic science- Introduction – History & Development in India - Physical Evidence- Definition, Types – Biological, Chemical, Digital Evidence - Identification of Physical Evidence - Trace Evidence. Handwriting Examination, Definition, General and Individual characteristics of handwriting, Classification of Fingerprint Patterns, Systematic methods of classification of Fingerprints.

UNIT II 12 Hours

Food Adulteration: Contamination of wheat, rice, dhal, milk, butter, etc., with clay, sand, stone, water and toxic chemicals (e.g., Kasseri dhal with mentanil yellow). Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN). First aid and antidotes for poisoned persons. Heavy metals (Hg, Pb, Cd)- Contamination of Sea food. Use of neutron activation analysis in detecting poisoning (e.g., As in human hair)

UNIT III 12 Hours

Forensic toxicology & Serology: Classification & Composition of Alcoholic & Non-Alcoholic beverages. Collection of samples for identification of alcohols, Blood, Urine, Vitreous fluid, Brain, Liver etc.. Tests and Evaluation - Blood alcohol content (BAC), Urine Alcohol Content (UAC), Breath Analysis. Detecting of steroid consumption among athletes and race horses, using Mass spectrum, Gas chromatography. Forensic serology - blood typing - forensic characterization of blood stains -paternity testing.

UNIT IV 12 Hours

Crime Detection: Accidental explosions during manufacture of matches and fire-works- Human bombs, possible explosives (gelatin sticks, RDX) and timed bombs in road and railway tracks- Defusing live bombs- Hit -and-go traffic accidents. Metal detector devices and other security measures for VVIP. Composition of bullets and detection of powder burns- fluorescent properties of anthracene – criminal detection.

UNIT V 12 Hours

Detection of Forgery and Counterfeiting: Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV-light. Alloy analysis using AAS to detect counterfeit coins. Checking silver line, watermark in currency notes. Jewellery: detection of gold purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy).

Text Books

B. B. Nanda and R.K. Tiwari, ***Forensic Science in India: A Vision for the Twenty First Century***, Select Publishers, New Delhi, 2001, First Edition. (Unit I-V)

Jay Seigal, ***Forensic Chemistry: Fundamentals and Applications***, Wiley-Blackwell, 2015, Revised Edition. (Unit I-V)

Reference Books

Eckert G. William, ***Introduction to Forensic Sciences***, CRC press, New York, Washington, 1996, Second Edition.

Richard Saferstein, ***Criminalistics: An Introduction to Forensic Science***, Pearson Prentice Hall, 1995, Fifth Edition.

P. C. Dikshit, ***Textbook of Forensic Medicine and Toxicology***, Peepee Publishers and Distributors (P) Ltd, 2013, Second Edition.

K. S Narayan Reddy and O. P. Murthy, ***The Essentials of Forensic Medicine and Toxicology***, Jaypee Brothers Medical Publishers (P) Ltd, 2014, 33rdEdition.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Forensic science- Introduction – History & Development in India	2	E-Resources
1.2	Physical Evidence- Definition, Types – Biological, Chemical, Digital Evidence	2	E-Resources
1.3	Identification of Physical Evidence - Trace Evidence.	3	E-Resources

1.4	Handwriting Examination–Definition, General & Individual characteristics of handwriting.	2	E-Resources
1.5	Classification of Fingerprint Patterns, Systematic methods of classification Food Adulteration of Fingerprints.	3	E-Resources
UNIT - II			
2.1	Contamination of wheat, rice, dhal, milk, butter, etc., with clay, sand, stone, water and toxic chemicals (e.g., Kasseri dhal with mentanil yellow).	3	Discussion
2.2	Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN). First aid and antidotes for poisoned persons	5	E-Resources
2.3	Contamination of Sea food. Use of neutron activation analysis in detecting poisoning (e.g., As in human hair)	4	E-Resources
UNIT - III			
3.1	Classification & Composition of Alcoholic & Non-Alcoholic beverages.	1	E-Resources
3.2	Collection of samples for identification of alcohols – Blood, Urine, Vitreous fluid, Brain, Liver etc.	2	E-Resources
3.3	Tests and Evaluation - Blood alcohol content (BAC), Urine Alcohol Content (UAC), Breath Analysis	3	E-Resources
3.4	Detecting of steroid consumption among athletes and race horses-using Mass spectrum- Gas chromatography	3	E-Resources
3.5	Forensic serology - blood typing - forensic characterization of blood stains -paternity testing:	3	E-Resources
UNIT - IV			
4.1	Accidental explosions during manufacture of matches and fire-works- Human bombs, possible explosives (gelatin sticks, RDX).	3	E-Resources

