ALAGAPPA UNIVERSITY, KARAIKUDI

SYLLABUS UNDER CBCS PATTERN FOR AFFILIATED COLLEGES
WITH EFFECT FROM THE ACADEMIC YEAR 2022-23 ONWARDS

B.Sc., CHEMISTRY
Programme Structure

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Credits	Hours/ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2211T	T/OL	Tamil/Other Languages-I	T	3	6	25	75	100
	II	712CE	E	Communicative English -I	T	3	6	25	75	100
	III	22BCH1C1	CC	Physical Chemistry - I	T	5	5	25	75	100
		22BCH1P1	CC	Inorganic Volumetric Analysis Practical–I	P	4	4	40	60	100
		-	AL-IA	Physics/ Maths/ Zoology/ Botany	T	3	3	25	75	100
		-	AL-IA	Practical-Respective Allied Theory Course	P	2	2	40	60	100
	IV	22BVE1	SEC -I	Value Education	T	2	2	25	75	100
		-	-	Library	-	-	2	-	-	-
				Total		**22**	**30**	**205**	**495**	**700**
II	I	2221T	T/OL	Tamil/Other Languages-II	T	3	6	25	75	100
	II	722CE	E	Communicative English - II	T	3	6	25	75	100
	III	22BCH2C1	CC	Inorganic Chemistry –I	T	5	5	25	75	100
		22BCH2P1	CC	Inorganic Qualitative Analysis Practical-II	P	4	4	40	60	100
		-	AL-IB	Physics/ Maths/ Zoology/ Botany	T	3	3	25	75	100
		-	AL-IB	Practical-Respective Allied Theory Course	P	2	2	40	60	100
	IV	22BES2	SEC-II	Environmental Studies	T	2	2	25	75	100
	-	Naan Mudhalvan Course		Language Proficiency for Employability(Effective English)	T	2	2	25	75	100
				Total		**24**	**30**	**230**	**570**	**800**
III	I	2231T	T/OL	Tamil/Other Languages-III	T	3	6	25	75	100
	II	2232E	E	English for Enrichment– I	T	3	6	25	75	100
	III	22BCH3C1	CC	Physical Chemistry–II	T	3	3	25	75	100
		22BCH3C2	CC	Organic Chemistry –I	T	3	3	25	75	100
		22BCH3P1	CC	Organic Estimation Practical– III	P	3	3	40	60	100
		-	AL-IIA	Physics/ Maths/ Zoology/ Botany	T	3	3	25	75	100
		-	AL-IIA	Practical-Respective Allied Theory Course	P	2	2	40	60	100
	IV	22BE3	SEC-III	Entrepreneurship	T	2	2	25	75	100
		-	NME-II	Adipadai Tamil/ Advance Tamil IT Skills for Employment/ MOOC'S	T	2	2	25	75	100
				Total		**24**	**30**	**255**	**645**	**900**

IV	I	2241T	T/OL	Tamil/Other Languages -IV	T	3	6	25	75	100
	II	2242E	E	English for Enrichment–II	T	3	3	25	75	100
	III	22BCH4C1	CC	Organic Chemistry –II	T	4	4	25	75	100
		22BCH4C2	CC	Inorganic Chemistry – II	T	4	4	25	75	100
		22BCH4P1	CC	Organic Analysis Practical – IV	P	3	3	40	60	100
		-	Al-IIB	Physics/ Maths/ Zoology/ Botany	T	3	3	25	75	100
		-	AL-IIB	Practical-Respective Allied Theory Course	P	2	2	40	60	100
	IV	-	NME-II	Adipadai Tamil Advance Tamil Small Business Management / MOOC'S	T	2	2	25	75	100
		Naan Mudhalvan Course		Digital Skills for Employability – (Microsoft-Office Fundamentals)	-	2	3	25	75	100
				Total		**26**	**30**	**255**	**645**	**900**

V	III	22BCH5C1	CC	Physical Chemistry – III	T	4	5	25	75	100
		22BCH5C2	CC	Organic Chemistry-III	T	4	5	25	75	100
		22BCH5C3	CC	Inorganic Chemistry - III	T	4	6	25	75	100
		22BCH5P1	CC	Gravimetric Estimation And Organic Preparation Practical – V	P	4	4	40	60	100
		22BCH5P2	CC	Physical Chemistry Practical -VI	P	4	4	40	60	100
		22BCH5P3	CC	Applied Chemistry Practical-VII	P	4	4	40	60	100
		-		Career development/ employability Skills	-	-	2	-	-	
				Total		**24**	**30**	**195**	**405**	**600**
VI	III	22BCH6I		Internship		24	26	150	250	400
	IV	Naan Mudhalvan Course		Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	-	2	4	25	75	100
				Total		**26**	**30**	**175**	**325**	**500**
		(Or)								
	III	22BCH6E1/ 22BCH6E2	DSE	(A) - Analytical Chemistry **(or)** (B)Agricultural Chemistry	T	6	6	25	75	100
		22BCH6E3/ 22BCH6E4		(A) –Industrial Chemistry **(or)** (B)Medicinal Chemistry	T	6	6	25	75	100
		22BCH6E5/ 22BCH6E6		(A)Polymer Chemistry **(or)** (B) Application of Computers in Chemistry	T	6	6	25	75	100
		22BCH6E7/ 22BCH6E8		(A)-Pharmaceutical Chemistry **(or)** (B)Material Chemistry and Nano Science.	T	6	6	25	75	100
	IV	-	-	Library/Yogaetc	-	-	2	-	-	-
		Naan Mudhalvan Course		Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	T	2	4	25	75	100
				Total		**26**	**30**	**125**	**375**	**500**
		(Or)								
	III	22BCH6PR		Project		6	8	25	75	100
		22BCH6E1/ 22BCH6E2		(A)Analytical Chemistry**(or)** (B)Agricultural Chemistry	T	6	6	25	75	100
		22BCH6E3/ 22BCH6E4		(A) Industrial Chemistry **(or)** (B) Medicinal Chemistry	T	6	6	25	75	100

		22BCH6E5/ 22BCH6E6		(A) Polymer Chemistry **(or)** (B) Application of Computers in Chemistry	T	6	6	25	75	100
		Naan Mudhalvan Course		Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	-	2	4	25	75	100
				Total		**26**	**30**	**125**	**375**	**500**
				Grand Total		**146**	**--**	**--**	**-**	**4400**

*Employability Readiness -Women's Colleges Naandi course and all other Colleges IBM Skills build Course.

Sem.	Part	Course Code	Title ofthePaper	Credits	Hours/ Week	Marks		
						Int.	Ext.	Total
I	III	71BEPP	Professional English for Physical Science-I	4	5	25	75	100
II		72BEPP	Professional English for Physical Science-II	4	5	25	75	100
III		*	Professional English for Physical Science-III	4	5	25	75	100
IV			Professional English for Physical Science-IV	4	5	25	75	100

*The Syllabus of Professional English for III & IV Semester will be provided after Receiving the syllabus from TANSCHE.

As per TANSCHE, the Professional English book will be taught to all four streams apart from the existing hours of teaching/additional hours of teaching (1hour/day) as a 4 credit paper as an add on course on par with Major paper and completion of the paper is a must to continue his/her studies further.

- TOL-Tamil/Other Languages,
- E–English
- CC – Core course Core competency, critical thinking, analytical reasoning, research skill & team work
- Allied –Exposure beyond the discipline
- AECC-Ability Enhancement Compulsory Course (Professional English & Environmental Studies) -Additional academic knowledge, psychology and problem solving etc.,
- SEC-Skill Enhancement Course – Exposure beyond the discipline (Value Education, Entrepreneurship Course, Computer application for Science, etc.,
- NME -Non Major Elective – Exposure beyond the discipline
- DSE– Discipline specific elective – Student choice– either or
    - Internship
    - Internship Marks = Internal = 150 (75+75) two midterm valuation through Viva voce and External 250 marks (Report=150+VivaVoce=100) = Total 400 marks
    - Theory paper
    - Project +3 theory papers.
- MOOCs–Massive Open Online Courses
- T-Theory, P- Practical

Semester - I				
Course Code: 22BCH1C1	**Core Course-I**	**T/P**	**C**	**H**
	PHYSICAL CHEMISTRY – I	**T**	**5**	**5**
Objectives	➢ To study the gas laws, physical properties of liquids and the classification of liquid crystals, the law of mass action, its applications and the nature of colloids.			
Unit-I	1.1 Ideal gas laws – ideal gases and real gases – deviation of real gases from ideal behaviour. 1.2 Van der waal's equation (Derivation) – other equations of state – Clausius, Berthelot and Dieterici (no derivation) 1.3 Reduced equation of state and law of corresponding states – Boyle and Inversion temperatures of gases (no derivation): Definition and related problems. 1.4 Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable)			
Unit-II	2.1. Critical phenomenon of gases: P-V isotherms of real and Van der waal's gases – critical states of gases – Definition and determination of the critical constants. 2.2 Relation between van der Waal's constants and critical constants – problems related to the calculation of Van der waal's constants and critical constants. 2.3. Kinetic theory of gases: Mean free path – collision frequency – problems involving RMS velocity and most probable velocity. 2.4. Viscosity of gases – Loschmidt number - Principle of equipartition of energy.			
Unit- III	3.1. Phase rule: Definition – phase, number of components and number of degrees of freedom – Gibbs phase rule (derivation) 3.2 One component system: water system and carbon dioxide system. Two component system: reduced phase rule – simple eutectic systems – Pb-Ag system and KI-H_2O system 3.3 Systems involving compound formation: Congruent and incongruent melting points– Zn-Mg system, $FeCl_3$-H_2O system and Dehydration of $CuSO_4.5H_2O$ 3.4 Distribution law: Statement – Conditions for the validity of distribution law – thermodynamic derivation – applications of the distribution law.			
Unit -IV	4.1. Chemical Equilibrium: Reversible and irreversible reactions – statement of law of mass action – Derivation of law of mass action from kinetic theory. 4.2 Relationship between Kp and Kc (derivation) - Van't Hoff reaction isotherm. 4.3 Applications of Law of mass action to the equilibria involving the formation of NH_3, dissociation of $CaCO_3$ and the dehydration of $CuSO_4.5H_2O$. 4.4 Lechatelier's principle: statement – application to the formation of NH_3.			
Unit-V	5.1. Colloidal state: Lyophilic and Lyophobic colloids – Tyndall effect – Brownian movement – Electrophoresis – Electro-osmosis – Electrical double layer – Zeta potential – Coagulation – protective colloids – Gold number –flocculation values – Hofmeister series. 5.2. Gels: Elastic and non-elastic gels – imbibition – syneresis – thixotropy			

	5.3. Emulsions: Definition – types of emulsions – emulsifiers 5.4. Applications of colloids: Cottrell precipitator – Sewage disposal – detergent action of soap – artificial rain – formation of delta – smoke screens.

