

# **DEPARTMENT OF CHEMISTRY**

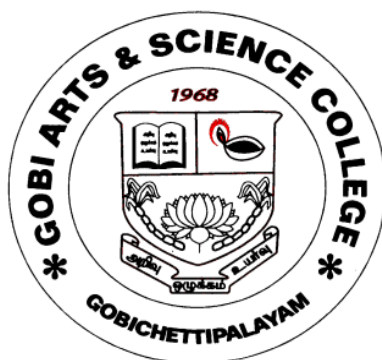
## **B.Sc. CHEMISTRY**

**(Students admitted during 2019-2020 Onwards)**

**(Under CBCS with Outcome Based Education (OBE) Pattern)**

### **SYLLABUS**

**V & VI SEMESTER**



## **GOBI ARTS & SCIENCE COLLEGE**

(Govt. Aided Autonomous Co-educational Institution, Affiliated to Bharathiar University, Coimbatore, Accredited with 'A' Grade by NAAC (4<sup>th</sup> cycle) and Recognised as a STAR College by DBT, Government of India)

**KARATTADIPALAYAM POST,  
GOBICHETTIPALAYAM - 638453  
ERODE DISTRICT.**

## BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

### I. END OF SEMESTER (EOS) EXAMINATIONS:

#### 1. Part I, II & III-Theory: 70 Marks

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	$15 \times 1 = 15$	MCQ	70
K2	B (Either or Pattern)	$5 \times 5 = 25$	Short answers	
K3 & K4	C (Answer 3 out of 5)	$3 \times 10 = 30$	Descriptive/Detailed	

#### 2. Practical Examinations: 70 Marks

Knowledge Level	Section		Total
	Practical	Record work	
K3	60	10	70
K4			
K5			

### II. CONTINUOUS INTERNAL ASSESSMENT (CIA):

#### 1. Test – I & II: 30 Marks (Theory)

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	$10 \times 1 = 10$	MCQ	30
K2	B (Answer 2 out of 3)	$2 \times 5 = 10$	Short answers	
K3 & K4	C (Answer 1 out of 2)	$1 \times 10 = 10$	Descriptive/Detailed	

#### 2. Practical Internal Assessment: 30 Marks

Knowledge Level	Section		Total
	Test	Lab Performance	
K3	20	10	30
K4			
K5			

#### Components of Continuous Internal Assessment (CIA)

Components		Calculation	CIA Total
Test 1	30	$\frac{\text{Test 1} + \text{Test 2}}{2}$	30
Test 2	30		

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH05	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Inorganic Chemistry	<b>Semester:</b>	V
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To know the various theories and types of isomers in coordination compounds.
- To learn the concept of metal carbonyls and principles of gravimetric analysis.
- To understand about basic knowledge in analytical chemistry.
- To develop the knowledge in modern science like Nano chemistry.

### Course Outcomes (CO)

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

Knowledge Level	CO Number	Course Outcome
K3, K4	CO1	Apply basic knowledge and theories of coordination compounds to determine various isomerism
K2, K3	CO2	Explain the bonding models, structures, reactivities and applications of metal carbonyls and the theoretical principles of gravimetric analysis
K1, K2	CO3	Make obvious in understanding the types and process of chromatography and the steps involved in their investigation.
K2, K3	CO4	Expand their acquaintance in various aspects of analytical techniques and its applications.
K1, K2, K3	CO5	Broaden the knowledge of nanoscience and their various applications in different fields.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
I	<b>Co-ordination compounds:</b> IUPAC Nomenclature, theories of co-ordination compounds – Werner's, Sidgwick's, VB, crystal field, M.O. and their limitations. <b>Isomerism in co-ordination compounds:</b> Geometrical and optical isomerism in square planar, tetrahedral and octahedral complexes. Stability of Co-ordination complexes, factors affecting stability, substitution reactions in octahedral and square planar complexes.	15
II	<b>Metal carbonyls:</b> Definition, types, EAN rule, theoretical basis, synthetic methods, reactivity, structure and bonding in Ni(CO) <sub>4</sub> , Fe(CO) <sub>5</sub> , Cr(CO) <sub>6</sub> , Co <sub>2</sub> (CO) <sub>8</sub> and Mn <sub>2</sub> (CO) <sub>10</sub> . <b>Principles of Gravimetric Analysis:</b> Methods of obtaining the precipitate- Conditions for precipitation- Choice of precipitants- Advantages of using Organic Precipitants- Specific and Selective Precipitants- Sequestering Agents- Solubility Products and Precipitation- Factors which affect Solubility of Precipitates- Theories of Precipitation: Co-precipitation – post precipitation- procedures to minimize occlusion- procedures to minimize surface adsorption- Effect of digestion- General rules for precipitation- precipitation from homogeneous medium- washing of precipitates- Drying of precipitates- Types, care and use of crucibles.	15
III	<b>Chromatographic technique:</b> Principle of adsorption. Paper, TLC and column chromatography – adsorbents, preparation of column, adsorption, elution, recovery of substances and applications. <b>Gas and HPLC:</b> Principle, Experimental techniques and instrumentation and	15

	application of gas chromatography and high performance liquid chromatography.	
<b>IV</b>	<p><b>Data analysis:</b> Types of errors, idea of significant figures and its importance, accuracy, methods of expression of accuracy.</p> <p><b>Error analysis:</b> minimizing errors, precision, average deviation, standard deviation and confidence limits.</p> <p><b>Thermogravimetric and differential thermal analysis:</b> Principle, instrumentation. Characteristics of TGA and DTA curves. Factors affecting TGA and DTA curves. Thermometric titration – Application of TGA and DTA.</p>	<b>15</b>
<b>V</b>	<p><b>Nanoscience:</b> Introduction – definition, types – quantum dots, wire and wells, nano rods, fullerenes and carbon nanotubes, nanowires and crystals, nano composites and clusters. Properties of nano materials. Preparation of nano structured materials: bottom up and top down approaches – methods of preparation of nano materials – plasma arching, chemical vapour deposition, electrodeposition, sol-gel synthesis, ball-milling and use of natural nano particles.</p> <p><b>Applications of Nanomaterials:</b> Catalysis, environmental and biomedical (drug delivery) applications. Nanomaterials – environmental hazards.</p>	<b>15</b>

<\* - *Self study: Basic nature of metal carbonyls*>.

#### Text Books:

1. G.D. Tuli, R.D. Madan and W.U. Malik, Selected Topics in Inorganic Chemistry, S. Chand and Sons, 5<sup>th</sup> edition (2014).
2. R. Gopalan, K. Rangarajan and P.S. Subramanian, Elements of Analytical Chemistry, 3<sup>rd</sup> edition 2013, Sultan Chand & Sons.
3. G.R. Chatwal and Sham Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House, 5<sup>th</sup> edition (2011).
4. S. Shanmugam, Nanotechnology, MJP Publishers, 1<sup>st</sup> edition (2010).
5. Charles P. Poole Jr, Frank J. Owens, Introduction to Nanotechnology, Wiley-Blackwell; 1<sup>st</sup> edition (2003).

#### Reference Books:

1. R.D. Madan, Modern Inorganic Chemistry, S. Chand & Company Ltd. 4<sup>th</sup> edition (2004).
2. G.D. Christian, Analytical Chemistry, John Wiley & Sons, New York, 6<sup>th</sup> edition (2004).
3. D.A. Skoog, F.J. Holler and T.A. Nieman, Principles of Instrumental Analysis, Cengage Learning, 6<sup>th</sup> edition (2007).
4. D.A. Skoog, D.M. West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, Cengage Learning, 9<sup>th</sup> edition (2013).
5. R. Booker and E. Boysen, Nanotechnology, Wiley India Pvt. Ltd. 1<sup>st</sup> edition (2007).