4.2	Timed bombs in road and railway tracks- Defusing live bombs- Hit -and-go traffic accidents	3	E-Resources
4.3	Metal detector devices and other security measures for VVIP	3	E-Resources
4.4	Composition of bullets and detection of powder burns- fluorescent properties of anthracene – criminal detection.	3	E-Resources
UNIT - V			
5.1	Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV-light	4	E-Resources
5.2	Alloy analysis using AAS to detect counterfeit coins. Checking silver line, watermark in currency notes	4	E-Resources
5.3	Jewellery: detection of gold purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy).	4	E-Resources
	Total	**60**	

Course Designer
Dr. K. Shahul Hameed
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHS61	**Medical Laboratory Technology and Clinical Biochemistry**	**SBS - III**	**30**	**2**

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	
Employability Oriented	✓
Entrepreneurship Oriented	✓

Course Relevance	
Local	✓
Regional	
National	
Global	✓

Preamble

To understand the types of microorganisms and to determine Hb, RBC, WBC, Platelet, ESR, lipids, cholesterol in blood and urine. To study the basic analytical techniques used in clinical laboratories.

Syllabus

UNIT I 6 Hours

Types of microorganism - general characteristics of Bacteria, Fungi and Viruses, sterilization and disinfection - Types of stains and staining procedures - Collection and preparation of samples, Typhoid test, and Tuberculin test, VDRL, Pregnancy and HIV test - Blood collection, use of anti- coagulants - Transportations of blood after collection, Rh and blood grouping.

UNIT II 6 Hours

Determination of Hemoglobin content, Total RBC, WBC and platelet count - ESR calculation of red blood cell, examination of Malaria parasites - Routine examination of urine.

UNIT III 6 Hours

Diagnostic tests and estimation of sugar and Urea in serum, Urine, and blood - Glucose tolerance test - Interpretation of results. Detection of poisons- Antidotes for poisoning.

UNIT IV 6 Hours

Lipids: General properties, Functions and classification of lipids – Determination of total lipids, Triglycerides and cholesterol in blood.

UNIT V 6 Hours

Analytical Biochemistry: Principles of colorimetry, Flame photometry, Chromatography, Electrophoresis and Basic Immunochemical Techniques - Use of Microscope, Fundamentals of Automation in clinical laboratories.

- Visit to a Hospital Clinical Lab and submission of Report.
- For Report/Assignment=5 marks (Internal).
- Contact Gov. Hospital for Visit

Reference Books

Varely, ***Clinical Biochemistry***, Sultan Chand, 2005.

Mukherji, ***Text Book of Medical Laboratory Technology***, Vol. I, Vol. II and Vol. III, Sultan Chand. (2006),

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Types of microorganism - general characteristics of Bacteria, Fungi and Viruses, sterilization and disinfection - Types of stains and staining procedures.	2	E-Resources
1.2	Collection and preparation of samples, Typhoid test, and Tuberculin test, VDRL, Pregnancy and HIV test.	2	E-Resources
1.3	Blood collection, use of anti- coagulants - Transportations of blood after collection, Rh and blood grouping.	2	Group Discussion
UNIT - II			
2.1	Determination of Hemoglobin content, Total RBC, WBC and platelet count.	3	E-Resources
2.2	ESR calculation of red blood cell, examination of Malaria parasites - Routine examination of urine.	3	E-Resources