Text Books:

G. W. Castellan *Physical Chemistry* 7th edition

Puri, Sharma & Pathania *Advanced Physical Chemistry*

S.Glasstone *Physical Chemistry*

Reference Books:

Iran N Levine *Physical Chemistry* 6th edition

Paul Monk *Physical Chemistry* 4th edition

Peter Atkins *Physical Chemistry* 7th edition

Outcomes	Students can learn about the behaviour of gases and liquids and solve the problems regarding molecular velocities, applications of law of mass action and also learn the chemistry of colloids.

Semester -I				
Course Code: 22BCH1P1	**Core Practical-I**	**T/P**	**C**	**H**
	INORGANIC VOLUMETRIC ANALYSIS PRACTICAL – I	**P**	**4**	**4**

Max. Marks: 60 **Duration: 4 Hrs.**

A double titration involves the making up the solution to be Estimated and the preparation of a primary standard solution.

I. ACIDIMETRY AND ALKALIMETRY

1. Estimation of NaOH/KOH (Std. Na_2CO_3)
2. Estimation of Na_2CO_3(Std. Na_2CO_3)
3. Estimation of HCl/H_2SO_4 (Std. Oxalic acid)
4. Estimation of Oxalic acid (Std. Oxalic acid)

II. REDOX TITRATIONS

a) PERMANGANOMETRY

1. Estimation of Ferrous Ammonium Sulphate
2. Estimation of oxalic acid

b) DICHROMETRY

1. Estimation of Ferrous Ion
2. Estimation of ferric ion using external indicator

III IODO AND IODIMETRY

1. Estimation of Potassium dichromate
2. Estimation of Potassium Permanganate

Distribution of External marks:

Record : 10 marks
Procedure : 10 marks 60 marks
Experiment : 40 marks`
Experiment: Less than 1% error.....40 marks
1 – 2 % error…...30 marks
2 – 3 % error…...20 marks
3 – 4 % error…...15 marks
>4 % error…...10 marks

Note: University practical examination – 3 hours

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Semester -II				
Course Code: 22BCH2C1	**Core Course-II**	**T/P**	**C**	**H**
	INORGANIC CHEMISTRY – I	**T**	**5**	**5**

Objectives	The objective of this paper is to introduce the students about the composition and stability of the nucleus and types of nuclear reactions. To know about basic metallurgical processes. To provide the detailed chemistry about p-block elements especially the Nitrogen family. To gain knowledge about the magnetic properties and its applications. To study about the solubility of ionic compounds hydrogen bonding and Van der waals forces.
Unit-I	**NUCLEAR CHEMISTRY** 1.1. Constitution of nuclei – stability of nuclei and (n-p) ratio – relationship. Magic number, mass defect, mass energy relationship, binding energy and calculation of binding energy from mass defect. 1.2. Radioactivity: Natural radioactivity –Soddy's group displacement law – Radioactivity equilibrium – Rate of radioactive disintegration – half-life period and average life period– radioactive disintegration series. 1.3. Nuclear fission & fusion: Theory of nuclear fission, Applications – principle of atom bomb. Theory of nuclear fusion– principle of hydrogen bomb-Solar and Stellar energy 1.4. Applications of radioactivity: medicine – agriculture – industry – structural elucidations–tracer techniques - carbon dating.
Unit-II	2.1.Basic principles of Metallurgy: Ore dressing: Gravity separation – Froth flotation – Magnetic separation – Roasting – Calcination – Smelting – Flux – Purification – Electrolytic refining – Zone refining – Van-Arkel vapour phase refining – Alumino thermite process. 2.2. Group – IA: Extraction of lithium and its uses - Diagonal relationship of Lithium with Magnesium. 2.3. Group – II A: Extraction of Beryllium and its uses – Diagonal relationship of Beryllium with Aluminium. 2.4. Group – I B: Extraction of copper and its uses – Extraction of silver and its uses.
Unit- III	**GROUP – VA** 3.1. Nitrogen: Ammonia – manufacture, properties, uses and structure. 3.2. Hydrazine: preparation, properties and uses. 3.3. Nitric Acid: Manufacture of Nitric acid – Action of nitric acid on metals. 3.4.Arsenic: Extraction and uses– Distinction between arsenites and arsenates- Antimony: Extraction and uses – preparation and uses of tartar emetic- Bismuth: Extraction of Bismuth and its uses – preparation and the uses of Sodium bismuthate.

Unit -IV	4.1 Dipole moment: Definition – Experimental determination – Calculation of percentage ionic character of HF and HCl – Dipole moment and molecular structure: CO_2, H_2O, NH_3 and CH_4. 4.2 Magnetic properties: Paramagnetic, diamagnetic and ferromagnetic substances and their characteristics – magnetic permeability. 4.3 Magnetic susceptibility – specific and molar magnetic susceptibilities – determination of magnetic susceptibility by Gouy's method. 4.4 Applications of magnetic susceptibilities: number of unpaired electrons in a Molecule – structure of coordination compounds – formation of free radicals.
Unit-V	5.1 Peracids and persalts: preparation, properties and structure of permono sulphuric acid, perdisulphuric acid and potassium perdisulphate. 5.2 Preparation of permonocarbonic acid, perdicarbonic acid and perdicarbonates. 5.3 Solubility of ionic compounds: Lattice energy – Born-lande equation (no derivation) – Born Haber cycle – Fajan's rule. 5.4 Hydrogen bonding: Intra and intermolecular hydrogen bonding with suitable examples – applications of hydrogen bonding –Van der waals forces.

Text Books:

R.D.Madhan, *Inorganic Chemistry*

P.L.Soni, *Inorganic Chemistry*

Shriver & Atkins, *Inorganic Chemistry*

Reference Books:

Lee J.D. *Inorganic Chemistry*

Cotton F.A. & Wilkinson, *Advanced Inorganic Chemistry*

James E.Huheey, *Inorganic Chemistry*

Outcomes	The students become familiar with the concepts of nuclear reactions, know the basics of metallurgy, the principles of extraction and refining on metals. Students can learn about the p-block elements, Nitrogen family. They become familiar with the magnetic susceptibilities, its applications, hydrogen bonding and Van der waals forces.

Semester -II				
Course Code: 22BCH2P1	**Core Practical-II**	**T/P**	**C**	**H**
	INORGANIC QUALITATIVE ANALYSIS PRACTICAL – II	**P**	**4**	**4**

Max. Marks: 60 **Duration: 4 Hrs.**

Analysis of a mixture containing two cations and two anions of which one anion will be an interfering ion. Semimicro methods are to be used.

Anions to be studied: Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Fluoride, Oxalate, Phosphate, Borate and Chromate.

Cations to be studied: Lead, Cadmium, Copper, Aluminium, Iron (only ferrous), Cobalt, Manganese, Nickel, Zinc, Barium, Calcium, Strontium, Magnesium and Ammonium ion.

Distribution of External marks

Record	:	10 marks
Two anions with correct procedure	: 13 + 13	26 marks
Group Separation	:	8 marks
Two cations with correct procedure	: 8 + 8	16 marks
		60 marks

Note: University practical examination – 3 hours

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Semester –III				
Course Code: 22BCH3C1	**Core Course-III**	**T/P**	**C**	**H**
	PHYSICAL CHEMISTRY – II	**T**	**5**	**5**
Objectives	To understand various types of photochemical processes, the laws of photochemistry and to learn the kinetics of photochemical reactions. To know the fundamental concepts of conductance studies, to understand theory of strong electrolytes and to learn the fundamentals of electrochemical cells and the calculations of cell potential. To understand various applications of EMF measurement, To study about the storage cells, fuel cells and polarography. To equip learners with concepts of symmetrical elements and its outcome.			
Unit-I	**PHOTOCHEMISTRY** 1.1. Fundamentals: photochemical reactions. Comparison of photochemical and thermal reactions. Consequences of light absorption Jablonski diagram. Fluorescence and phosphorescence- Chemiluminescence. 1.2. Laws of photochemistry: Beer – Lambert law and its limitations. Grotthus – Draper law of photochemical activation. Stark – Einstein law of photochemical equivalence. Quantum efficiency and reasons for variation of quantum yield. 1.3 Kinetics of photochemical reactions: derivation of kinetic equation of a Photochemical reaction. Rate equations for photochemical reactions – hydrogen and chlorine and hydrogen and bromine. 1.4 Lasers – population inversion, optical pumping, Q – switching.			
Unit-II	**ELECTROCHEMISTRY – 1** 2.1. Conductance and transference: Cell constant, Specific conductance, Equivalent conductance and its variation with dilution. 2.2. Transport number – experimental determination of transport number. Kohlrausch's law and its applications, Diffusion and ionic mobility. 2.3. Measurement of conductance of an electrolyte. Applications of conductance measurements to determine degree of dissociation of weak electrolytes, ionic product of water, solubility product of a sparingly soluble electrolyte. Ostwald's dilution law. 2.4 Classification of electrolytes. Debye – Huckel theory of strong electrolytes and Debye – Huckel limiting law.			
Unit- III	**ELECTROCHEMISTRY – 2 – Ionic Equilibria** 3.1. Acid and bases, Lewis concept of acid and base. Conjugate acid and bases. Relative strength of acids and bases. Dissociation constants of acids (k_a) and bases (k_b). 3.2 Ionic product of water (Kw). pH of a solution and its calculation. Common ion effect and its applications. 3.3. Buffer solutions, different classes of buffers. Henderson – Hasselbalch equation and calculation of pH of a buffer and application of buffer solution 3.4. Indicators and theory of indicators. Range of indicators and choice of indicators.			

Unit -IV	**ELECTROCHEMISTRY – 3 - Electromotive Force and Electrochemical Cells** 4.1. Electrochemical cells. Types of electrochemical cells. Different types of electrodes and electrode potentials. Single electrode potentials. Standard electrodes and electrode reactions. Electrochemical cells and cell reactions. 4.2. Electromotive force (EMF) of a cell. Relation between EMF of a cell and equilibrium constant- Nernst equation. 4.3 Electrochemical series. Concentration cells. Fuel cells. Measurement of cell EMF and applications of EMF such as determination of solubility product and pH. 4.4. Corrosion, basic principles of corrosion inhibition and various methods of mitigation of corrosion.
Unit-V	**GROUP THEORY** 5.1. Definition of a group. Various symmetry elements and corresponding symmetry operations. Identification of possible symmetry elements in a molecule. 5.2. Deduction of point group. Order of a group, sub – groups and classes. 5.3. Group multiplication table. Construction group multiplication tables for C2V and C2h with suitable examples. 5.4. Matrix representation of symmetry operations.

Text Books:

Castellan G. W., *Physical Chemistry*, 7th edition.

