BACHELOR OF SCIENCE (CHEMISTRY)

VISION

To nourish the students with unique proficiency in chemistry with social responsibility for diverse and a dynamic world and to produce competent Chemists, Researchers and Scientists through quality education.

MISSION

- To impel basic knowledge through teaching and good laboratory practices through practicals.
- To motivate the students for research through student project

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To succeed in obtaining employment appropriate to their interests in domain related fields and will become productive and valued professionals.

PEO 2: To develop in their professional career through life-long learning, higher education and other creative pursuits.

PEO 3: To cater the needs of the industry/society so as to contribute for the development of the country.

PROGRAMME OUTCOMES (PO)

After completion of the programme, the graduates will be able to

PO 1: Apply the knowledge of Chemistry, and interdisciplinary knowledge to the scientific issues and problems being faced in industry/society.

PO 2: Interpret and apply scientific concepts and principles of chemical sciences persuasively.

PO 3: Depict chemical processes and procedures both theoretically and practically.

PO 4: Handle and use chemicals safely and know the systematic usage of apparatuses.

PO 5: Develop critical thinking and problem solving abilities and acquire affinity towards chemistry and develop interest in life-long learning.

PROGRAMME SPECIFIC OUTCOMES (PSO)

After completion of the programme, the graduates will be able to

PSO1: Possess sound knowledge about the fundamental concepts and theories of science in general and chemistry in particular.

PSO2: Solve the complex problems and acquire analytical skills using the latest techniques and tools in science frontiers along with the needed skills for an understanding of societal, environmental, safety and cultural impacts.

PSO3: Apply the contextual knowledge of chemistry to function effectively as an individual as well as a leader in multidisciplinary environments.

PSO4: Synthesize, evaluate, interpret and effectively apply the basic laws, principles, phenomena and mechanisms in the field of sciences.

PSO5: Explicitly communicate and exchange their ideas with regard to theoretical and experimental aspects with the impacts of chemistry to the chemists and non-chemists.

REGULATIONS

ELIGIBILITY

A candidate who has passed the Higher Secondary Examination of Tamil Nadu Higher Secondary Board or an examination of some other board accepted by the syndicate as equivalent there to with Chemistry, Physics and any one the following subjects namely Mathematics, Botany, Zoology or Biology shall be eligible for admission into B.Sc., course in Chemistry. However non Mathematics candidates have to take Allied subjects other than Mathematics.

DURATION OF THE PROGRAMME

The course shall extend over a period of three years comprising of six semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects.

MAXIMUM DURATION FOR THE COMPLETION OF THE UG PROGRAMME

The maximum duration for completion of the UG Programme shall not exceed 12 semesters.

B.Sc., SCHEME OF EXAMINATIONS

Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit
				CA	CE	Total	
FIRST SEMESTER							
PART-I							
18UTALA101 18UHILA101 18UFRLA101	Tamil I / Hindi I / French I	5	3	25	75	100	3
PART-II							
18UENLA101	Foundation English I	5	3	25	75	100	3
PART-III							
18UCHM101	Core I: General Chemistry I	5	3	25	75	100	4
18UCHM102	Core II: Industrial Chemistry	5	3	25	75	100	4
18UMACHA101	Allied I: Algebra and Differential Calculus	5	3	25	75	100	4
18UCHMP101	Core Practical I: Volumetric and Inorganic Preparations	3	3	40	60	100	3
PART-IV							
18UVE101	Value Education I: Yoga	2	3	25	75	100	2
	Total	**30**				**700**	**23**

Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
SECOND SEMESTER							
PART I							
18UTALA201 18UHILA201 18UFRLA201	Tamil II / Hindi II / French II	5	3	25	75	100	3
PART II							
18UENLA201	Foundation English II	5	3	25	75	100	3
PART III							
18UCHM201	Core III: General Chemistry II	5	3	25	75	100	4
18UCHM202	Core IV: Pharmaceutical Chemistry	5	3	25	75	100	4
18UMACHA201	Allied II : Integral Calculus and Vector Calculus	5	3	25	75	100	4
18UCHMP201	Core Practical II: Organic Qualitative Analysis	3	3	40	60	100	3
PART IV							
18UVE201	Value Education II: Environmental Studies	2	3	25	75	100	2
Total		**30**				**700**	**23**