#### E-references:

1. <https://www.askiitians.com/revision-notes/chemistry/coordination-compounds/>
2. <http://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf>

#### Mapping with Programme Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	H	S	S	H
CO2	S	S	H	H
CO3	S	H	H	S
CO4	S	S	S	H
CO5	H	S	M	S

S - Strong; H - High; M - Medium; L - Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH06	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Organic Chemistry - I	<b>Semester:</b>	V
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To learn about various molecular rearrangements with mechanism.
- To know the basic concepts of stereoisomerism and geometrical isomerism.
- To understand polymer science and structural elucidation of natural products.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
K2, K3	CO1	Analyze the rearrangements of electron deficient carbon and nitrogen atom.
K2, K3, K4	CO2	Recognize and built stereoisomers, including enantiomers and diastereomers, racemic mixture and meso compounds.
K2, K3, K4	CO3	Utilize the principle of conformation in synthesis and study of pharmaceutical and bio-molecules.
K1, K2	CO4	Explain the essential principles of polymer science.
K2, K3	CO5	Outline the extraction of terpenes and formulate a plan to elucidate the structure.

K1 - Remember; K2 - Understanding; K3 - Apply; K4 - Analyze; K5 – Evaluate

### SYLLABUS

Unit	Content	No. of Hours
I	<b>Molecular rearrangements:</b> Difference between inter and intramolecular nature. Mechanism and evidences of: pinacol – pinacolone (migratory aptitude), Beckmann, Hoffmann, curtius, Schmidt, Benzilic acid, Claisen, Cope and Fries arrangements.	12
II	<b>Stereoisomerism:</b> Definition – classification into optical and geometrical isomerism. Optical isomerism – optical activity – specific rotations – condition for optical activity-stereogenic centre – chirality. Elements of symmetry – Enantiomers, diastereomers and mesomers and their physical and chemical properties. Recermization – resolution – Asymmetric synthesis – Waltan inversion. Projection formulae: Fisher and Sawhorse, erythro and threo representations. Configuration – D, L and R, S. notations for optical isomers with one and two asymmetric Carbon. Optical activity of biphenyls, allenes and spiranes.	12
III	<b>Geometrical isomerism:</b> Alkenes – cis – trans and E-Z notations. Geometrical isomerism in maleic, fumaric acids and in unsymmetrical oximes – methods of distinguishing geometrical isomers (dipolemoment, dehydration, cyclization and m.pt). Cis–trans isomerism in cyclopropane. <b>Conformational analysis:</b> Introduction of terms (conformation, conformer, configuration, dihedral angle, torsional strain, conformational analysis). Conformational analysis of ethane, n- butane and cyclohexane - axial, equatorial bonds and cis – trans – isomers in cyclohexane (chair form only). Stability of cis and trans decalins - Elementary treatment – Cis and trans representation of disubstituted cyclohexane.	12

<b>IV</b>	<b>Macromolecule:</b> Polymer – definition and classification. Polymerization – condensation, addition, radical chain, ionic and co – ordination and copolymerization. Molecular weight concept: Number, weight and viscosity average molecular weight. Measurement of molecular weights. Ebullioscopic, cryoscopic and ultracentrifuge methods. Crystals structure and physical properties of polymer – crystalline melting point, T <sub>m</sub> – the glass transition temperature, T <sub>g</sub> . Relationship between T <sub>m</sub> and T <sub>g</sub> . Polymer degradation – definition – oxidative and photo degradation.	<b>12</b>
<b>V</b>	<b>Terpenes:</b> Definition, distinction between terpenes and terpenoids, classification, isoprene rule and special isoprene rule. Preparation, properties, structural elucidation and synthesis of geraniol, menthol, $\alpha$ -terpineol, $\alpha$ -pinene and camphor.	<b>12</b>

<\* - *Self study: Applications of polymer*>.

#### Text Books:

1. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons, 5<sup>th</sup> edition (2010).
2. V.K. Ahluwalia and Rakesh K. Parashar, Organic Reaction Mechanisms, Narosa Publishing House, 4<sup>th</sup> edition, 2010.
3. Gurdeep R. Chatwal, Organic Chemistry of Natural Products Vol-II, Himalaya Publishing House.
4. O.P. Agarwal, Chemistry of Organic Natural Products Vol I & II, Goel Publishing House, 3<sup>rd</sup> edition.
5. O.P. Agarwal, Chemistry of Organic Natural Products Vol I, Krishna Prakashan Media (P) Ltd.

#### Reference Books:

1. Robert T. Morrison, Robert N. Boyd, Organic Chemistry, Prentice Hall, 6<sup>th</sup> edition (1992).
2. E. Eliel and S.H. Wilen, Stereochemistry of Organic Compounds, Wiley, 1<sup>st</sup> edition (1994).
3. P. Kalsi, Stereochemistry of Organic Compounds, 6th Edition, New Age International.
4. D. Nasipuri, Stereochemistry of Organic Compounds: Principles and Applications, New Age International Pvt Ltd Publishers; 2nd edition (1996).
5. P. Kalsi, Stereochemistry of Organic Compounds, New Age International, 6<sup>th</sup> edition (2004).

#### E-references:

1. <https://www.compoundchem.com/2014/05/22/typesofisomerism/>
2. <http://semmelweis.hu/farmakognozia/files/2015/11/Terpenoids-2015-11.pdf>

#### Mapping with Programme Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
<b>CO1</b>	S	S	H	H
<b>CO2</b>	S	H	S	M
<b>CO3</b>	S	S	S	H
<b>CO4</b>	S	S	S	H
<b>CO5</b>	S	M	S	H

S - Strong; H - High; M - Medium; L – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH07	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Physical Chemistry - I	<b>Semester:</b>	V
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To understand the concepts of electro chemistry.
- To learn the applications of conductance measurements.
- To understand the applications of electrochemical cells and energy storage devices.

#### Course Outcomes (CO)

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

Knowledge Level	CO Number	Course Outcome
K1, K2	CO1	Compile the conduction of strong and weak electrolytes.
K2, K3	CO2	Design conductance experiments for assessing the electrochemical principles.
K2, K3	CO3	Apply the electrochemical equilibria in the construction of cells.
K1, K2, K3	CO4	Uses the concept of emf and its applications.
K2, K3	CO5	Discuss the polarographic techniques and applications.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
I	<b>Electro chemistry:</b> Electrical conduction – Electrical transport and the ohm's law – conduction in metals and in electrolytic solutions. The Arrhenius theory of electrolytic dissociation and the Ostwald's dilution law. The measurement of conductivity in electrolytic solution. Migration of ion, and the Kohlrausch's law of the independent migration of ion. The idea of strong and weak electrolytes. An Elementary treatment of the Debye – Huckel Onsagar equation for the equivalent conductivity of strong electrolytes.	12
II	<b>Electrical Conduction:</b> Conductance at high fields and high frequencies – transference numbers. The determination of transference numbers by the Hittorf method and the moving boundary method. <b>Application of conductance measurements:</b> Determination of degree of dissociation of weak electrolyte- determination of dissociation constant of a weak organic acid. Determination of solubility product of sparingly soluble salt, determination of ionic product of water. Conductometric titrations.	12
III	<b>Equilibria in Electrochemical Cells:</b> Types of reversible electrode: metal/metal-ion, Gas/ion, metal/metal insoluble salt/oxidation – reduction electrodes. Galvanic cells, reversible and irreversible cell. emf and its measurements – Weston saturated standard cell. <b>Reference electrodes:</b> Standard hydrogen electrode, Ag/AgCl reference electrode, Calomel electrode. Single electrode potential. Measurement of single electrode potentials using reference electrodes. Standard electrode potentials – sign convention. Electrochemical series and its significance: Computations cell emf.	12
IV	Temperature dependence of cell emf. Thermodynamic quantities of cell reactions. Determination $\Delta G$ , $\Delta H$ and $\Delta S$ . emf and equilibrium constant. Nernst equation.	12

	Concentration cells with and without transference. Liquid junction potential. Application of emf measurements: Determination of pH using Hydrogen electrode, Quinhydrone electrode and glass electrode. Potentiometric Acid - base Titration. Determination of transport numbers, valency of ion and solubility products.	
V	<b>Lead acid storage battery fuel cell:</b> H <sub>2</sub> -O <sub>2</sub> fuel cell, Hydrocarbon –Oxygen fuel Cell. Decomposition potential. Over voltage elementary treatment. <b>Polarography:</b> Principle – Concentration polarization, Diffusion current, Polarographic cell assembly, advantages of DME, Ilkovic equation (Derivation not required) and significance. Half wave potential. Application of polarography, Amperometric titrations.	12

<\* - *Self study: Faraday's law of electrolysis*>.