Glasstone S., *Physical Chemistry.*

Puri, Sharma & Pathania, *Advanced Physical Chemistry.*

Ramakrishnan V. and M.S.Gopinathan, *Group theory in Chemistry*

Rohatgi K.K.– Mukherjee, *Fundamentals of Photochemistry*

Reference Books:

Iran N Levine, *Physical Chemistry*, 6th edition

Peter Atkins, *Physical Chemistry* 7th edition

Paul Monk, *Physical Chemistry* 4th edition

George Davidson, *Introductory Group theory for Chemist.*

Outcomes	Students gain knowledge about photochemical reactions, electrochemical conductance and the applications of conductance measurements. They learn about the galvanic cells and its applications. Students can gain knowledge on the determination of pH, storage cells and fuel cells. Students can learn the basics of group theory.

Semester –III				
Course Code: 22BCH3C2	**Core Course-IV**	**T/P**	**C**	**H**
	ORGANIC CHEMISTRY –I	**T**	**5**	**5**
Objectives	To study the preparation and properties of phenols, ethers and the preparation of different alcohols. To know the methods of synthesis of aldehydes, ketones and carboxylic acids, to understand about stereochemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds. To study the synthesis, reactions, stability and significance of alicyclic compounds. To understand clearly about the classification and structural features of Carbohydrates.			
Unit-I	1.1. Definition: Rectified spirit - Absolute alcohol - Methylated spirit - Power alcohol -Estimation of the number of hydroxyl groups in a polyhydric alcohol. Aliphatic Nucleophilic substitution – SN^1 and SN^2 – Elimination reactions – E_1 and E_2. 1.2 Phenols - Preparation of phenols - acidity of phenol versus alcohols. Preparation of catechol, resorcinol, pyrogallol, hydroxyquinol and phloroglucinol. 1.3.Ethers: Estimation of alkoxy groups – Zeisel's method – preparation of chlorex and vinyl ether. 1.4 Preparation and uses of guaicol, veratrole, eugenol, anethole and crown ethers.			
Unit-II	2.1. Thioalcohols and thioethers: Preparation and uses of ethyl mercaptan, diethyl thioether, sulphonal and mustard gas. 2.2. Preparation and synthetic applications of Grignard reagent. 2.3 Aldehydes and Ketones: Preparation of aldehydes and ketones from fatty acids – Rosenmund reduction – Stephen's method – Meerwein-Pondorf-Varley reduction – Oppaenaur oxidation – preparation of Acrolein, Crotonaldehyde, Chloral. 2.4. Carboxylic acids and their derivatives: Structure of carboxylic acids – acidity of carboxylic acids –preparation of acrylic acid and crotonic acid.			
Unit- III	3.1. Halogen substituted acids: Preparation and properties of mono, di and tri carboxylic acids – Relative strengths of mono, di and tri chloroacetic acids. 3.2. Hydroxy acids: Preparation of lactic acid and tartaric acid – conversion of lactic acid into pyruvic acid – action of heat on hydroxy acids. 3.3. Preparation of maleic acid and fumaric acid – conversion of maleic acid into fumaric acid and vice versa process. 3.4. Preparation and synthetic applications of diethyl malonate – Action of heat on dicarboxylic acids.			
Unit -IV	4.1. Geometrical isomerism – maleic acid and fumaric acid – aldoximes and ketoximes – E-Z notations. 4.2. Optical isomerism: definition: optical activity and optical isomerism – optical isomerism of compounds containing asymmetric carbon atom – tartaric acid – enantiomers and diastereoisomers – racemic and meso forms – racemisation – resolution of racemic mixture – Walden inversion – asymmetric synthesis – chirality – specifications of absolute configurations by R and S notations. 4.3. Optical activity of compounds without asymmetric carbon atoms – allenes and spiranes. 4.4. Optical activity of elements other than carbon atoms – quaternary ammonium			

	compounds – tertiary amine oxides.
Unit-V	5.1. Alicyclic compounds – general methods of preparation of cycloalkanes – Baeyer's strain theory and its modifications. 5.2. Conformational analysis: differences between configuration and conformation – Fischer and Sawhorse and Newman projection formulae – conformational analysis of ethane, n-butane. Conformation and stabilty of cyclohexane 5.3. Carbohydrates: Classification- Structure of glucose and fructose – mutarotation– epimerization – interconversion of glucose and fructose. 5.4. Structure (No elucidation) and uses of sucrose and starch.

Text Books:

P.L.Soni, *Organic Chemistry.*

B.S.Bahl and Arun Bahl, *Advanced Organic Chemistry*.

R.T.Morrison and R.W.Boyd, *Organic Chemistry*.

Reference Books:

Organic Chemistry – Volume I, I.L.Finar

Organic Chemistry – Volume II, I.L.Finar

Organic Chemistry – J.Clayden

Organic Chemistry – Jerry March

Organic Chemistry – Mc muray

Outcomes	Students can well understand the preparation of phenols, ethers and different alcohols and the mechanism of nucleophilic substitution and elimination reactions. Students can derive an easy and elegant methods to synthesize aldehydes, ketones, carboxylic acids and alicyclic compounds. Students can well understand stereochemistry and carbohydrates.

Semester -III				
Course Code: 22BCH3P1	**Core Practical-III**	**T/P**	**C**	**H**
	ORGANIC ESTIMATION PRACTICAL – III	**P**	**4**	**4**

Max. Marks: 60 **Duration: 4 Hrs.**

ORGANIC ESTIMATION

1. Estimation of phenol
2. Estimation of aniline
3. Estimation of glucose

Distribution of External marks

1. Record	10 marks
2. Organic estimation	50 marks
a. Procedure 10 marks	
b. Experiment 40 marks	
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	60 marks

Organic Estimation

Less than 2% error	–	40 marks
2 – 3 % error	–	35 marks
3 – 4 % error	–	30 marks
>4 % error	–	15 marks

Note: University practical examination – 3 hours

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Semester –IV				
Course Code: 22BCH4C1	**Core Course-V**	**T/P**	**C**	**H**
	ORGANIC CHEMISTRY –II	**T**	**5**	**5**
Objectives	To know about aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds, to know the synthesis of different dyes and green chemistry.			
Unit-I	1.1. Aromatic compounds: Aromatic hydrocarbons – aromaticity and Huckel's rule – Simple Applications. 1.2. Aromatic substitution: Electrophilic substitution with suitable examples – Mechanism of Halogenation, Nitration, Sulphonation and Friedel-Craft's reactions – 1.3. Directive influence of substituents: Orientation – Effect of substituents – activating and deactivating groups – Rules of disubstitution 1.4 Aromatic halogen compounds: preparation of nuclear and side chain halogen compounds – Distinction between them – preparation and uses of benzylidene chloride, benzylidyne chloride and DDT.			
Unit-II	2.1. Aromatic aldehydes: Mechanism of the following reactions; Perkin reaction – Claisen reaction - Knoevenagal reaction – Benzoin condensation – Cannizzaro's reaction. 2.2. Aromatic ketones: Preparation of acetophenone and benzophenone by Friedel-Craft's reaction – halogenation of acetophenone – Distinction between acetophenone and benzophenone. 2.3. Aromatic acids: Effect of substituents on the acidic character of benzoic acid – substituted benzoic acids – preparation and uses of salicylic acid and anthranilic acid. 2.4 Derivatives of phthalic acid: preparation of phthalic anhydride and phthalimide. Preparation of the following compounds – phenylacetic acid, mandelic acid, cinnamic acid, aspirin and methyl salicylate.			
Unit- III	3.1. Aromatic sulphonic acids: preparation, properties and uses of benzene sulphonic acid – preparation and uses of saccharin, chloramine-T and dichloramine-T. 3.2. Aromatic nitro compounds: conversion of nitrobenzene into o-, p- and m-dinitro benzenes – reduction reactions of nitrobenzene in neutral, acidic and basic media – preparation and uses of TNT and amatol. 3.3. Relative basic character of aromatic amines – preparation and uses of acetanilide, sulphanilic acid and sulphanilamide. 3.4. Benzene diazonium chloride: synthetic applications of benzene diazonium chloride.			
Unit -IV	4.1 Polynuclear hydrocarbons: preparation, properties and uses of naphthalene, anthracene and phenanthrene 4.2 Preparation and uses of naphthylamine, naphthols, naphthaquinone and anthraquinone – preparation of biphenyl, benzidine and stilbene. .4.3 Oils and fats: definition – determination and application – saponification value – iodine value – Reichert-Meissel value – acid value. 4.4 Green Chemistry– Overview, set of principles of Green Chemistry, Green			

	synthetic methods:Ionic liquid, Supercritical fluids and microwave.
Unit-V	5.1 Dyes: Definition of dyes, pigments, chromophore and auxochrome with suitable examples. Difference between dyes and pigments. 5.2 Otto-Witt theory of colour and constitution – bathochromic shift and hypsochromic shift – classification of dyes with examples according to structure and applications. 5.3 Colour index of dyes and its significance. Phototropism and its importance in applications of dyes with suitable examples. 5.4 Preparation and uses of following dyes: Methyl orange, malachite green, phenolphthalein, indigo and alizarin

Text Books:

B.S.Bahl and Arun Bahl, *Advanced Organic Chemistry*

R.T.Morrison and R.W.Boyd, *Organic Chemistry*

P.L.Soni, *Organic Chemistry*

Reference Books:

Organic Chemistry – Volume I - I.L.Finar

Organic Chemistry – Volume II - I.L.Finar

Reaction Mechanism of Organic Compounds – Jerry March

Organic Chemistry – J. Clayden

Outcomes	Students can understand the basic knowledge of aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds. Students can identify the green synthetic methods and the synthesis of dyes.