UNIT - III			
3.1	Diagnostic tests and estimation of sugar and Urea in serum, Urine, and blood - Glucose tolerance test - Interpretation of results.	3	E-Resources
3.2	Detection of poisons- Antidotes for poisoning.	3	Group Discussion
UNIT - IV			
4.1	Lipids: General properties, Functions and classification of lipids.	3	Group Discussion
4.2	Determination of total lipids, Triglycerides and cholesterol in blood.	3	E-Resources
UNIT - V			
5.1	Analytical Biochemistry: Principles of colorimetry, Flame photometry, Chromatography.	3	E-Resources
5.2	Basic Immunochemical Techniques - Use of Microscope, Fundamentals of Automation in clinical laboratories	3	Group Discussion
	Total	**30**	

Course Designer
Dr. K. Shahul Hameed
Assistant Professor of Chemistry

Course Code	Course Title	Category	Total Hours	Credits
20UCHS62	Competitive Examination in Chemistry-II	SBS - IV	30	2

Nature of Course	
Knowledge Oriented	✓
Skill Oriented	✓
Employability Oriented	✓
Entrepreneurship Oriented	

Course Relevance	
Local	
Regional	✓
National	✓
Global	

Preamble

Objective type of questions in Chemistry, aptitude and reasoning is provided to the students.

Syllabus

UNIT I 6 Hours

Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids.

UNIT II 6 Hours

Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; Unimolecular reactions; enzyme kinetics; salt effects.

.**UNIT III** 6 Hours

Concepts of acids and bases, Hard-Soft acid base concept, non-aqueous solvents & Nuclear chemistry: nuclear reactions, fission and fusion and radio-analytical techniques.

UNIT IV 6 Hours

Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye - Huckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.

UNIT V 6 Hours

Structure determination of organic compounds by IR, UV-Vis, ^{1}H & ^{13}C NMR and Mass spectroscopic techniques.

Reference Books

B. S. Bahl & Arun Bahl, ***Advanced Organic Chemistry***, S. Chand & Company, New Delhi, 2009.

P. L. Soni & H. M. Chawla, ***Text book of Organic Chemistry***, Sulthan Chand & Sons, New Delhi, 2012, Twenty ninth edition.

B.R. Puri, L.R. Sharma and M.S. Pathania, ***Principles of Physical Chemistry***, ShobanlalNagin Chand and Co. Jalendhar, 2001, 41stEdn.
B. S. Bahl, G. D. Tuli and ArunBahl, ***Essentials of Physical Chemistry***, S. Chand & Co. Ltd, New Delhi, 2011, 12th Edn.
P. L. Soni and M. Katyal, ***Textbook of Inorganic Chemistry***, Sultan Chand and Sons, NewDelhi.
B.R. Puri, L.R. Sharma and K.C. Kalia, ***Principles of Inorganic Chemistry***, Milestone Publishers, 2010.
Dr. Hemant Kulshrestha & Dr. Ajay Taneja, ***Upkar's CSIR-UGC NET/JRF/SET Chemical Sciences***, Agra.

Pedagogy

Chalk & Talk, E-Resources, Group Discussion

Teaching aids

Black Board, LCD Projector

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures	Content Delivery Methods
UNIT - I			
1.1	Chemistry of natural products: Carbohydrates,	2	Chalk & Talk
1.2	Proteins and peptides,	2	E-Resources
1.3	Fatty acids, nucleic acids.	2	E-Resources
UNIT - II			
2.1	Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation	2	E-Resources
2.2	Determination of reaction mechanisms; collision and transition state theories of rate constants;	2	E-Resources
2.3	Unimolecular reactions; enzyme kinetics; salt effects.	2	E-Resources
UNIT - III			
3.1	Concepts of acids and bases, Hard-Soft acid base concept, non-aqueous solvents.	3	E-Resources

3.2	Nuclear chemistry: nuclear reactions, fission and fusion and radio-analytical techniques.	3	PPT
UNIT - IV			
4.1	Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance.	3	E-Resources
4.2	Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.	3	Chalk & Talk
UNIT - V			
5.1	Structure determination of organic compounds by IR, UV-Vis.	2	E-Resources
5.2	Structure determination of organic compounds by ^{1}H & ^{13}C NMR and Mass spectroscopic techniques.	4	PPT
	Total	**30**	

Course Designer
Dr. M. Jannathul Firdhouse
Assistant Professor of Chemistry