#### Text Books:

1. B.R Puri, L.R Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 46<sup>th</sup> edition (2012).
2. S. Glasstone, An introduction to electrochemistry, Read Books Publications (2007).
3. P.W. Atkin's, J. De. Paula, Atkin's Physical Chemistry, Oxford University Press, 8<sup>th</sup> edition (2006).
4. B.K. Sharma, Instrumental methods of chemical analysis Krishna Prakashan Media Publications.
5. Gurdeep R. Chatwal, Sham K. Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House, 5<sup>th</sup> edition (2018).

#### Reference Books:

1. P.H. Rieger, Electrochemistry, Springer Publications (1994).
2. Christopher M. A. Brett, Ana Maria Oliveira Brett, Electrochemistry: Principles, Methods, and Applications, Oxford Science Publications (1993).
3. Allen J. Bard, Larry R. Faulkner, Electrochemical Methods: Fundamentals and Applications, Wiley, 2<sup>nd</sup> edition (2000).
4. Galen W. Ewing, Instrumental methods of chemical analysis, McGraw Hill Higher Education, 5<sup>th</sup> revised edition (1985).

#### E-references:

1. [https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry -supplement%20text.pdf](https://chem.pg.edu.pl/documents/175289/4235721/Electrochemistry%20-supplement%20text.pdf)
2. <https://nptel.ac.in/courses/103108100/38>

#### Mapping with Programme Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	S	H	S	H
CO2	S	S	H	M
CO3	S	S	H	H
CO4	H	S	S	M
CO5	S	H	H	S

S - Strong; H - High; M - Medium; L - Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH08	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Major Elective - I: Pharmaceutical Chemistry	<b>Semester:</b>	V
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To know about important terminologies in pharmaceutical chemistry.
- To develop the basic knowledge of different types of drugs and its applications.
- To understand the concepts of clinical chemistry and Antiviral drugs.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K1</b>	<b>CO1</b>	Terminologies of Pharmaceutical chemistry.
<b>K3</b>	<b>CO2</b>	Formulate a method for testing sugar, salt in blood and to differentiate blood group types.
<b>K3</b>	<b>CO3</b>	Identify the application of several drugs.
<b>K4</b>	<b>CO4</b>	Analyze the structure, mechanism & therapeutic uses of drugs.
<b>K4</b>	<b>CO5</b>	Predict the pathway of controlling diseases by using indian medicinal plants.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

### SYLLABUS

Unit	Content	No. of Hours
<b>I</b>	Important terminologies used in pharmaceutical chemistry – definition of the following terms – drug – pharmacology – pharmacognogy – pharmacy – pharmacodynamics – materia medica - therapeutics – chemotherapy – toxicology – pharmacopocia (IP, BP, USP) - pharmacophore – bacteria – Virus – fungi – synergism –antagonism – toxicology – therapeutic index. The nature and sources of drugs – routes of drug administration – adsorption and bio – availability of drugs – distribution of drugs – bio – transformation of drugs – excretion of drugs – mechanism of drug action – drug receptors and biological response – different types of drug action – methods of prolonging the action of drugs-site of drug action. Treatment of acute drug poisoning – drug assay. Relationship between the chemical structure and pharmacological activity.	<b>12</b>
<b>II</b>	Blood – composition – grouping – Rh factor – buffers in blood – clotting mechanism – coagulation of blood – thrombosis – anti coagulants example Heparin – coumarin – Hemostatic agents examples oxycel – fibrinogen – vitamin K. Clinical chemistry – estimation sugar (glucose) in blood – Folin and Wu method –O. Toludine method – determination of serum cholestrol – Sackett’s method – normal composition of urine – diagnostic tests for salts in serum and urine – detection and estimation of sugar in urine – Benedict’s method – clinitest tablet –reagent strip method - titrimetric method – detection of bilirubin in urine – Fauchet test – detection of diabetes-detection of anemia – estimation of hemoglobin concentration – red blood cell count Diabetes and hypoglycemic drugs – types – control- hypoglycemic drugs example – insulin – tolbutamide – chlorpropamide.	<b>12</b>

III	<p>Analgesics – definition – different types of pain – superficial – deep non visceral - visceral – referred – psychogenic – classification of analgesics – Antipyretics and non steroidal anti inflammatory drugs (NASIDS) – classification – structure and therapeutic uses of acetyl salicylic acid (aspirin).</p> <p>Paracetamol (acetaminophen, crocin, calpol) – heterocyclic aryl acetic acid derivatives – diclofenac (voveran) – selective COX-2 inhibitors. Ibuprofen – fenamates mefenamic acid (meftal) – opioid analgesics preparation – structure – therapeutic uses of morphine – derivatives of morphine – heroin – pethidine – methadone.</p> <p>Central nervous system stimulants – definition – example caffeine-theophylline. Anthelmintics – definition – types of parasites – structure and mechanism of action of mebendazole – Antihistaminic – definition – example promethazinehydro chloride – chlorpheniraminemaleate.</p>	12
IV	<p>Cardiovascular drugs – structure and uses of cardiac glycosides ex – digitoxin. Anti hypertensive and anti hypotensive drugs – ex clonidine, methyl dopa – anti arrhythmic agent's example procainamide – vasopressor drugs example buphenine-Autonomic drugs – definition – example adrenalin – atropine. Diuretics-Definition – mersalyl sodium. Antibiotics – definition – classification – example – penicillins – cloxacillin-ampicillin – cefixime – streptomycin – tetracycline. Antineoplastic agents – definition – classification – examples – vinblastin. Sedatives and hypnotics – definition – examples – thiopental sodium – paraldehyde. Antipsychotic (tranquilizers) – definition – examples – reserpine – lysergic acid diethylamide – marijuana – diazepam.</p>	12
V	<p>Antiviral drugs – definition – names of diseases caused by virus – examples- interferon – ribavirin. AIDS – causes – prevention – treatment. Antifungal agents – definition – classification – examples- griseofulvin- fluconazole -Immunological agents – active and passive immunity – definition – vaccine and toxoids – examples – BCG, MMR, HEPATITIS, TETANUS TOXOID –anti snake-venom serum – immunoglobulin- Vitamins - definition – classification – sources and deficiency symptoms of vitamins A, B, C, D, E and K – anti oxidants – definition – classification –Example – spirulina. Some important Indian medicinal plants- trees – spics – their medicinal uses. AIDS – causes – prevention – treatment. Causes and treatment of common diseases – malaria – filariasis – plague- diphtheria – whooping cough – influenza – measles – tuberculosis – cholera – typhoid-dysentery – jaundice – asthma – epilepsy – piles – leprosy.</p>	12

<\* - Self study: Anaemia – causes and control – antianaemic drugs – haematinic products>.

#### Text Books:

1. Jayashree Gosh, A text book of pharmaceutical chemistry, S. Chand & Sons (2012).
2. K.R. Arumugam, N. Muruges, Text book of pharmacology, Sathya publishers (2003).
3. P. Thangaraj, Medicinal plants, 7<sup>th</sup> edition, CRS press (1997).