Semester –IV				
Course Code: 22BCH4C2	**Core Course-VI**	**T/P**	**C**	**H**
	INORGANIC CHEMISTRY – II	**T**	**4**	**4**

Objectives	To provide the detailed chemistry about halogen family and noble gases, to introduce the students about the transition and inner transition elements, to help the students to understand the development and uses of bioinorganic compounds.
Unit-I	1.1 General trends in the properties of halogens – deviation of fluorine from other elements of the group. 1.2 Preparation of fluorine – properties of fluorine – hydrogen fluoride – oxides of halogens –oxyacids of halogens. 1.3 Interhalogen Compounds**:** XY, XY_3, XY_5 and XY_7 types and their structure. 1.4 Pseudohalogens and pseudohalides definition with examples.
Unit-II	2.1 Carbides -Types of carbides - Covalent, ionic and interstitial carbides with suitable examples – uses. Allotropes of carbon – Graphene and Fullerene. 2.2 Noble gas compounds: preparation of xenon fluorides and oxyfluoride and krypton fluoride. 2.3 Group VI A Elements: Ores, Extraction and Uses of Selenium and Tellurium. 2.4 Group VI B Elements: Ores, Extraction and Uses of Uranium.
Unit- III	3.1 Transition elements - position in the periodic table – General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. 3.2 Stability of various oxidation states. Difference between the first, second and Third transition series. 3.3 Occurrence, extraction and uses of titanium, and tungsten. 3.4 Need of alloys and classification of alloys. Composition and uses of alloys of Fe, Ni, Cu, Steels: classification of steels and their uses.
Unit -IV	**LANTHANIDES AND ACTINIDES** 4.1 Position of lanthanides, actinides in the periodic table – general characteristics of lanthanides and actinides – lanthanide contraction – actinide contraction. 4.2 Occurrence, extraction and separation of lanthanides by ion exchange method and valency change method. 4.3 Occurrence, extraction and uses of thorium. 4.4 Organometallic compounds of lanthanides – optical properties – magnetic properties of lanthanides. Applications of lanthanides and actinides.
Unit-V	**BIO – INORGANIC CHEMISTRY** 5.1. Essentiality (significance) of metal and metal ions in biological systems. 5.2 Role of alkaline and alkaline earth metal ions in biological systems. (Na,K,Mg, Ca and Ba). 5.2 Role of iron in biological systems – structure of haemoglobin – oxygen transportation by haemoglobin (elementary study). Structure of chlorophyll – photosynthesis. 5.4 Role of zinc in biological systems. Metal poisoning – cadmium and mercury poisoning.

Text Books:

J.D. Lee, *Inorganic Chemistry*

R.D. Madhan, *Inorganic Chemistry*

Sathyaprakash, *Advanced Inorganic Chemistry*

Reference Books:

Shriver and Atkins *Inorganic Chemistry* 7th edition

Catherine, *Inorganic Chemistry* 2nd edition.

James E.Huheey, *Inorganic Chemistry*

Outcomes	It may give a clear knowledge about halogen family, noble gases, transition and inner transition elements and alloys. The students will have a better understanding of haemoglobin, oxygen transport and the role of metal ions in biological systems.

Semester -IV				
Course Code: 22BCH4P1	**Core Practical-IV**	**T/P**	**C**	**H**
	ORGANIC ANALYSIS PRACTICAL – IV	**P**	**4**	**4**

Max. Marks: 60 **Duration: 4 Hrs**

I. Organic Analysis

Substances to be analysed:

1. Aromatic acid (mono carboxylic acid)
2. Aromatic ester (mono functional group)
3. Aromatic aldehyde
4. Phenol
5. Carbohydrate (Glucose only)
6. Aliphatic amide (urea)
7. Aromatic amide
8. Aromatic amine (Aniline)

Distribution of External marks

1. Record		10 marks
2. Organic analysis		50 marks
a. Aromatic/Aliphatic	10 marks	
b. Saturated/Unsaturated	10 marks	
c. Elements present	10 marks	
d. Functional group present	15 marks	
e. Derivative	05 marks	
		60 marks

Note: University practical examination – 3 hours

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Semester –IV				
Course Code: 22BCH5C1	**Core Course-VII**	**T/P**	**C**	**H**
	PHYSICAL CHEMISTRY – III	**T**	**4**	**5**

Objectives	To understand thebasics of the first law of thermodynamics and the laws of thermochemistry. To study the second law of thermodynamics, the concept of entropy, concept of Gibbs Free energy and their applications. To understand the kinetics and the theories of reaction rate. To know the basic principles of spectroscopy.
Unit-I	**THERMODYNAMICS – PART – I** 1.1 Definition of thermodynamic terms: System and surroundings – isolated system, open system and closed system – homogeneous system and heterogeneous system – state of the system – intensive and extensive variables – state and path functions – Thermodynamic processes: reversible and irreversible – isothermal and adiabatic – exact and inexact differentials. 1.2 Laws of thermodynamics: Zeroth law of thermodynamics and its significance. First law of thermodynamics: Statement – mathematical derivation. 1.3 Definition: Internal energy (U), enthalpy (H), molar heat capacity at constant volume (C_v) and molar heat capacity at constant pressure (Cp) – Relationship between C_v and Cp – work done in an isothermal reversible expansion of an ideal gas – adiabatic reversible expansion of an ideal gas – derivation of PV^{γ} = a constant. Calculation of q, w, ΔU and ΔH for the reversible isothermal expansion of an ideal gas. 1.4 Joule -Thomson effect – derivation of Joule -Thomson coefficient in ideal and real gases – Joule -Thomson coefficient and inversion temperature. Thermochemistry - Hess's law of constant heat summation and its applications – Bond energy and its applications. Variation of enthalpy of change of reaction with temperature – Kirchoff's equation.
Unit-II	**THERMODYNAMICS – PART – II** 2.1 Second law of thermodynamics: Different statements of second law of thermodynamics – cyclic process – Carnot cycle and its efficiency (derivation) – Carnot's theorem. 2.2 Concept of entropy: Entropy as a state function – calculation of entropy changes in terms of P, V and T – entropy changes in reversible and irreversible processes – entropy of mixing of gases – physical significance of entropy. 2.3 Free energy functions: Helmholtz free energy (A) – Gibbs free energy (G) – variation of Helmholtz free energy with internal energy and entropy at constant temperature – variation of Gibbs free energy with enthalpy and entropy at constant temperature and pressure. 2.4 Gibbs - Helmholtz equation and its applications – thermodynamic equation of state – Maxwell's relation.
Unit- III	**THERMODYNAMICS – PART – III** 3.1 Partial molar quantities: Definition – chemical potential – Gibbs - Duhem equation – variation of chemical potential with temperature and pressure. 3.2 Classius - Clapeyron equation – derivation and applications – concept of fugacity and activity. 3.3 Third law of thermodynamics: Nernst heat theorem – third law – determination of

	absolute entropy. Debye's law. 3.4 Exemption to third law of thermodynamics. Temperature dependence of the equilibrium constant – van't Hoff equation.
Unit -IV	**CHEMICAL KINETICS** 4.1 Rate of reaction – rate constant – order and molecularity of reactions – first order and pseudo unimolecular reactions (definition and examples) – derivation of rate constant for the inversion of cane sugar. 4.2 Second order reactions – definition – examples – derivation of rate constant (same concentration and different concentration) and half-life period – application to saponification of ester. Third order reactions: definition and examples – application to the reaction between $FeCl_3$ and $SnCl_2$. 4.3 Methods of determination of order of reactions. Zero order reactions – definition and examples – derivation of rate constant. 4.4 Theory of reaction rates – collision theory of bimolecular reactions – unimolecular reactions -Lindemann's hypothesis – theory of absolute reaction rates.
Unit-V	**SPECTROSCOPY** 5.1. Fundamentals of spectroscopy: Definition, fundamentals of light such as wavelength, velocity, frequency, photons and definite energy of a photon. Electromagnetic spectrum. 5.2 Fundamentals of materials such as equipartition principle and different types of movements of particles in a material and quantization of electronic, rotational, vibrational and spin energies. 5.3 Beer – Lambert law. Principle of different types of spectroscopy. 5.4 Rotational or microwave spectroscopy: rigid rotator, derivation of equation for rotational constant for a diatomic molecule. Calculation of bond length and dipole moment and percentage of ionic character of a bond.

Text Books:

N.Kundu and SN.Jain, *Physical Chemistry*

B.R.Puri and L.R.Sharma, *Principles of Physical Chemistry*

B.R.Puri, L.R.Sharma and M.S.Pathania, *Principles of Physical Chemistry*

Reference Books:

Atkins P.W., *Advanced Physical Chemistry*

Banwell, *Modern spectroscopy*

G.M.Barrow, *Physical Chemistry*

George Davidson, *Introductory Group theory for Chemist*

S.Glasstone, *Textbook of Physical Chemistry*

K.J.Laidler, *Chemical Kinetics*

J. Micheal Hollas, *Modern spectroscopy*

V.Ramakrishnan and M.S.Gopinathan, *Group theory in Chemistry*

Outcomes	Students gain knowledge about the concept of the first law of thermodynamics and its applications and also explain the laws of thermochemistry. Students can acquire knowledge about the second law of thermodynamics, kinetics and its theories and can solve the problems related to kinetics. Students can gain knowledge on general basic principles of spectroscopy, rotational spectroscopy and its applications.

Semester –IV				
Course Code: 22BCH5C2	**Core Course-VIII**	**T/P**	**C**	**H**
	ORGANIC CHEMISTRY-III	**T**	**4**	**5**

Objectives	To study the basic concepts involved in spectroscopic techniques of UV, IR, NMR and Mass spectroscopy and their instrumentation techniques along with its applications. To understand stereochemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds. To study about the basic concepts, characteristic features, preparation and reaction of heterocyclic compounds. To learn the classification, structure and properties of alkaloids, terpenoids, amino acids and proteins. To understand sulpha drugs, antibiotics and their classifications and also know the information about antiseptics and disinfectants. To study the vitamins and its classifications; Hormones and their physiological functions.
Unit-I	**ORGANIC SPECTROSCOPY** 1.1. Applications of spectroscopy to organic molecules: Theory and applications of spectroscopic methods – electromagnetic spectrum – UV spectrum – identification of conjugation – calculation of absorption maxima. 1.2. IR spectra – functional group detection – finger print region – study of intermolecular and intramolecular hydrogen bonding. 1.3. NMR spectrum – TMS – choice of TMS as a better solvent – equivalent and non-equivalent protons – number of signals – chemical shift – peak area and proton counting – splitting of signals – spin-spin coupling – detailed study of NMR spectrum of ethyl alcohol. 1.4. Identification of simple organic compounds by using UV-Visible, IR and NMR spectral data.
Unit-II	2.1 Tautomerism: Definition – prototrophy and anionotropy. 2.2 Detailed study of the following types of tautomerism: Keto-enol tautomerism – Nitro – aci-nitro tautomerism - Lactam-lactim tautomerism. 2.3 Organic photochemistry – photochemical reactions of olefins, cis-trans isomerisation and dimerisation. 2.4 Molecular rearrangements: Detailed study of the following rearrangements: Pinacole-pinacolone, Hoffmann, Curtius, Benzil-benzilic acid, Claisen, Beckman, Fries and Benzidine rearrangements.
Unit- III	3.1. Heterocyclic compounds containing one heteroatom: preparation, properties and Resonance structures of furan, thiophene & pyrrole. 3.2. Preparation, properties and resonance structures of pyridine. 3.3. Preparation, properties of quinoline, isoquinoline and indole. 3.4. Heterocyclic compounds containing two heteroatoms: Preparation and properties of oxazole, pyrazole, thiazole and imidazole.
Unit -IV	4.1 Natural products: Alkaloids - definition – occurrence – extraction of alkaloids from plants – classification of alkaloids – General properties. 4.2 Structural elucidation and synthesis of the following alkaloids: Coniine and Piperine. 4.3 Terpenes: definition – isoprene rule – isolation – classification – General properties – structural elucidation and synthesis of citral and geraniol.