THIRD SEMESTER							
PARTI							
18UTALA301 18UHILA301 18UFRLA301	Tamil III / Hindi III / French III	5	3	25	75	100	3
PARTII							
18UENLA301	Foundation English III	5	3	25	75	100	3
PART III							
18UCHM301	Core V: General Chemistry III	4	3	25	75	100	4
18UPHCHA301	Allied III: Physics I	3	3	25	75	100	2
18UCHMP301	Core Practical III: Inorganic Qualitative Analysis	3	3	40	60	100	3
18UPHCHAP301	Allied Practical I: Physics I	3	3	40	60	100	2
PART IV							
18UCHSB301	SBC I: Food Chemistry	2	3	40	60	100	2
	NMEC I	2	3	25	75	100	2
NON CREDIT							
18ULS301	Career Competency Skills I	1	-	-	-	-	-
	Add-on course	2	-	-	-	-	-
Total		**30**	**-**	**-**	**-**	**800**	**21**

FOURTH SEMESTER							
PART I							
18UTALA401 18UHILA401 18UFRLA401	Tamil IV / Hindi IV / French IV	5	3	25	75	100	3
PART II							
18UENLA401	Foundation English IV	5	3	25	75	100	3
PART III							
18UCHM401	Core VI: General Chemistry IV	4	3	25	75	100	4
18UPHCHA401	Allied IV: Physics II	3	3	25	75	100	2
18UCHMP401	Core Practical IV: Physical Practical	3	3	40	60	100	3
18UPHCHAP401	Allied Practical II: Physics II	3	3	40	60	100	2
PART IV							
18UCHSB401	SBC II: Textile Chemistry	2	3	25	75	100	2
	NMEC II	2	3	25	75	100	2
NON CREDIT							
18ULS401	Career Competency Skills II	1	-	-	-	-	-
	Add-on Course	2	-	-	-	-	-
	Total	**30**	**-**	**-**	**-**	**800**	**21**

Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
FIFTH SEMESTER							
PART III							
18UCHM501	Core VII: Inorganic Chemistry I	5	3	25	75	100	4
18UCHM502	Core VIII: Organic Chemistry I	5	3	25	75	100	5
18UCHM503	Core IX: Physical Chemistry I	4	3	25	75	100	4
18UCHM504	Core X: Analytical Chemistry	4	3	25	75	100	4
	Elective I (One Unit – Self Study)	4	3	25	75	100	4
18UCHMP501	Core Practical IV: Gravimetric Estimation and Organic Preparation	5	6	25	75	100	3
PART IV							
18UCHSB501	SBC III: Polymer Chemistry	2	3	25	75	100	2
18UCHE501	Extension Activity	-	-	-	-	-	2
NON CREDIT							
18ULS501	Career Competency Skills III	1	-	-	-	-	-
	Total	**30**				**700**	**28**

Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
SIXTH SEMESTER							
PART III							
18UCHM601	Core XI: Inorganic Chemistry II	5	3	25	75	100	5
18UCHM602	Core XII: Organic Chemistry II	6	3	25	75	100	5
18UCHM603	Core XIII: Physical Chemistry II	5	3	25	75	100	4
	Elective II (One Unit – Self Study)	5	3	25	75	100	4
18UCHPR601	Project & Viva-Voce	5		25	75	100	4
PART IV							
18UCHSB601	SBC IV: Agricultural Chemistry	3	3	25	75	100	2
18ULS601	Career Competency Skills IV	1	-	-	-	-	-
Total		**30**				600	24

Non-Major Elective Course:

The department offers the following two subjects as Non Major Elective course for other than chemistry students for third and fourth semesters.

S. No	Semester	Subject Code	Subject
1.	III	18UCHNM301	Applied Chemistry I
2.	IV	18UCHNM401	Applied Chemistry II

Add-on course:

The department offers the following two subjects as Add-on courses for third and fourth semesters.

S. No	Semester	Subject Code	Subject
1.	III	18UCHAC301	Water quality analysis and treatment
2.	IV	18UCHAC401	Chemistry of Milk and Milk Products

Elective I

The department offers the following two subjects as Elective courses for Fifth semester

S. No	Semester	Paper code	Paper name
1.	V	18UCHEL501	Elective I: Spectroscopy I
2.	V	18UCHEL502	Elective I: Bio-Inorganic Chemistry

Elective II

The department offers the following two subjects as Elective courses for Sixth semester

S. No	Semester	Paper code	Paper name
1.	VI	18UCHEL601	Elective II: Green Chemistry and Nano Chemistry
2.	VI	18UCHEL602	Elective II: Spectroscopy II

Advanced Learners' course:

The department offers the following two subjects as Advanced Learner's course for fourth semester

S. No	Semester	Subject Code	Subject
1.	IV	18UCHAL401	Chemistry in daily life I
2.	IV	18UCHAL402	Chemistry in context

Advanced Learners' Course:

The department offers the following two subjects as Advanced Learner's course for fifth semester

S. No	Semester	Subject Code	Subject
1.	V	18UCHAL501	Chemistry for Environment
2.	V	18UCHAL502	Quantum and Solid State Chemistry

FOR COURSE COMPLETION

- Students shall complete the course of study under Part I (Tamil/Malayalam/French/Hindi) and Part II (English) papers in I, II, III and IV semester.
- Students shall pass Value Education such as Yoga and Environmental Studies in I and II Semester, respectively.
- Students shall complete allied subjects in I, II, III and IV Semester.
- Students shall choose and pass a Non Major Elective Course and Ad-on Course in III and IV semester.
- Students shall pass Skill based Courses in III, IV, V and VI semesters
- Students shall involve an extension activity in V semester.

TOTAL CREDIT DISTRIBUTION

S. No.	Components	No. papers	Marks	Credits
1	PART I :Language	4	4 X 100 = 400	4 X 3 = 12
2	PART II : Foundation English	4	4 X 100 = 400	4 X 3 = 12
3	PART III : Core Papers	13	13 X 100=1300	10 X 4 = 40 3 X 5 = 15
	Project & Viva-Voce	-	1 X 100=100	1 X 4 = 4
	Elective paper	2	2 X 100 = 200	2 X 4 = 8
	Skill Based Course (SBC)	4	4 X 100 = 400	4 X 2 = 8
	Core Practical	5	5 X 100 = 500	5 X 3= 15
	Allied Theory: Mathematics I & II	2	2X100=200	2 X 4 = 8
	Allied: Physics Theory & Physics Practical	4	2 X 100=200 2 X 100=200	2 X 2 = 4 2 X 2 = 4
4	PART-IV : Value Education I & II	2	2 X 100 = 200	2 X 2 = 4
	NMEC I & II	2	2 X 100 = 200	2 X 2 = 4
	PART IV: Extension Activity	-	--- -	1 X 2 = 2
5	Ad-on Course	2	-	-
6	Career Competency skills	4	-	-
	TOTAL	**36**	**4300**	**140**

18UTALA101	**TAMIL – I:** கவிதைகளும் கதைகளும்	பருவம் **- I**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

- தற்காலத்தமிழ் இலக்கியவகைகளைமாணவர்களுக்குக் கற்பித்தல்.
- காலந்தோறும் தமிழ்க் கவிதைவளர்ச்சிநிலைகளைஅறிமுகப்படுத்துதல்.
- அடிப்படைத் தமிழ் இலக்கணத்தைக் கற்பித்துஅரசுப்போட்டித் தேர்வுகளுக்கு ஆயத்தப்படுத்துதல்.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	மரபுக் கவிதைகள் அ.பாரதியார் - பாரததேசம் ஆ.பாரதிதாசன் - தமிழின் இனிமை இ. நாமக்கல் கவிஞர் - கவிதைஎன்றால் என்ன? ஈ. முடியரசன் - நல்லஉலகமடா!	10	CO1
II	புதுக்கவிதைகள் அ.வைரமுத்து - ரத்ததானம் - தண்ணீர் பிச்சை ஆ.வெ.இறையன்பு - பூபாளத்திற்கொருபுல்லாங்குழல் - பனித்துளியில் பாற்கடல் இ. தீபா - மழைக்குஒருமடல் - பாரதியார், வறுமை ஈ. சிற்பி - ஒருகிராமத்துநதி–ஒருகிராமத்துநதி	10	CO2
III	சிறுகதைகள் அ.அறிஞர் அண்ணா - செவ்வாழை ஆ. கிருத்திகா - உழவுமாடுகள் இ.வள்ளி.வ. - தணல் துண்டாய் சிலதருணங்கள் ஈ.தி.ஜானகிராமன் - முள்முடி	10	CO3
IV	இலக்கியவரலாறு அ. மரபுக்கவிதையின் தோற்றமும் வளர்ச்சியும் ஆ. புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் இ. சிறுகதையின் தோற்றமும் வளர்ச்சியும் ஈ. நாடகத்தின் தோற்றமும் வளர்ச்சியும்	10	CO4
V	அடிப்படை இலக்கணம் அ.முதலெழுத்துகள் மற்றும் சார்பெழுத்துகள் (நன்னூல் விதிப்படிவிளக்கம்) ஆ.வல்லினம் மிகும் மிகா இடங்கள். இ. மரபுப் பெயர்கள் - இளமைப் பெயர்கள்	10	CO5

Text Book:	
1	தமிழ்த்துறை வெளியீடு, கே.எஸ்.ரங்கசாமிகலைஅறிவியல் கல்லூரி(தன்னாட்சி), திருச்செங்கோடு.