#### Reference Books:

1. M.R. Chaudhari, V.N. Kulkarni, S.B. Gokhale, Biochemistry & Clinical Pathology, Nirali prakashan (2008).
2. J. Jack Li and E.J. Corey, Drug Discovery: practices, Processes and Perspectives, Elsevier (2012).
3. D. Cairns, Essentials of Pharmaceutical chemistry, Pharmaceutical press, Michigan (2000).
4. Ramnik Sood, Text book of Medical laboratory technology, Jaypee Brothers Medical Publishers (2006).

#### E-references:

1. [https://en.wikipedia.org/wiki/Clinical\\_chemistry](https://en.wikipedia.org/wiki/Clinical_chemistry)
2. <https://www.britannica.com/science/cardiovascular-drug>

### Mapping with Programme Specific Outcomes

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>C01</b>	S	S	H	S
<b>C02</b>	H	S	H	S
<b>C03</b>	S	H	S	H
<b>C04</b>	S	S	S	H
<b>C05</b>	S	H	H	S

**S** - Strong; **H** - High; **M** - Medium; **L** – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH09	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Molecular Spectroscopy	<b>Semester:</b>	VI
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To understand the introduction of spectroscopic techniques.
- To know about the instrumentation of different spectrometer.
- To learn basic components common to most spectroscopic instrument.
- To learn the applications of electromagnetic spectrum.

### Course Outcomes (CO)

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

Knowledge Level	CO Number	Course Outcome
K1, K2, K3	CO1	Formulate the various spectroscopic methods in different energy ranges.
K2, K3	CO2	Apply advanced knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
K2, K3, K4	CO3	Analyze and interpret spectroscopic data collected by the methods discussed in the course.
K3, K4	CO4	Solve problems related to the structure, purity and concentration of chemicals.
K3, K4	CO5	Create practical applications and research possibilities in different fields.

K1 - Remember; K2 - Understanding; K3 - Apply; K4 - Analyze; K5 - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
I	<b>Electromagnetic Spectrum:</b> Various regions of electromagnetic spectrum, properties of electromagnetic radiation. <b>Microwave Spectra:</b> Theory of rotational spectra-selection rule. Determination of moment of inertia and bond length from rotational spectra of hetero diatomic molecules – CO & HCl. Types of molecules – Isotopic mass from rotational spectra, Instrumentation (out line).	12
II	<b>IR Spectra:</b> Theory, molecular vibration, selection rule, force constant, zero point energy, deduction of molecular properties from vibrational spectra of H <sub>2</sub> O, CO <sub>2</sub> and CO. Characteristic frequencies – finger print region. Application of IR to organic compounds. Instrumentation. (Outline).	12
III	<b>Raman Spectra:</b> Theory, rotational Raman spectra, comparison with IR mutual exclusion rule – example H <sub>2</sub> O and CO <sub>2</sub> . <b>Electronic Spectra:</b> Theory, types of electronic transition, selection rule, Franck Condon principle. Chromophores and auxochromes. Absorption Intensity shifts. Determination of $\lambda_{\max}$ for dienes and $\alpha,\beta$ -unsaturated ketones.	12
IV	<b>Proton magnetic resonance:</b> Theory, chemical shift, factors affecting chemical shift. Spin-spin coupling, coupling constant, vicinal, geminal coupling (elementary treatment only). PMR spectra of ethanol, diethyl ether, isopropyl chloride, benzoic acid. Instrumentation. (Outline).	12
V	<b>Electron spin resonance spectroscopy:</b> Theory, comparison with NMR, derivative curves, hyperfine splitting. Application – structural determination of hydrogen, deuterium,	12

	methyl free radical. Instrumentation (outline). <b>Mass Spectra:</b> Theory, basic principle, isotope abundance, base peak, molecular ion peak, meta stable ion. Important features of the parent ion peak and general fragmentation modes. McLaffarty rearrangements. Nitrogen rule-Instrumentation (Outline).	
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<\* - *Self study: Introduction about Stark and Zeeman effect*>.

#### Text Books:

1. C. N. Banwell and E. M. Mccash, Fundamentals of Molecular Spectroscopy, Tata McGraw-Hill Pvt. Ltd. 4<sup>th</sup> edition (2007).
2. D.L. Pavia, G.M. Lampman, G.S. Kriz, J.A. Vyvyan, Introduction to Spectroscopy, Ceneage Learning, 4<sup>th</sup> edition (2008).
3. G.R. Chatwal and Sham Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House (2011).
4. Y. R. Sharma, Elementary Organic Spectroscopy, Sultan Chand and Sons, 1<sup>st</sup> edition (1980).

#### Reference Books:

1. R.M. Silverstein, F.X. Webster, D.J. Kiemle, D.L. Bryce, Spectrometric Identification of Organic Compounds, Wiley Publications, 8<sup>th</sup> Edition (2014).
2. William Kemp, Organic Spectroscopy, Red Globe Press, 3<sup>rd</sup> edition (1991).

#### E-references:

1. <http://web.mit.edu/5.33/www/lec/spec1.pdf>
2. <https://slideplayer.com/slide/250208/>
3. <https://www.thoughtco.com/introduction-to-spectroscopy-603741>

#### Mapping with Programme Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	H
CO2	S	H	H	S
CO3	H	S	H	S
CO4	S	H	M	S
CO5	H	S	S	M

S - Strong; H - High; M - Medium; L - Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH10	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Organic Chemistry - II	<b>Semester:</b>	VI
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To learn about photochemistry and its applications.
- To comprehend the basic concepts of pericyclic reactions.
- To appreciate the structural elucidation of alkaloids and the chemistry of heterocyclic compounds.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
K1, K2	CO1	Analyze the principles of photochemistry and photoreactions of carbonyl compounds and olefins.
K1, K2	CO2	Critically scrutinize the results of FMO and correlation diagram methods in pericyclic reactions.
K1, K2, K3	CO3	Illuminate the open and cyclic structure of carbohydrates.
K1, K2, K3	CO4	Identifies the various techniques for structural elucidation of alkaloids.
K1, K2, K3	CO5	Summarize the preparation, properties and structure of heterocyclic compounds.

K1 - Remember; K2 - Understanding; K3 - Apply; K4 - Analyze; K5 – Evaluate

SYLLABUS		
Unit	Content	No. of Hours
I	<b>Organic photochemistry:</b> Principles of photochemistry. Electronic excitations – excited states – modes of dissipation of energy – Jablonsky diagram. Energy transfer – quantum efficiency-Photochemistry of carbonyl compounds. Photo reduction. Norrish type reaction. Photochemical reaction of cyclic ketones. The paterno – Buchi reaction. Photochemistry of $\alpha,\beta$ -unsaturated ketones, cis-trans conversion of olefins.	12
II	<b>Pericyclic reaction:</b> Conservation of molecular orbital symmetry – Symmetry properties of molecular orbitals. Electrocyclic reactions: Inter conversion of 1, 3 Butadiene–cyclobutene system and 1,3,5-hexatriene–cyclohexadiene system by correlation diagram and FMO method. Cycloaddition reactions–2+2 and Diels-Alder reaction by correlation diagram and FMO method. Simple Claisen and Cope rearrangement by FMO method.	12
III	<b>Carbohydrates:</b> Classification, constitution of glucose and fructose. Reactions of glucose and fructose, Osazone formation, mutarotation and its mechanism. Cyclic structure – Pyranose and furanose forms. Determination of ring size – Haworth projection formula. Configuration of monosaccharides – Epimerisation, interconversions – D-Arabinose to D – glucose and vice versa. D – glucose to D – fructose and vice versa. Epimerisation D – glucose to D – mannose. Disaccharides – chemistry and structure of Sucrose and lactose. Polysaccharides –chemistry and structure of starch and cellulose.	12
IV	<b>Alkaloids:</b> Classification – General methods of determination of structure- Zeisel method of determination of methoxy group – Hoffmann exhaustive methylation –	12

	Von Braun degradation – Herzig – Meyer method of determination of N – methyl group. Isolation properties, structural elucidation and synthesis (any one method) of the following alkaloids, coniine, piperine, nicotine, papaverine and atropine.	
V	<b>Heterocyclic compounds:</b> Aromaticity – preparation, properties and uses of furan, Pyrrole, thiophene and pyridine. Comparative study of basicity of pyrrole and pyridine with amines. Synthesis and reactions of quinoline, isoquinoline and indole with special reference to Skraup, Bischler and Napieralski and Fischer Indole synthesis.	12

<\* - Self study: Detection of carboxy, carbonyl and ester groups>.