	4.5 Amino acids- Essential and non-essential amino acids preparation of alpha amino acid, isoelectric point of amino acids classification of proteins, primary, secondary & tertiary structure of proteins.
Unit-V	5.1. Chemotherapy and applications of a few drugs (elementary study) Sulpha drugs – sulphadiazine, prontosil – prontosil-S- Antimalarials – quinine, plasmaquine and chloroquine. Arsenical drugs – salvarsan-606 and neo-salvarsan. Antiviral Drugs – Remdesiver, Favipiravir 5.2 Antibiotics: definition – importance of antibiotics – structure and uses of penicillin, tetracycline (auromycin and terramycin), streptomycin and chloromycetin (structural elucidation not required). Antibacterial Drugs – Oxazolidinone, Nitrofurans. 5.3 Hormones: definition – classification – origin, structures and functions of testosterone, progesterone, and thyroxine. 5.4 Vitamins: Definition – classification of vitamins based on solubility – effect of deficiency of different vitamins – source, structure and uses of vitamin-C.

Text Books:

Soni P.L., *Organic Chemistry*

Bahl B.S. and Arun Bahl, *Advanced Organic Chemistry*

Morrison R.T. and R.W.Boyd, *Organic Chemistry*

Finar I.L., *Organic Chemistry* Volume I

Finar I.L., *Organic Chemistry* – Volume II

Reference Books:

Clayden J., *Organic Chemistry*

Company Ltd., New Delhi, 2003

Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry, 3rd Edition, S.Chand&

Jerry March, *Reaction Mechanism of Organic Compounds*

Mc Muray, *Organic Chemistry* – 7th edition

Paula Y. Organic Chemistry – 4th edition

Sharma Y. R., *Electro organic spectroscopy*

Wade L. G., *Organic Chemistry* – 6th edition

Outcomes	Can be able to know all the spectroscopic techniques in the electromagnetic spectrum. The study of instrumentation techniques is very much useful to identify the simple as well as complex organic molecules. Students can gain knowledge on stereochemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds. It brings an idea of the synthesis, reactions, applications and important features of heterocyclic compounds. Students can learn about the chemistry of alkaloids, terpenoids, amino acids and proteins. Can be able to know about sulpha drugs, antibiotics and their important features and gives the clinical uses of Antiseptics and disinfectants. Can brings the knowledge toward vitamins and their classifications and also give information about hormones.

Semester –IV				
Course Code: 22BCH5C3	**Core Course-IX**	**T/P**	**C**	**H**
	INORGANIC CHEMISTRY - III	**T**	**4**	**6**

Objectives	The objective of this paper is to expose the students about the basic concepts of coordination complexes, to help the students to understand the facts of reactions and reaction mechanism in complexes. to enable the students to make sense of bonding in organometallic compounds and to understand the nature of nanomaterials, bulk materials and solid electrolytes.
Unit-I	**COORDINATION CHEMISTRY – I** 1.1. Definition and terminology**:** classification of inorganic compounds as double salts and complexes. Differences between normal compounds and co-ordination compounds. Ligands, classification of ligands with suitable examples for each class. Chelates - Ambidentate ligands. Co-ordination number. 1.2 IUPAC nomenclature of complexes. EAN rule and calculation of effective atomic number of a complex. 1.2. Isomerism in complexes**:** Structural isomerisms such as ionization isomerism, Hydrate isomerism, co-ordination isomerism and linkage isomerism. Stereoisomerism: geometrical isomerism and optical isomerism with suitable examples. 1.3. Theories of co-ordination compounds**:** Werner's theory, valence bond theory and crystal field theory Strong and weak ligands and spectrochemical series. Calculating crystal field stabilization energies.
Unit-II	**CO-ORDINATION CHEMSITRY –II** 2.1 Magnetic properties of transition metal complexes (spin only magnetic moment) – Preparation of mononuclear carbonyls. 2.2 Chelates: Chelation- application of chelate formation. 2.3 Applications of co-ordination compounds, separation of Cu and Cd ions, Ni and Co ions, silver and mercury ions. 2.4 Structure of EDTA complexes, Complexometric Titrations- Principle and applications-quantitative estimation of Nickel using DMG,
Unit- III	**COORDINATION CHEMISTRY– III – Reactions of complexes** 3.1. Stability of complexes: Comparison of stability of simple complexes in terms of stability constants. Inert and labile complexes. 3.2 Factors affecting the stability of complexes and HSAB theory. 3.3 Ligand Substitution Reactions: various mechanisms of ligand exchange reactions in complexes with suitable examples. Factors influencing the ligand substitution reactions such as trans effect, steric effect. 3.4 Redox reactions: mechanisms of redox reactions such as inner – sphere mechanism and outer– sphere mechanism with suitable examples. Isomerisation reactions, photochemical Reactions.
Unit -IV	**ORGANOMETALLIC COMPOUNDS OF d–BLOCK ELEMENTS & METALLOENZYMES**

	4.1. Bonding in d – block organometallic compounds. Electronic configuration and geometry of d – block organometallic compounds. 4.2. Metal carbonyl complexes: Structures of mononuclear - Ni, Fe, Cr and binuclear carbonyl- $Fe_2(CO)_9$. 4.3. Metallocenes: Synthesis and reactivity of cyclopentadienyl compounds. Metal clusters. 4.4 Metallo enzymes: Iron, magnesium and zinc enzymes. Hemocyanin structure and enzymatic activity.
Unit-V	**MATERIAL CHEMISTRY** 5.1. Nanomaterials: definition of nanoparticles. Properties of nanomaterials. Semiconducting nanoparticles and metallic nanoparticles. Optical properties of nanoparticles. 5.2. Fabrication of nanoparticles: solution-based synthesis of nanoparticles, vapour phase synthesis of nanoparticles such as physical vapour deposition and chemical vapour deposition. 5.3. Bulk materials: synthesis of bulk materials by direct reactions in solid phase, by condensation reaction in solution and by chemical deposition. 5.4. Solid electrolytes: Advantages of solid-state electrolytes. Solid cationic electrolytes, solid anionic electrolytes and mixed ionic – electronic conductors. Applications of solid electrolytes.

Text Books:

Lee J.D., *Inorganic Chemistry*

Madhan R.D., *Inorganic chemistry*

Sathyaprakash, *Advanced inorganic chemistry*

Reference Books:

Catherine, *Inorganic Chemistry* – 2nd edition.

James E Huheey, *Inorganic Chemistry*

Shriver and Atkins, *Inorganic Chemistry* – 7th edition

Outcomes	The students become familiar with the nomenclature and theories of coordination compounds. Enable the students to apply the theory to the complexes and applications of coordination complexes in inorganic analysis. The students will be able to identify the bonding in organometallic compounds and learn the chemistry of nanomaterials, bulk materials and solid electrolytes.

Semester -V				
Course Code: 22BCH5P1	**Core Practical-V**	**T/P**	**C**	**H**
	GRAVIMETRIC ESTIMATION AND ORGANIC PREPARATION PRACTICAL – V	**P**	**4**	**4**

Max. Marks: 60 **Duration: 6 Hrs.**

I. Gravimetric Estimation

1. Estimation of barium as barium chromate / sulphate
2. Estimation of lead as lead chromate / sulphate
3. Estimation of calcium as calcium oxalate
4. Estimation of nickel as nickel dimethyl glyoxime complex

II. Preparation of organic compounds

Preparations involving the following methods

a) Oxidation b) Reduction c) Hydrolysis d) Nitration e) Ozasone formation
f) Bromination g) Diazotisation h) Benzoylation.

III. Determination of melting and boiling points of simple organic compounds: (not for examination purpose)

IV. Separation of organic mixture: (not for examination purpose)

Distribution of External marks:

1. Record		10 marks
2. Gravimetric estimation		25 marks
a. Procedure	10 marks	
b. Experiment	15 marks	
4. Organic preparation		25 marks
a. Procedure	10marks	
b. Crude sample	10 marks	
c. Recrystallized sample	5 marks	
		60 marks

Gravimetric Experiments:

Less than 1% error.....15 marks
1 – 2 % error…...12 marks
2 – 3 % error…...9 marks
3 – 4 % error…... 6 marks
>4% error.....3 marks

Note: University practical examination – 6 hours

Semester -V				
Course Code: 22BCH5P2	**Core Practical-VI**	**T/P**	**C**	**H**
	PHYSICAL CHEMISTRY PRACTICAL -VI	**P**	**4**	**4**

Max. Marks: 60 **Duration: 6 Hrs**

1. Phase diagram:
a. Simple eutectic
b. Compound formation

2. Determination of molecular weight:
a. Rast-macro method (using naphthalene as solvent)
b. Transition temperature (using sodium thiosulphate pentahydrate as salt hydrate)

3. Critical solution temperature
a. CST of phenol – water system
b. Estimation of sodium chloride by studying the CST of phenol-water system

4. Kinetics
Determination of relative strength of acids by acid catalysed hydrolysis of ester

5. Partition co-efficient
a. Study of equilibrium $KI + I_2 \leftrightarrow KI_3$ by studying the partition co-efficient of iodine between water and carbon tetra chloride.
b. Determination of association factor of benzoic acid in benzene

6. Electrochemistry
a. Conductometric titration between an acid and a base (HCl Vs NaOH)
b. Potentiometric method – Potentiometric titration between 1. an acid and a base (HCl Vs NaOH) and 2. KMnO4 Vs FAS

7. Thermochemistry
a. Determination of heat of solution – ammonium oxalate

Distribution of External marks:

Record	10 marks
Experiment	50 marks
	60 marks

Note: University practical examination – 6 hours

Semester -IV				
Course Code: 22BCH5P3	**Core Course-VII**	**T/P**	**C**	**H**
	APPLIED CHEMISTRY PRACTICAL -VII	**P**	**4**	**4**

1. Determination of total, temporary and permanent hardness of a water sample by EDTA method.
2. Determination of percentage of available chlorine in the supplied sample of bleaching powder.
3. Determination of Biological oxygen demand (BOD) of a given sample of water.
4. Determination of coefficient of viscosity of the given liquid by Ostwald's Viscometer method.
5. Determination of Molecular weight of a polymer by viscometric method.
6. Determination of Acid value of an oil.
7. Determination of Saponification value of an oil.
8. Determination of the amount of Cu in the copper ore.
9. Determination of half cell potential of Zn, Cu and Ni electrodes at various concentration of electrolyte and calculation of EMF of Daniel cell.
10. To study the Adsorption of acetic acid on active charcoal and to verify the Freundlich and Langmuir isotherm.
11. Identification of adulterations in food materials