#### Text Books:

1. S.M. Mukhaerji, Reaction Mechanism in Organic Chemistry, Laxmi Publications; 3<sup>rd</sup> edition (2007).
2. M.K. Jain, Sc. Sharma, Modern Organic Chemistry, Vishal Publishing Co. Golden Jubilee Year edition (2017).
3. A. Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons, 5<sup>th</sup> edition (2010).

#### Reference Books:

1. Jagdamba Singh, Jaya Singh, Photochemistry and Pericyclic Reactions, NEW AGE Publications, 3<sup>rd</sup> edition, 2009.
2. C.H. De Puy, O.L. Chapman, Molecular reactions and photochemistry, Prentice-Hall (1972).
3. Gurdeep R. Chatwal, Organic Chemistry of Natural Products Vol-II, Himalaya Publishing House (2018).
4. O.P. Agarwal, Chemistry of organic Natural Products Vol I, Krishna Prakashan Media (P) Ltd. 2015.

#### E-references:

1. <https://www.alchemyst.co.uk/pdf/Organic/pericyclics.pdf>
2. <https://www.britannica.com/science/alkaloid>

#### Mapping with Programme Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	H	H	H	M
CO2	H	H	M	H
CO3	S	S	S	H
CO4	S	S	H	S
CO5	S	S	H	M

S - Strong; H - High; M - Medium; L – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH11	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Physical Chemistry - II	<b>Semester:</b>	VI
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To understand the basic concepts of chemical kinetics and its theoretical aspects.
- To learn about the kinetics of photochemical reactions and surface chemistry.
- To know the basic concepts of Quantum chemistry and its applications.

#### Course Outcomes (CO)

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

Knowledge Level	CO Number	Course Outcome
<b>K2, K3</b>	<b>CO1</b>	Explain the kinetics of chemical reaction.
<b>K3</b>	<b>CO2</b>	Compare the different theories of chemical kinetics.
<b>K2, K3, K4</b>	<b>CO3</b>	Describe the various photophysical and photochemical processes.
<b>K2, K4</b>	<b>CO4</b>	Identify the types and applications of adsorption.
<b>K1, K2</b>	<b>CO5</b>	Outline the basic principles of quantum chemistry.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
<b>I</b>	<b>Chemical kinetics:</b> Empirical laws and experimental aspects – Rate laws – stoichiometry – order and molecularity of reactions – setting up and solving simple differential equations for first order, second order, third order and zero order reactions. Expressions for half – life periods of first order, second order, zero order and third order reactions.	<b>12</b>
<b>II</b>	<b>Theoretical aspects:</b> Effect of temperature on the rate constant. The activation energy the collision theory of reaction rates and its limitations, Lindemann theory of unimolecular reactions. The theory of absolute reaction rates comparison of the collision theory with the absolute reaction rate theory. Significances of free energy of activation and entropy of activation.	<b>12</b>
<b>III</b>	<b>Kinetics of photochemical reactions:</b> Absorption of light and photochemical processes laws of photochemistry – Quantum yield photochemical reactions- chain reactions – H <sub>2</sub> – Br <sub>2</sub> reaction – comparison of the thermal and photochemical reactions – Kinetics of H <sub>2</sub> – Br <sub>2</sub> reaction, photo sensitized reactions – photophysical process – Fluorescence, phosphorescence, chemiluminescence, Applications of photochemistry.	<b>12</b>
<b>IV</b>	<b>Adsorption:</b> Adsorption Vs absorption - types of adsorption – physical and chemical adsorption and their differences. Adsorption isotherm – Freundlich adsorption isotherm, Applications of adsorption. Catalyst – types of catalyst – theories of catalysis: enzyme catalysis, acid-base catalysis. Symmetry in crystal system – axis of symmetry. Plane of symmetry – centre – point groups – symmetry operating NH <sub>3</sub> and H <sub>2</sub> O molecules.	<b>12</b>
<b>V</b>	<b>Quantum chemistry:</b> Black body radiation and introduction of Planck's quantum theory. Photoelectric effect. Compton effect, De Broglie concept of wave – particle dualism. Heisenberg's uncertainty principle. Schrödinger's wave equation –	<b>12</b>

derivation, significance of $\psi$ and $\psi^2$ , Eigen values and Eigen function. Particle in a box (one dimensional only).	
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<\* - Self study: Determination of order of reactions>.

#### Text Books:

1. B.R Puri, L.R Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 46<sup>th</sup> edition (2012).
2. P.W. Atkin's, J. De. Paula, Atkin's Physical Chemistry, Oxford University Press, 8<sup>th</sup> edition (2006).
3. Levine, Quantum Chemistry, Pearson Education India, 7<sup>th</sup> edition (2016).
4. P.L. Soni, Text Book of Physical Chemistry, Sultan Chand & Sons (2011).

#### Reference Books:

1. Keith J. Laidler, John H. Meiser, Bryan C. Sanctuary, Physical Chemistry, Houghton Mifflin, 4th Revised edition (2002).
2. Laidler, Chemical Kinetics, Pearson Education India; 3<sup>rd</sup> edition (2003).
3. A.K. Chandra, Introductory Quantum Chemistry, Tata McGraw Hill Publishing Co. Ltd. 4<sup>th</sup> edition (1994).

#### E-references:

1. <https://www.askiitians.com/iit-jee-chemistry/chemical-kinetics.aspx>
2. <https://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2007/lecture-notes/>

#### Mapping with Programme Specific Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	S	S	H	S
CO2	H	S	S	H
CO3	H	H	S	S
CO4	H	S	H	S
CO5	S	S	H	M

S - Strong; H - High; M - Medium; L - Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACH12	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Major Elective - II: Environmental Chemistry	<b>Semester:</b>	VI
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To understand about the various kinds of pollution and its influence on eco system.
- To know about radioactivity in the environment and it's monitoring.
- To learn about the basic knowledge of instrumental techniques used in environmental.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K1</b>	<b>CO1</b>	Create awareness and impact of toxic chemical in environment.
<b>K2, K3</b>	<b>CO2</b>	Assess the effect of air pollution and various measure to control.
<b>K1, K2</b>	<b>CO3</b>	Predict the problem in water pollution and demonstrate the treatment of waste water.
<b>K2</b>	<b>CO4</b>	Select in-depth about noise pollution, radioactive in the environment and its effects.
<b>K2, K3</b>	<b>CO5</b>	Identify pollutions using various instruments.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

### SYLLABUS

Unit	Content	No. of Hours
<b>I</b>	An introduction – Environmental segments – environmental pollution – the effects of pollutants – toxic chemical in the environment – impact of toxic chemical on – enzymes-Arsenic, cadmium, lead, mercury, carbon monoxide, nitrogen oxides, sulphurdioxide, peroxyacetyl nitrate (PAN). Cyanide, pesticides, Methyl isocyanide.	<b>12</b>
<b>II</b>	<b>Air pollution:</b> Air pollutants – carbonmonoxide - oxides of nitrogen – Hydrocarbons and photochemical smog. SO <sub>2</sub> – Acid rain – particulates – air pollution from automobiles – effects of atmospheric pollution – Air pollution control – Air quality Standards.	<b>12</b>
<b>III</b>	<b>Water pollution:</b> water pollutants – organic pesticides – detergents – marine oil pollution – inorganic pollutants – acid mine drainage – sediments – Thermal pollution – trace element in water – effects of water pollution –water quality parameters and standards – water pollution control – treatment of waste water.	<b>12</b>
<b>IV</b>	<b>Noise pollution:</b> noise pollution source – international standards – effect of noise pollution – noise threshold limit values – noise measuring equipments – noise control. Radioactivity in the environment – Radioactive materials in Water & Air pollution, its monitoring and the evaluation of its significance – effects on the environment – discharge of radioactive materials into the sea – personal monitoring.	<b>12</b>
<b>V</b>	Instrumental techniques in environmental, chemical analysis – neutron activation analysis- anodic stripping voltammetry (ASV) – Atomic absorption Spectrophotometry (AAS) – Inductively coupled plasma emission spectrometry (ICPES) – X-ray fluorescence – non-dispersive IR spectrometry – Fourier transform IR (FTIR) spectroscopy – Gas chromatography – chemiluminescence - high	<b>12</b>

performance liquid chromatography (HPLC). Ion selective electrodes – Ion chromatography.	
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<\* - Self study: Natural cycle of the environment oxygen cycle and nitrogen cycle>.

**Text Books:**

1. A.K. De, Environmental Chemistry, New Age International (P) Ltd, 4<sup>th</sup> edition (2001).
2. S.S. Dara, D.D. Mishra, A Text Book of Environmental Chemistry & Pollution Control, S Chand & Company, 7<sup>th</sup> Revised edition (2004).
3. M. Mehra, O.D. Tyagi, A Textbook of Environmental Chemistry, Anmol Publications Pvt Ltd.
4. V. Subramanian, A Textbook of Environmental Chemistry, IK International Publishing House Pvt. Ltd (2011).
5. Anubha Kaushik, Perspectives in Environmental Studies, New Age International Private Limited.

**Reference Books:**

1. Dr. R.K. Khitoliya, Environmental Pollution, S. Chand & Company Ltd, Revised edition (2014).
2. Shweta Sharma, Pooja Sharma, Environmental Chemistry, Alpha Science International Ltd (2014).
3. P.S. Sindhu, Environmental Chemistry, New Age International Private Limited, 2<sup>nd</sup> edition (2010).
4. S.C. Bhatia, Environmental Chemistry, CBS Publishers & Distributors Pvt. Ltd. (2011).

**E-references:**

1. <https://www.askiitians.com/revision-notes/chemistry/environmental-chemistry/>
2. <http://www.ncert.nic.in/ncerts/l/kech207.pdf>

**Mapping with Programme Specific Outcomes**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	S	S	S	H
<b>CO2</b>	S	S	H	S
<b>CO3</b>	H	S	H	S
<b>CO4</b>	S	S	H	M
<b>CO5</b>	H	S	S	H

S - Strong; H - High; M - Medium; L – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UECH01	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	60	Major Skill Based Paper: Industrial Chemistry	<b>Semester:</b>	VI
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To understand how to use chemistry knowledge in industries.
- To learn about the basic knowledge in industrial production.
- To learn about the various industrial products such as fibers, dyes, petrochemicals etc.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K1, K2</b>	<b>CO1</b>	Evaluate the processing of textile fibres.
<b>K2</b>	<b>CO2</b>	Acquire an idea about dyeing process & printing mechanism.
<b>K3, K4</b>	<b>CO3</b>	Analyze various petrochemical products & process and apply the chemical knowledge for homemade preparation of shampoos, soaps and detergent powder.
<b>K3</b>	<b>CO4</b>	Predict the process of glass manufacturing.
<b>K4</b>	<b>CO5</b>	Identify the composition, methods of preparation of rubber & perfumes.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

SYLLABUS		
Unit	Content	No. of Hours
<b>I</b>	<b>Fibres:</b> Definition – classification – structure and properties of cotton – wool and silk - synthesis properties and uses of Rayon. General sequence of processing of textile fibres: Sizing – desizing – singeing – scouring – bleaching – mercerization.	<b>12</b>
<b>II</b>	<b>Dyes:</b> Classification of dyes based on chemical structure – mode of application – auxochrome - chromophore – MO theory of colour and constitution – Indigo dyes- Isolation– synthesis – application for cotton fabric – Natural dyes – Turmeric – Henna. Machinery used – Jig dyeing – Beck dyeing – Jet dyeing.	<b>12</b>
<b>III</b>	<b>Petrochemicals:</b> Classification of petrochemicals – composition of petroleum- Natural gas – purification and uses – petroleum – properties – classification of crude-refining – cracking – Thermal cracking mechanism – hydrocracking – fluid catalytic cracking. Octane number and antiknock compounds – cetane number. <b>Soaps:</b> Manufacture of soaps – hot batch process – Hot continuous process – Toilet soap – Transparent soap.	<b>12</b>
<b>IV</b>	<b>Glass:</b> Properties – raw materials – method of manufacture – shaping – Annealing – finishing – special classes. Ceramics – classification – raw materials – manufacturing process – Glazing – Decoration. Refractories – classification - properties-manufacture.	<b>12</b>
<b>V</b>	<b>Rubber:</b> Classification – source of natural rubber – manufacture of latex – Properties of natural rubber – synthetic rubber – chloroprene – isoprene – vulcanization – Buna	<b>12</b>

	– S, Buna-N. <b>Cosmetics:</b> Ingredients and Health effects of Talcum powder, Tooth paste, Perfumes, Nail polish and Shampoos. Colour chemicals used in food: Soft drinks and its hazardous effects.	
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<\* - *Self study: Synthesis properties and uses of Nylon 6,6 – Dacron*>.

**Text Books:**

1. B.K. Sharma, Industrial chemistry, Goel Publication house, Meerut, 15<sup>th</sup> edition (2006).
2. M.G. Arora, M. Singh, Industrial chemistry, Anmol publications, 2<sup>nd</sup> edition (2003).

**Reference Books:**

1. O.P. Vermani, A.K. Narula, Industrial chemistry, Galgotia Publications Pvt. Ltd. (2008).
2. C.A. Heaton, An introduction of Industrial chemistry, Springer-Science+Business Media, 3<sup>rd</sup> edition (1991).

**E-references:**

1. <https://www.sciencedirect.com/topics/materials-science/textile-fiber>
2. <https://en.wikipedia.org/wiki/Petrochemical>

**Mapping with Programme Specific Outcomes**

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	H
CO2	H	H	S	S
CO3	S	S	S	H
CO4	S	S	S	S
CO5	H	S	S	H

S - Strong; H - High; M - Medium; L – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACHP5	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	80	Major Core Practical - V : Gravimetric Analysis and Preparation of Inorganic Complexes	<b>Semester:</b>	VI
			<b>Credits:</b>	5.0

### Course Objective

#### The course aims

- To develop the experimental skills in gravimetric analysis.
- To prepare various inorganic complexes.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K1, K2</b>	<b>CO1</b>	Identify the weight of various metals by using Gravimetric analysis.
<b>K2</b>	<b>CO2</b>	Formulate various inorganic complexes.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
	<p><b>I. Gravimetric analysis</b></p> <p>1) Estimation of Pb as lead chromate</p> <p>2) Estimation of Ba as barium chromate</p> <p>3) Estimation of Ca as calcium oxalate</p> <p>4) Estimation of Ba as barium sulphate</p> <p><b>II. Preparation of inorganic complexes</b></p> <p>1) Preparation of tetrammine copper (II) tetrahydrate</p> <p>2) Preparation of sodium thiosulphate</p> <p>3) Preparation potassium trioxalatochromate (III)</p> <p>4) Preparation of tris-(thiourea)-copper (II) sulphatedihydrate</p>	<b>80</b>

#### Text Books:

1. V. Venkateswaran, R. Veerasamy and A.R. Kulandaivelu, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2<sup>nd</sup> edition (1997).
2. P.K. Mani and A.O. Thomas, Textbook for Practical Chemistry for B.Sc. Main students, Xavier press, Cannanore (2003).
3. D.N. Bajpai, O.P. Pandey and S. Giri, Practical Chemistry, S. Chand and Sons, Revised edition (2006).
4. V.K. Ahluwalia, S. Dhingra, A. Gulati, College Practical Chemistry, Universities Press (India) Limited (2012).