Distribution of marks

Record	10 marks
Procedure	10 marks
Experiment	40 marks
	60 Marks

Note: University practical examination – 6 hours

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Semester –VI				
Course Code: 22BCH6E1	**DSE- IA**	**T/P**	**C**	**H**
	ANALYTICAL CHEMISTRY	**T**	**6**	**6**
Objectives	To provide the basic idea about the instrumental analysis and analytical techniques, along with handling the laboratory techniques and safety procedures. To know about important terminologies involved in error analysis, and find out sources of error, methods of reporting analytical data. To study about the principles and classification of separation methods, the methods of separation techniques and its applications. To provide the principles of gravimetric analysis, methods and characteristic features of precipitation techniques, analysis of thermal analytical methods and the electroanalytical techniques.			
Unit-I	**LABORATORY HYGIENE AND SAFETY & ANALYTICAL DATA ANALYSIS** 1.1 Storage and handling of chemicals – carcinogenic, corrosive, explosive, toxic and poisonous chemicals – general precautions for avoiding accidents. 1.2 First aid techniques for acid in eye, alkali in eye, acid burns, alkali burns, bromine burns, poisoning, inhalation of gases, cut by glasses and heat burns – methods to avoid poisoning – treatment for specific poisons. 1.3 Definition and classification of errors – methods of minimizing errors – definition of accuracy and precision - Students t-test and F-test – confidence limit – rejection of experimental data. 1.4 Significant figures – curve fitting – method of least squares – problems involving straight line graphs.			
Unit-II	2.1 Separation and Purification Techniques: Solvent extraction – Soxhlet extraction – Principle, procedure and applications of fractional distillation, steam distillation 2.2 Desiccants – classification – choice of desiccant – vacuum drying. 2.3 Chromatography - Definition – Principles, working and applications– Paper chromatography - Column chromatography. 2.4 Principle and working of Thin Layer Chromatography and Gas Liquid Chromatography, Superiority of TLC over other Chromatography.			
Unit- III	3.1 Colorimetric Analysis – Principle – Beer-Lambert's Law – standard series method (Nessler's method) – balancing method. 3.2 Photoelectric colorimetric method – estimation of iron, copper and nickel. 3.3 Thermo analytical methods: Thermogravimetric analysis – Principle – instrumentation – characteristics of Thermogravimetric curve – Applications of TGA for calcium oxalate monohydrate. 3.4 Differential Thermal Analysis – Principle – instrumentation – characteristics of differential thermal curve – Applications of DTA for calcium oxalate monohydrate.			
Unit -IV	4.1 Gravimetric analysis: Super saturation - Basic Principle of Gravimetric Analysis, Characteristics of precipitating agents – choice of precipitant. 4.2 Conditions of precipitation, Co-precipitation, Post precipitation-Differences			

	between them. 4.3 Precipitation from homogeneous solution – digestion and washing of precipitates – ignition of the precipitate. 4.4 Specific and selective precipitant, sequestering agents and its uses.
Unit-V	5.1 Faraday's laws, ohm's law, current density, Definitions of current efficiency, polarised and depolarised electrodes, decomposition potential, overpotential. 5.2 Electrolytic separation of copper from nickel and copper from lead. 5.3 Polarographic method- Determination of lead in tap water. 5.4 Potentiometric Titration and Conductometric Titrations.
Douglas A.Skoog and D.M.West, *Principles of Instrumental Analysis*, W.B.Saunders, New York, 1982. Gopalan R., P.S.Subramanian and K.Rengarajan, *Elements of Analytical Chemistry*, Sultan Chand & Sons, New Delhi, 1995. Gurdeep Chatwal, Sham Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, Mumbai, 1998. *Vogel's quantitative chemical analysis* – 5th edition.	
Outcomes	It brings about the knowledge of first aid and lab safety techniques, terms and methods of finding error analysis, and can able to determine the sources of errors and its effects towards analytical results. Clearly brings about the principles and methods of separation techniques and their applications. Brings about the methods of gravimetric analysis; can able to know the concepts and methods of precipitation techniques, Thermal Gravimetric Analysis and Electroanalytical techniques.

Semester –VI				
Course Code: 22BCH6E2	**DSE-I B**	**T/P**	**C**	**H**
	AGRICULTURAL CHEMISTRY	**T**	**6**	**6**
Objectives	To provide the basic idea about the classification and properties of soil forming rocks. To know about the importance of fertilizers in plant growth and the use of biofertilizers. To study about the principles used in the manufacture of organic manure. To provide the principles of pest management and control and gain knowledge about fungicides and herbicides.			
Unit-I	1.1. Origin of earth – Geological formations of India – Soil forming rocks and minerals – Classification – weathering of rocks and minerals – processes of weathering and factors affecting them. Soil formation – Factors of soil formation – soil forming processes – profile development – definition of soil – soil composition. 1.2. Soil Physical properties – soil separates and particle size distribution – soil texture and structure – Bulk density, particle density, pore space, soil air, soil temperature, soil water, soil consistence and significance of physical properties to plant growth. 1.2. Soil chemical properties – soil colloids – Inorganic colloids – clay minerals – amorphous – exchange reactions – organic colloids – soil organic matter – decomposition. 1.4 Humus formation – significance of soil fertility, soil reaction – Biological properties of soil – nutrient availability.			
Unit-II	2.1. Fertilizer – definition – fertilizer selection based on soil testing – fertility index – Nitrogenous fertilizers – effect of nitrogen on plant growth and development. 2.2. Phosphate fertilizers – Effect of phosphorus on plant growth and development – super phosphate and Bone meals. Potassium fertilizers – function of potassium on plant growth. 2.3. Secondary and micronutrient fertilizers – complex and mixed fertilizers – sources, manufacture, properties and reactions in soils. 2.4. Biofertilizers – nitrogen fixing biofertilizer – rhizobium, azospirillum – phosphate mobilizing biofertilizer – bacteria – bacillus, pseudomonas, fungi – aspergillus, pencillium.			
Unit- III	3.1. Nutrient potential of different organic manures – Agricultural, industrial and urban Waste preparation of enriched farm yard manures – Zinc enriched organics. 3.2. Green manures – green leaf manure – bulky organic and concentrated organic manures – compost – enriched farmyard manures. 3.3. Composting of coir pith; sugarcane trash, leaf litters and farm wastes – oil cakes, bone meal, fish meal, guano poultry manures – integrated nutrient management. 3.4. Preparation of different fertilizer mixtures.			
Unit -IV	4.1. Pest management and control Pesticides – formulations – emulsifiable concentrate, Water miscible liquids, wettable powder dusts, granules. 4.2 Classification of pesticides – mode of action – characteristics – uses – fate of pesticides in soil and plants – impact of pesticides on environment – safety measures in analysis and handling of pesticides. 4.3. Insecticides – plant products – Nicotine, pyrethrum, rotenone, petroleum oils. Inorganic pesticides – Arsenical fluorides, borates. Organic pesticides – organo chlorine compounds D.D.T, B.H.C, methoxychlor, chloredane, endosulfon. 4.4 Organophosphorus compounds – Dischlorevas, methyl Carbamic acid derivatives – carbaryl – structure and mode of action.			

Unit-V	5.1. Fungicides – Inorganic – Sulphur compounds – Copper compounds – Mercuric compounds Organic – dithiocarbamates – Dithane M and Boredeaux mixture. 5.2. Herbicides: Inorganic herbicides – Arsenical compounds Boron compounds – cyanamide – Cyanides and thiocyanates, chlorates and sulphamates. 5.3 Organic herbicides & Nitro-compounds – chlorinated compounds – 2-4D-Phridine compounds. 5.4 Triazine compounds – Propionic acid derivatives – Urea herbicides, Alachlor.

REFERENCE BOOKS:

Biswas, T.D. and Mukherjee S.K. 1987 *Text book of soil science*.

Brady N.C., *The Nature of properties of soils* Eurasia publishing house, (P) Ltd., 9th Ed. 1984.

Buchel, K.H. 1983, *Chemistry of pesticides* – John wiley& sons, Newyork.

Colling, G.H. 1955, *Commercial Fertilizers* – McGraw Hill Publishing Co., New York.

Daji A.J. (1970) *A Text book of soil science* – Asia publishing house, Madras.

Donahue. R.L. Miller.R.W. and Shickluna, J.C. 1987. *Soils – An introduction to soils and plant Growth* – Prentice Hall of India (P) Ltd., New Delhi.

Hesse, P.R. 1971. *A text book of soil chemical analysis John Murray*, New York.

Jackon, M.L. 1958, *Soil Chemical Analysis*, Prentice Hall of India, New Delhi.

Melnikov, N.N.1971. *Chemistry of pesticides* Vol.36 of Residue Review – springer verlac, New York.

SreeRamula, U.S.1979, *Chemistry of Insecticides and Fungicides* – Oxford and IBH publishing Co., New Delhi.

Tisdale.S.L. Nelson.W.L. and Beaton.J.D. 1990, *Soil fertility and fertilizers*. Macmillan Publishing company, New York.

Outcomes	It brings about the basic idea of the significance of soil fertility and nutrient availability for the plant growth. Clearly brings about the fertilizer selection based on soil testing. Brings about the principles used in the manufacture of organic manure and the importance of green manures. Students can able to know the impact of pesticides, insecticides and herbicides on environment.

Semester –VI				
Course Code: 22BCH6E3	**DSE-II A**	**T/P**	**C**	**H**
	INDUSTRIAL CHEMISTRY	**T**	**6**	**6**
Objectives	The objective is to expose the students about the basic concepts of paint formulation and varnishes, to help the students to understand the manufacture of ceramics and glass and its types. To enable the students to make sense of soap and detergent making, manufacture of refractories and cement. To understand the nature of fertilizers in plant growth, sugar and match industries and use of enamels, explosives and inorganic polymers.			
Unit-I	1.1. Paints: Paint – definition – classification of paints based on their applications – constituents – Requisites of a good paint. 1.2. Pigments: Definition – composition, characteristics and uses of white lead, Zinc oxide, Lithopone and TiO_2 – Blue pigments – Ultramarine blue- characteristics – uses. 1.3. Red pigments – red lead –characteristics and uses. Green pigments – chrome green, Guigwet's green and chromium oxide – characteristics and their uses. 1.4. Varnishes: Definition – constituents of varnish – characteristics of a good varnish – uses – Japans varnish. Enamel – definition – Types – Ingredients and uses.			
Unit-II	2.1. Ceramics: Definition, classification of ceramics, general properties of ceramics –permeable (porous) and impermeable (non-porous wares) 2.2. High technology ceramics and their applications, Basic raw material – Manufacture and applications of colour to pottery. 2.3 Glass: Definition, Classification (silicate & non-silicate glasses) - Manufacture and processing of glass. 2.4 Composition and properties of the following types of glasses: Sodalime glass, Lead glass, Armoured glass, safety glass, borosilicate glass, fluorosilicate glass, coloured glass, photosensitive glass			
Unit- III	3.1 Soap: Definition – General consideration in soap making – manufacture of soap – toilet and transparent soaps. 3.2 Detergents: Definition – classification of face active agents – anionic detergents – cationic detergents – shampoo – raw materials. 3.3 Refractories: Introduction, Classification – Properties – Manufacture of Fire Clay-bricks and uses. 3.4 Cement: Raw materials – Portland cement – composition – types of Portland cement – Manufacture – Uses of Cement – chemistry of setting of cement mortar – Cement Raw Materials in India – Growth of Cement Industry in India.			
Unit -IV	4.1. Fertilizers: Definition – manufactures of Ammonium sulphate, CAN, urea, calcium super phosphate and mixed fertilizers (NPK) – Fertilizer industries in India. 4.2. Sugar Industry: Manufacture of sugar from molasses and beetroot – sugar industries in India.			