**Reference Books:**

1. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> edition, Pearson Education Ltd. Singapore (2004).
2. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, Vogel's textbook of quantitative Chemical Analysis, 6th Edition, Pearson Education Ltd., Singapore (2002).

**E-reference:**

1. <https://byjus.com/chemistry/gravimetric-analysis/>

**Mapping with Programme Outcomes**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	S	H	H	M
<b>CO2</b>	S	S	H	S

**S** - Strong; **H** - High; **M** - Medium; **L** - Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACHP6	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	80	Major Core Practical -VI: Application Oriented Practicals	<b>Semester:</b>	VI
			<b>Credits:</b>	5.0

### Course Objective

#### The course aims

- To develop practical skills in quantitative estimations.
- To improve the practical skill in the preparation of standard solutions and reagents.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
K4	CO1	Identify the melting and boiling points of the various compounds.
K5	CO2	Evaluate the amount of unknown substance present in the given solution.

K1 - Remember; K2 - Understanding; K3 - Apply; K4 - Analyze; K5 - Evaluate

### SYLLABUS

Unit	Content	No. of Hours
	<p><b>Application oriented practicals</b></p> <p><b>1. Determination of melting and boiling points</b></p> <p>a) The following substances may be given for melting points: benzoic acid, acetanilide, urea, naphthalene, biphenyl, benzamide, m-dinitro benzene, salicylic acid, m-nitro benzoic acid, anthranilic acid.</p> <p>b) The following substances may be given for the boiling points: chlorobenzene, toluene, ethyl benzoate, o-chlorophenol, p- chlorophenol, o- toluidine, benzaldehyde, aniline, acetophenone.</p> <p><b>2. Quantitative estimations</b></p> <p>a) Colorimetric estimation of Fe<sup>3+</sup></p> <p>b) Spectrophotometric estimation of metal ions like Cu<sup>2+</sup>, dyes etc.</p> <p>c) Estimation of glucose using Benedict's reagent</p> <p>d) Estimation of Calcium content of milk using EDTA</p> <p>e) Estimation of alkali content of antacid tablet</p> <p><b>3. Preparation of standard solutions and reagents.</b></p>	<b>80</b>

#### Text Books:

- V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu, Basic principles of practical chemistry, S. Chand & Sons, 2<sup>nd</sup> edition (1997).
- Arthur I vogel, Qualitative organic analysis, Pearson Educational Publishers, 2<sup>nd</sup> edition.
- Gnanapragasam and Ramamurthy, Organic chemistry lab manual, Viswanathan S. Printers and publishers Pvt. Ltd. (2009).

#### Reference Books:

- B. S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell, Vogel text book for practical organic chemistry, Pearson Educational Publishers, 5<sup>th</sup> edition.
- B.B. Day, M.V. Sitaram and T.R. Govindachari, Laboratory manual of organic chemistry, Allied publishers Ltd.
- Jagmohan, Advanced practical organic chemistry.

**E-references:**

1. [https://www.youtube.com/watch?v=pDmWDOOr\\_3H0](https://www.youtube.com/watch?v=pDmWDOOr_3H0)
2. [https://fac.ksu.edu.sa/sites/default/files/9\\_determination\\_of\\_calcium\\_in\\_milk.pdf](https://fac.ksu.edu.sa/sites/default/files/9_determination_of_calcium_in_milk.pdf)

**Mapping with Programme Outcomes**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	H	S	H	S
<b>CO2</b>	S	H	M	S

**S** - Strong; **H** - High; **M** - Medium; **L** – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UACHP7	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	80	Major Core Practical - VII : Physical Chemistry	<b>Semester:</b>	VI
			<b>Credits:</b>	5.0

### Course Objective

#### The course aims

- To learn analytical and technical skills to work effectively in the various fields of chemistry.
- To understand the practical knowledge in physical chemistry.
- To know about eutectic systems and transition temperature.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K4, K5</b>	<b>CO1</b>	Predict the rate constant for ester hydrolysis reaction.
<b>K4</b>	<b>CO2</b>	Assess the eutectic composition and eutectic temperature of simple system.
<b>K5</b>	<b>CO3</b>	Determine transition temperature by using thermometric method.
<b>K4, K5</b>	<b>CO4</b>	Identify the strength of alkaline solution by using potentiometric and conductometric method.
<b>K5</b>	<b>CO5</b>	Evaluate the equivalent conductance of strong electrode and dissociation constant of weak acids.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
	<p><b>Experiments in physical Chemistry:</b></p> <p><b>1. Kinetics:</b></p> <p>a) Acid catalysed hydrolysis of an ester (methyl – acetate or ethyl acetate).</p> <p><b>2. Heterogeneous Equilibria:</b></p> <p>a) Critical solution temperature</p> <p>i) Phenol – water system UCST</p> <p>ii) Effect of impurity on UCST (upto 1 percent NaCl solution or upto 1 percent succinic acid solution)</p> <p>b) Eutectic systems:</p> <p>i) naphthalene and naphalamine</p> <p>ii) naphthalene and diphenylamine (only simple systems to be given)</p> <p>c) Determination of transition temperature – thermometric method. Sodium acetate, sodium thiosulphate, <math>\text{SrCl}_2 \cdot 6\text{H}_2\text{O}</math> and <math>\text{MnCl}_2</math>.</p> <p><b>3. Electrochemistry:</b></p> <p>a) Conductivity Experiments</p> <p>i) Equivalent conductance – HCl, KCl</p> <p>ii) Titration: acid – base</p> <p>iii) Dissociation constant of weak acids</p> <p>b) i) Potentiometric redox titration (Fe Vs <math>\text{KMnO}_4</math>)</p>	<b>80</b>

ii) Potentiometric acid – base titration <b>4. Determination of Molecular weight by Rast method.</b> <b>5. Distribution law: (Demonstration only)</b> a) Distribution co- efficient of iodine between benzene and water b) Equilibrium constant of reaction $I_2 + I = I_3$ c) Determination of Strength of unknown KI	
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#### Text Books:

1. V. Venkateswaran, R. Veerasamy and A.R. Kulandaivelu, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2<sup>nd</sup> edition (1997).
2. P.K. Mani and A.O. Thomas, Textbook For Practical Chemistry for B.Sc. Main students, Xavier press, Cannanore (2003).
3. D.N. Bajpai, O.P. Pandey and S. Giri, Practical Chemistry, S. Chand and Sons, Revised edition (2006).
4. V.K. Ahluwalia, S. Dhingra, A. Gulati, College Practical Chemistry, Universities Press (India) Limited (2012).

#### Reference Books:

1. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5<sup>th</sup> edition, Pearson Education Ltd. Singapore (2004).
2. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, Vogel's textbook of quantitative Chemical Analysis, 6th Edition, Pearson Education Ltd., Singapore (2002).
3. J. Ngurtu, R. Kapoor, Advanced Experimental Chemistry, S. Chand & Company Ltd. (1991).