	4.3 Fermentation: Manufacture of spirits and wines. Distillation: Manufacture of vinegar and ethyl alcohol. 4.4 Match industries: Manufacture – chemistry of lighting and pyrotechny.
Unit-V	5.1 Adhesives: definition – classification of adhesives – animal glue – preparation – uses – protein adhesives – starch adhesives – preparation – uses. 5.2 Enamels: Introduction – Raw Materials – Manufacture and applications. 5.3 Explosives: Definition – Classification – Characteristics of explosives – Nitro cellulose, T.N.T. Picric acid, Gun Powder, Cordite and Dynamite, RDX. 5.4 Inorganic polymers and its uses: Silicones, Borazines, Phosphazenes and Zeolite

REFERENCE BOOKS:

Arun Bahl and B.S. Bahl – "*Text Book of Organic Chemistry*", 11th and 18th Ed., (2006), S.Chand, New Delhi.

Chakarabarthy B.N. – "*Industrial Chemistry*", 1st Ed., Oxford and IBH Publishing, New Delhi.

Krishnamoorthy, P. Vallinayagan& K. Jaya Subramanian – "*Applied Chemistry*", 2nd Ed., (1999, 2001), Tata MaGraw-Hill Publishing Co. Ltd., New Delhi

Sharma B.K. – "*Industrial Chemistry*", 1st Ed., (1983), Goel Publication, Meerut.

Soni P.L. – "*Text Book of Organic Chemistry*", 26th Ed., (1994), S. Chand & Co, New Delhi.

Outcomes	The students become familiar with the paint formulation and varnishes. Enable the students to understand soap making, use of refractories and cement in daily life. The students will able to identify the proper use of fertilizers, explosives and sugar. Can also learn the chemistry of adhesives, enamels and inorganic polymers.

Semester –VI				
Course Code: 22BCH6E4	**DSE-II B**	**T/P**	**C**	**H**
	MEDICINAL CHEMISTRY	**T**	**6**	**6**
Objectives	The student is expected to learn about important drugs and the mode of action, diagnostic medical instrumentation and clinical tests for health management and drug development			
Unit-I	**PHYSICAL CHEMICAL FACTORS AND BIOLOGICAL ACTIVITY** 1.1. Structure and pharmacological actions: Factors governing ability of drugs to reach active site. Absorption, distribution, metabolism and excretion. Ferguson's theory. Steric factor – Taft's steric factor- Hammet substitution constant resonance effect and inductive effect. Verloop steric parameter. Hansch equation. Topless scheme. 1.2. Isosterism and bio-isosterism. Classical and non-classical bioisosteres. 1.3. Basic concepts: Definition: drug – classification of drugs: biological and chemical – Nomenclature of drugs. Mechanism of drugs – factors affecting metabolic activity – chemical pathway of drug metabolism – bio transformation – oxidative, reductive and hydrolytic bio transformations – conjugate reactions – gluco uranides, amino acids, ethereal sulphate, methylated, acetylated and glucothione conjugations. 1.4 Absorption of drugs – routes of administration – factors affecting absorption – digestion of proteins – gastric, intestinal and exopeptidaces – absorption of proteins – digestion and absorption of fats.			
Unit-II	**DIAGNOSTIC MEDICAL INSTRUMENTS** 2.1 Design of medical instruments – general components – transducers – types – Biopotential recorders – Electrocardiograph (ECG) – principles, block diagram, measurement and analysis of the ECG. 2.2 Electroencephalography (EEG) – principles, block diagram, measurement and analysis of the EEG. 2.3 X-ray – principles, block diagram, measurement and analysis of X-ray. 2.4 Ultrasonic Scanning – principles block diagram, measurement and analysis of the scans. CT Scan – principles, block diagram, measurement and analysis of the scan. MRI Scan – principles, block diagram, measurement and analysis of the scan.			
Unit- III	**CLINICAL CHEMISTRY** 3.1 Clinical chemistry – Composition of blood – blood grouping – determination of blood groups and matching – blood pressure – hypertension – determination. Determination of glucose in serum – Folin method, Wu's method, Nelson method, Somogyi method and O-toluidine method – determination of serum cholesterol – Sackett's method – tests for cholesterol. 3.2 Estimation of glucose in urine – Benedict's test – tests for salt in serum – test for chloridesin serum – tests for salt in urine – tests for cholesterol in urine – Detection of diabetes and anaemia. 3.3 Estimation of haemoglobin (Hb concentration) – estimation of red blood cells (count). Analysis of blood – determination of blood urea – urease method.			

	Estimation of bile pigment in serum – estimation of total protein in serum – estimation of total proteins and albumin based on Biuret and BCG methods. 3.4 First aid for accidents – important rules – first aids for cuts, bruisers, bleeding, fractures, burns, fainting and poisonous bites – composition of first aid box. Determination of Hallucinogens and poisons – antidotes – common poisons and their antidotes.
Unit -IV	**DISEASES AND TREATMENT** 4.1 Common diseases – Causes and treatment of some common diseases – insect borne diseases – malaria and filariasis. Air borne diseases – diphtheria, whooping cough, influenza, cold, fever and tuberculosis. Water borne – cholera, typhoid and dysentery. 4.2 Digestive disorders – Jaundice – respiratory disorder – asthma – nervous disorder – epilepsy – other diseases – piles and leprosy. 4.3 Important Indian medicinal plants and their uses. Structure, functions, dosage, uses and effects of the following drugs. Cardiovascular drugs – antiarrythmic drugs – quinidine. Anti-hypertensive drugs – clondine and reserpine. Anti-anginal drugs – glyceryl trinitrate and isosorbide dinitrate. Sulpha drugs – sulphanilide and sulpha diazine. 4.4 Health care medicines – vitamins – structure, functions and deficiency disease of vitamins A, D, K, B1, B2, B6, B12 and C.
Unit-V	**DISEASES AND TREATMENT II** 5.1 Cancer – causes, spread and treatment – structure, dosage and effects of chlorambusil, methotreate, plant products and hormones. Diabetes – control – structure, dosage and uses of barbiturates, hydantoin and succinimides. 5.2 Structure, uses and effects of the following drugs: Analgesics – narcotic analgesics – action, uses and structural activity of morphine. Non-narcotic analgesics – aspirin and paracetamol. 5.3 Anaesthetic – general anaesthetic – uses and disadvantages of vinyl ether and halothane. Intravenous anaesthetics – thiopental sodium – local anaesthetics – cocaine and chincocaine. Anti-psychotic drugs – piperazine and benzamides – anti-anxiety drugs – benzodiazepine. Psychotogenic drugs – marijuana. 5.4 Anti-depressant drugs – barbiturates – mechanism of action and uses. Antibiotics – classification – structure, properties, uses and assay of chloramphenicol, penicillin, streptomycin, erythromycin and tetracycline.

REFERENCE BOOKS:

Ashutosh Kar, *Medicinal Chemistry*.

C.Raja Rao and S.K.Guha, 2005, *Principles of Medical Electronics and Biomedical Instrumentation* Orient Longmann.

Chatwal G.R., 2002 *Medicinal Chemistry*, Himalaya Publishing House, New Delhi.

David Plummer – 2005 *Practical Biochemistry* , Tata McGraw-Hills Publishing Company.

Drugs – G.L.D. Krupadanam, D.V.Prasad, K.V.Rao, K.L.N. Reddy and C.Sudhakar.

<table>
<tr><td colspan="2">*Handbook of biomedical instrumentation* 2ed – R.S.Khandpur, Tata McGraw – Hill Publishing Company, New Delhi.

Jeyashree Gosh – 2003 *Text Book of Pharmaceutical Chemistry*, S.Chand and company, New Delhi.

Leslie Cromewell, F.J.Weilbell, E.A.Pfeiffer, *Biomedical instrumentation and measurements* Prentice Hall of India, New Delhi.</td></tr>
<tr><td>Outcomes</td><td>Can able to study about the important terminologies of Pharma Chemistry, and brings about the knowledge towards Indian Medicinal Plants. Brings about a clear idea towards various drugs, screening tests done and its significance, and provide the importance of the drugs for cancer, Diabetes, AIDS and Blood related diseases.</td></tr>
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Semester –VI				
Course Code: 22BCH6E5	**DSE- III A**	**T/P**	**C**	**H**
	POLYMER CHEMISTRY	**T**	**6**	**6**
Objectives	To provide the basic idea about the introduction to polymers and polymerisation techniques and various industrial polymer products, along with use of plastics and textile fibres.			
Unit-I	1.1 Introduction**:** Monomer – Polymer – Functionality of monomers and its significance – degree of polymerization – Natural and Synthetic polymers – classification of polymers – addition and condensation polymers. 1.2 General methods of preparation of polymers – stepwise polymerization – chain growth polymerization and polymerization through ring opening. 1.3 Polymerisation techniques: Bulk, solution, suspension and emulsion polymerization. Mechanism of Free-radical, cationic and anionic polymerization reactions			
Unit-II	2.1 Polymer structure**:** Definition & Structure of Linear, branched and cross-linked polymers with suitable examples. 2.2 Properties of polymers**:** The glassy state and the glass transition temperature – thermal analysis of polymers. 2.3 Poly degradation: Thermal, mechanical, unsaturated oxidative and hydrolytic degradation. 2.4 Molecular weight of polymers: Number average molecular weight and weight average molecular weight.			
Unit- III	3.1 Copolymerisation**:** Definitions: homo polymer and copolymer – Block and Graft copolymers. 3.2 Kinetics of polymerization: Free-radical polymerization – cationic polymerization. 3.3 Degree of polymerisation – Inhibition. Inhibitors and retarders. 3.4 Synthesis of reactants and intermediates: Adipic acid, sebacic acid, hexamethylene diamine, caprolactum, vinyl acetate, acrylonitrile and methyl methacrylate.			
Unit -IV	4.1 Polyolefins: Preparation and uses of polyethylene, PTFE, PVC, PVA, polypropylene and polystyrene. 4.2 Rubber: Natural and synthetic rubbers – isoprene rule – preparation and uses of butyl, buna, buna-s, buna-N, neoprene, Thiocol, Polyurethane and silicone rubber. 4.3 Compounding of rubber – Preparation of reclaim rubber, Definition of spongy rubber and foam rubber. 4.4 Biodegradable polymers – advantages of biodegradable polymers – polyglycolic acid, polylactic acid and polybutyrate.			
Unit-V	5.1. Plastics and Resins: Definition: Thermoplastics and thermosetting resins – constituents of plastics – fillers, dye pigments, plasticizers, lubricants and			

	catalysts. 5.2 Important thermoplastic resins: cellulose derivatives – cellulose acetate and cellulose nitrate. 5.3 Important thermosetting resins: phenolic resins, amine resins, epoxy resins and silicone resins. 5.4 Textile Fibres: Definition: Fibres: fibre polyamides: preparation and uses of Nylon 6 and Nylon 66 – polyesters: preparation and uses of terylene and Viscose rayon.

REFERENCE BOOKS:

Billmeyer F.W., *A Text book of Polymer Chemistry*, John Wiley & sons, Singapore, 1994.

Gowarikar V.R., N.V.Viswanathan, *Polymer science*, Wiley Eastern Limited, New Delhi 1986.

Ravve A., *Organic chemistry of macromolecules*, Marcel Dekker, New York 1967.

Seymour R.B., *Introduction to Polymer Chemistry*, Mc Graw Hill, New York, 1971.

Outcomes	It brings about basic knowledge of polymer science and methods of preparing polymers of industrial importance. Clearly brings about the preparative methods of plastics and their applications. Can be able to know about the textile fibres.

Semester –VI				
Course Code: 22BCH6E6	**DSE-III B**	**T/P**	**C**	**H**
	APPLICATION OF COMPUTERS IN CHEMISTRY	**T**	**6**	**6**

Objectives	To impart the skills on use of various open-source chemistry tools that are essential for any student or researcher with chemistry as a major subject.
Unit-I	Origin - Introduction to Origin, basic features like Scientific graphing, drawing various 2D &3D plots, Data analysis, statistics, signal processing, curve fitting, peak analysis, conversion of graph to various file format like JPEG, GIF, EPS.
Unit-II	ACD ChemSketch software – Introduction, Drawing simple various chemical structures (acyclic, cyclic, polycyclic, heterocyclic), name generation from structures, conversion of name of molecule into its structure - calculation of physical properties such as density, molecular weight, molecular formula, refractive index from structural formula, bond angles, bond lengths, dihedral angles - ^{1}H, ^{13}C NMR prediction from molecular structure - Drawing structure of bigger molecules - carbohydrates.
Unit- III	Cambridge ChemDraw Ultra software – Introduction, Drawing various chemical structures (acyclic, cyclic, polycyclic, heterocyclic), nomenclature generation, conversion of name into molecular structure - calculation of physical properties such as density, molecular weight, molecular formula, refractive index from structural formula - ^{1}H, ^{13}C NMR prediction from molecular structure, Drawing structure of bigger molecules - carbohydrates. Comparison of ACD ChemSketch and Cambridge ChemDraw Ultra software.
Unit -IV	Introduction to online chemical database search, Searching and downloading research papers using keywords in Scopus, Science direct, and google scholar, reaction search, product search, reactant search, structure search, markush search using Sci-finder. Introduction to End Note and its applications.
Unit-V	Chimera software - Introduction to Chimera software, Protein-ligand Docking, Protein data bank structure search, preparation of ligands and proteins for docking, Sites searching for ligand binding analysis, Docking of simple molecules over active site of protein molecules and analysis of docking results.

REFERENCES

http://www.phys.nthu.edu.tw/~cc/download/Origin 8 User Guide.pdf

ChemDraw 16.0 User guide, Copyright 1998-2016 PerkinElmer Informatics Inc.

ACD/ChemSketch , Version 11.0 for Microsoft Windows, Copyright © 1997–2007

Advanced Chemistry Development, Inc.

http://www.cgl.ucsf.edu/chimera/pdf/UsersGuide1.8.pdf

Outcomes	At the end of course, the participants will be able to use these software for drawing chemical structures, generation of their names, retrieve information about physical properties calculations, three-dimensional molecular structure calculations,

	spectroscopic signatures, chemical reaction pathways prediction, molecular functional groups, docking sites predictions, and other parameters efficiently.

Semester –VI				
Course Code: 22BCH6E7	**DSE-IV A**	**T/P**	**C**	**H**
	PHARMACEUTICAL CHEMISTRY	**T**	**6**	**6**
Objectives	The student is expected to learn about important drugs and the mode of action and find out the symptoms and drugs for chronic diseases. Health management and drug development			
Unit-I	**Basic Pharmaceutical Chemistry** Definition of the following terms: drug, pharmachophore, pharmacology, Pharmacopeia, bacteria, virus and vaccine. Causes, symptoms and drug for anemia, jaundice, cholera, malaria and filarial. Indian Medicinal plants and uses – Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai.			
Unit-II	**Antibacterials** Sulpha drugs-examples and actions-prontosil, sulphathiazole, sulphafurazole. Antibiotics-definition and action of penicillin, streptomycin, chloramphenicol, erythromycin-tetracycline –SAR of chloramphenicol only. Antiseptics and disinfectants – definition and distinction –examples and actions of phenolic compounds, chloro compounds and cationic surfactant as antibacterials.			
Unit- III	**Analgesics and CNS stimulants** Analgesics: Definition and Actions–narcotic and non-narcotic–morphine and its derivatives, pethidine and methodone – disadvantages and uses. Antipyretic analgesics-salicylic derivative, paracetamol, ibuprofen. Drugs affecting CNS– Definition, distinction and examples for tranquilisers, sedatives, hypnotics, psychedelic drugs–LSD, Hashish–their effects.			
Unit -IV	**Anaesthetics and Drugs for Chronic diseases** Anaesthetics - definition – local and general – volatile nitrous oxide, ether, Chloroform, cyclopropane–uses and disadvantages–non–volatile intravenous– thiopental sodium, methohexitone, propanidid. Causes, medicines and their mode of action for the treatment of cancer–antineoplastics–diabetes– hypoglycemic agents AIDS –AZT, DDC. Blood: Grouping, composition, Rh factor, blood pressure, hypertension and hypotension.			
Unit-V	**Vitamins, Hormones and Enzymes** Vitamins – fat soluble vitamins – (i) vitamin A; (ii) vitamin D; (iii) vitamin B complex; (iv)vitamin C; (V)vitamin E; (vi)vitamin K; (vii)vitamin P. Hormones–Introduction, properties and function of hormones, chemical nature of hormones. Physiological function of some hormones: Adrenaline, thyroxin, oxytocin, insulin, the sex hormones. Enzymes–Chemical nature of enzymes, classification of enzymes, properties of enzymes, mechanism of enzyme action. Action of Co-enzymes.			
Reference Books: Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry, 3rd Edition, S. Chand & Company Ltd., New Delhi, 2003.				

Outcomes	Can be able to study about the important terminologies of pharmachemistry, and brings about the knowledge towards Indian Medicinal Plants, choice of drugs and the function of hormones and enzymes.

Semester –VI				
Course Code: 22BCH6E8	**DSE-IV B**	**T/P**	**C**	**H**
	MATERIAL CHEMISTRY & NANO-SCIENCE	**T**	**6**	**6**
Objectives	The aim is to provide the basic knowledge about the ionic crystals, solid electrolytes, important alloys and the characteristics of glass, ceramics, composites and synthetic organic metals. It also aims to provide an idea of nanomaterial synthesis and characterization techniques.			
Unit-I	**Ionic Conductivity and Solid Electrolytes** 1.1 Types of ionic crystals – alkali halides – silver chloride – alkali earth fluorides – simple stoichiometric oxides. 1.2 Types of Ionic conductors – halide ion conductors – oxide ion conductors – solid electrolytes and its applications. 1.3 Electrochemical cell: Principle, batteries sensors and fuel cells. Crystal defects in solids: Line and plane defects – point defects – Schottky and Frenkel defects. 1.4 Electronic properties and band theory: metals, semiconductors. Inorganic solids, colour, magnetic properties, optical properties, luminescence and lasers.			
Unit-II	**Alloys and its Importance** 2.1 Definition: Alloys – purpose of making alloys – composition and uses of alloys of iron, copper, aluminium, lead, nickel and titanium. 2.2 Ferrous alloys: Fe-C phase transformation in ferrous alloys – carbon and ferrous alloys 2.3 Properties and uses of various types of carbon steels – stainless steel. 2.4 Non-ferrous alloys: Properties and applications.			
Unit- III	**Glass, Ceramics and Composites** 3.1 Glassy state, glass formers and glass modifiers and their applications. 3.2 Ceramic structure – mechanical properties – clay products – refractories – characterisation – properties and applications. 3.3 Microscopic composites, dispersion – strengthened and particle reinforced, fibre reinforced composites, macroscopic composites. 3.4 Nano-crystalline phase: Preparation, properties and applications.			
Unit -IV	**Synthetic Organic Metals** 4.1 Conducting organics, organic super conductors, magnetism in organic materials. 4.2 Electrically conducting organic solids – organic metals – Preparation and applications of conjugated polymers: Doped polyacetylene, polyparaphenylene, polyaniline and polypyrrole. 4.3 Blends and composites of polymer materials – Organic charge-transfer complexes and new superconductors: Fullerenes – doped fullerenes as superconductors. 4.4 Nanocarbon and its applications			
Unit-V	**Nanomaterials – Synthesis and Characterisation** 1.1 Preparative method for nanoparticles: Sol-gel thermolysis, combustion			

	method, solvothermal method and microemulsion method 5.2 Thin film deposition techniques: Physical methods – vacuum evaporation, sputtering, Pulse laser deposition 5.3 Chemical methods, CVD, chemical solution deposition, electrochemical deposition, spray pyrolysis deposition. 5.4 Materials Characterization Techniques: Physical characterization techniques: XRD, XPS, Laser Raman spectroscopy. Microscopic techniques: SEM, AFM and TEM.

Reference Books:

Anthony. R. West, *Solid state chemistry and its application*; John Wiley & Sons (1989).

R.S.Khurmi and R.S.Sedha, *Materials Science*; S.Chand& Company Ltd (2000).

V.Raghavan, *Materials Science and Engineering*, Prentice – Hall of India Pvt. Ltd., (2001).

K.I.Chopra and I.Kaur, *Thin film Devices and Their Applications*, Plenum Press, New York, 1983.

J.P.Sibilia, *A Guide to Materials Characterisation*, VCH Publishers Inc., New York 1998.

Outcomes	The students will gain knowledge about the ionic crystals, crystal defects, solid electrolytes, important alloys and its uses. Students will have an idea to choose the glass, ceramics, composites and synthetic organic metals in their life. They can synthesize and characterize the nanomaterials.