#### E-reference:

1. [http://www.icl-didactica.com/\\_images/imagenes/pdf/ld/chemistry\\_experiments.pdf](http://www.icl-didactica.com/_images/imagenes/pdf/ld/chemistry_experiments.pdf)

#### Mapping with Programme Outcomes

CO \ PSO	PSO1	PSO2	PSO3	PSO4
CO1	S	H	S	S
CO2	H	M	S	H
CO3	S	M	H	H
CO4	S	S	S	H
CO5	M	S	S	H

S - Strong; H - High; M - Medium; L – Low

<b>Programme Code:</b>	B.Sc.	<b>Programme Title:</b>	Chemistry	
<b>Course Code:</b>	19UECHP1	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	30	Major Skill Based Practical	<b>Semester:</b>	VI
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To develop the experimental skills in textile fields.
- To know about coloring cotton with various dyes.
- To know about preparation of washing and dish wash powder.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K4</b>	<b>CO1</b>	Select various dyes for coloring fibres.
<b>K3</b>	<b>CO2</b>	Make design on the cloths by printing methods.
<b>K3, K5</b>	<b>CO3</b>	Prepare dish wash and washing powder in home itself.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate

SYLLABUS		
Unit	Content	No. of Hours
	1. Identification of Textiles fibres a) Burning Test b) Solubility test and swelling test. 2. Colouring cotton with direct dyes. 3. Colouring of acid dyes on wool. 4. Colouring of cotton with reactive dye- cold brand. 5. Mordanting of animal fibres with Alum. 6. Colouring alum Mordantanted wool with turmeric. 7. Dyeing of cotton with Henna. 8. Batik dyeing on cotton. 9. Printing of cloths with screen. 10. Preparation of para red.	<b>30</b>

#### Text Books:

1. Dr.N.N. Mahapatra, Textile dyes and dyeing, A.P.H Publishing Corporation.
2. Seema Sekhri, Textbook of fabric science fundamentals to finishing, PHI learning private Ltd.
3. H. Panda, the complete technology book on herbal perfumes and cosmetics, NIIR Project consultancy services.
4. NIIR board consultants and engineering, the complete technology book on detergents.
5. B.K. Sharma, Industrial chemistry, Goel engineering house, Meerut.

**Reference Books:**

1. J.L. Smith, Textile processing, Abhishek publications.
2. Hemalatha Jain, Techniques of dyeing and printing, Ane books Pvt. Ltd.
3. Eiri Consultations and engineering, Hand book of synthetic detergents with formulations.

**E-references:**

1. [https://www.youtube.com/watch?v=Arb6\\_DUu-hY](https://www.youtube.com/watch?v=Arb6_DUu-hY)
2. [https://en.wikipedia.org/wiki/Textile\\_printing](https://en.wikipedia.org/wiki/Textile_printing)

**Mapping with Programme Outcomes**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	S	H	S	H
<b>CO2</b>	H	S	M	S
<b>CO3</b>	S	H	H	S

**S** - Strong; **H** - High; **M** - Medium; **L** – Low

## Question Paper Pattern

(Common for Major, Allied, Allied Optional and Major Optional Papers)

### For EOS Examinations: 70 Marks

The Question Paper is to be divided into THREE Sections.

Section-A Carries 15 Marks, Section-B Carries 25 Marks and Section-C Carries 30 Marks.

Section-A Contains 15 Multiple Choice Questions. (15 x 1 = 15 Marks)

Three Questions from each unit. (Q. No: 1 to 15)

Section-B Contains 5 Either or Choice Questions. (5 x 5 = 25)

Each Question carries 5 Marks. Both (a) and (b) from the same unit.

Q. No.: 16 (a) or (b) to 20(a) or (b)

Section-C Contains 5 Questions out of which, 3 Questions are to be answered. (3 x 10 = 30)

Each Question carries 10 Marks. One Question from each unit. Q. No.: 21 to 25

### For CIA Examinations: 30 Marks

Section-A: 10 Multiple Choice Questions. (10 x 1 = 10)

Section-B: Two Questions out of Three. (2 x 5 = 10)

Section-C: One Question out of Two. (1 x 10 = 10)

<b>Programme Code:</b>	ALL U.G.	<b>Programme Title:</b>	Major Optional	
<b>Course Code:</b>	19UFCH01	<b>Course Title:</b>	<b>Batch:</b>	2019
<b>Total Hours:</b>	90	Chemistry in Every Day Life	<b>Semester:</b>	V
			<b>Credits:</b>	4.0

### Course Objective

#### The course aims

- To learn the sources of food, constituents, poisoning and preservation.
- To understand the types of minerals and their functions.
- To know about commonly used medicines.

### Course Outcome

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

Knowledge Level	CO Number	Course Outcome
<b>K2, K3</b>	<b>CO1</b>	Predict source of food, types and its constituent.
<b>K2</b>	<b>CO2</b>	Explain causes and remedies of food poisoning.
<b>K1, K2</b>	<b>CO3</b>	Discuss the food preservation, processing and causes of food spoilage.
<b>K2, K3</b>	<b>CO4</b>	Create awareness about the principle mineral element in food.
<b>K1, K2</b>	<b>CO5</b>	Identify the chemicals present in medicine.

**K1** - Remember; **K2** - Understanding; **K3** - Apply; **K4** - Analyze; **K5** – Evaluate

SYLLABUS		
Unit	Content	No. of Hours
<b>I</b>	<b>Food:</b> Sources of foods, types, advantages and disadvantages, constituents of foods, carbohydrate, protein, fats and oils, flavours and natural toxicants.	<b>18</b>
<b>II</b>	<b>Food poisoning:</b> Sources, causes and remedy- Causes and remedies for acidity, gastritis, indigestion and constipation.	<b>18</b>
<b>III</b>	<b>Food preservation and processing:</b> Processing principles: Canning, chilling, freezing, dehydration, control of water activity, CA and MA storage, fermentation, hurdle technology, addition of preservatives and food additives. Processing by heating- sterilization, pasteurization. <b>Food spoilage:</b> Causes of food spoilage, types of food spoilage, preservation.	<b>18</b>
<b>IV</b>	<b>Minerals:</b> Mineral elements in food- Principal mineral elements-source, function-deficiency and daily requirements - Na, K, Zn, Ca, Mg, Fe, S and P.	<b>18</b>
<b>V</b>	<b>Medicine:</b> Chemicals in medicine: analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines (elementary idea of antioxidants).	<b>18</b>

<\* - *Self study: Study about sources and deficiency of vitamins A, B, C, D*>.

#### Text Books:

1. Seema Yadav, Food Chemistry, Anmol Publications Pvt Ltd, Revised edition (2002).
2. B. Sivasankar, Food Processing and Preservation, PHI Learning Private Limited, 6th edition (2009).
3. Alex V Ramani, Food Chemistry, MJP Publishers, 1<sup>st</sup> edition (2015).

**Reference Books:**

1. Meyer, Lillian Hoagland, Food Chemistry (2009).
2. Dennis D. Miller, Food Chemistry, John Wiley & Sons (1998).
3. H.K. Chopra, P.S. Panesar, Food Chemistry, Narosa Publishing House, 5th edition (2015).

**E-references:**

1. [http://www.savitapall.com/food\\_chemistry/notes/food%20chemistry%20summary.pdf](http://www.savitapall.com/food_chemistry/notes/food%20chemistry%20summary.pdf)
2. [https://www.internetchemistry.com/chemistry/food\\_chemistry.html](https://www.internetchemistry.com/chemistry/food_chemistry.html)

**Mapping with Programme Specific Outcomes**

<b>CO \ PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>CO1</b>	S	H	S	H
<b>CO2</b>	H	M	S	S
<b>CO3</b>	S	S	H	S
<b>CO4</b>	S	M	H	S
<b>CO5</b>	H	S	M	H

**S** - Strong; **H** - High; **M** - Medium; **L** – Low