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	மரபுக்கவிதைகளின் வடிவங்களைஅறிதல்.
CO2	புதுக்கவிதைகளின் வடிவங்கள் மற்றும் பாடுபொருள் தன்மையையைஅறிதல்.
CO3	சிறுகதைகளின் உருவம்,உள்ளடக்கங்களைஅறிதல்
CO4	காலந்தோறும் மாறும் இலக்கியவளர்ச்சியையைஅறிதல்
CO5	எழுத்துகளின் வகைகளைஅறிதல்.

18UENLA101	FOUNDATION ENGLISH – I	SEMESTER – I

COURSE OBJECTIVES:

The course aims

- To enable the students to develop their comprehensive skill
- To introduce the students to know about English poetry
- To introduce the students to know about English short stories

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I & II	**POETRY** William Wordsworth - The Solitary Reaper Margaret Atwood - This Is a Photograph of Me **SHORT STORY** A. J. Cronin - Two Gentlemen of Verona **GRAMMAR** Parts Of Speech Articles **COMPOSITION** Letter Writing – Formal **COMMUNICATION SKILLS** Greeting and Introducing Inviting a Person	20	CO1 & CO2
III & IV	**POETRY** Robert Frost - The Road Not Taken **SHORT STORIES** Pearl S. Buck - The Refugees C. Rajagopalachary – Tree Speaks **GRAMMAR** Kinds of Sentences	20	CO3 & CO4

	COMPOSITION Dialogue Writing **COMMUNICATION SKILLS** Seeking Permission Offering a Suggestion and Giving an Advice		
V	**SHORT STORY** R. K. Narayan - The Axe **GRAMMAR** Question Tag **COMPOSITION** Reading Comprehension **COMMUNICATION SKILLS** Persuading	10	CO5

Text Books:	
1	*G.Damodar, D.Venkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli.* 2009. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad
2	*M.M.Lukose*. 2010. **Images, A hand book of Stories.** Macmillan Publishers Indian Limited. Chennai.
3	*Dr.A.Shanmugakani,* M.A., Ph.D, **Prose for Communication**. Manimekala Publishing House, Madurai
4	*SasiKumar V and Syamala V*. 2006. **Form and Function A Communicative Grammar for Colleges.** Emerald Publishers. Chennai
5	*Farhathullah T.M.* 2006. **Communication Skills For Undergraduates**. Publishers-RBA Publications. Chennai.
Reference Book:	
1	*Thomas, A.J and Martinet, A.V.* 1994. **A Practical English Grammar.** Oxford University Press. Delhi.

After completion of the course, the students will be able to

CO1	Know the different parts of genres in English
CO2	Trace the famous authors of English
CO3	Enrich grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

18UCHM101	**CORE I: GENERAL CHEMISTRY I**	**SEMESTER I**

COURSE OBJECTIVES:

The course aims

- To impart the basic concepts about atom and periodic properties
- To empathize the acid –base concepts and different types of solvents
- To impel knowledge on the nomenclature of organic compounds and its bonding
- To infer basic knowledge about quantum chemistry & principles of physical chemistry
- To recognize the basic concepts of laboratory techniques

Credits: 4 **Total hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Atomic Structure**: Quantum numbers n, l, m and s - Pauli exclusion principle - Energy distribution - Hund's rule of maximum multiplicity - Aufbau's principle - Electronic configurations of elements - Stability of half-filled and completely filled orbitals. Shapes of s, p, d and f orbitals. **Periodic properties:** Periodicity and factors affecting the properties - Atomic radii - Ionic radii - Ionisation potential - Electron affinity – Electronegativity	10	CO1
II	**Acid- Base Chemistry:** Theories of acids-bases - Arrhenius, Bronsted – Lowry, Lewis, Solvent system (leveling and differentiating effects), Lux - Flood and Usanovich (definition only) Relative strength of acids and bases, Hard and soft acids and bases (HSAB). **Solvents:** Types of solvents – Protic and aprotic solvents – Amphi-protic amphoteric solvents - aqueous and non-aqueous solvents - liquid Ammonia- Advantages and	10	CO2

	disadvantages of liquid ammonia as solvent.		
III	**Basic Organic Chemistry:** Classification of organic compounds - Nomenclature -Functional groups – Bifunctional group-Priority rule of functional group - Homologous series - IUPAC - aliphatic - alicyclic and aromatic compounds - Bonding in organic chemistry - Hybridisation and geometry of molecules - methane, ethane, ethylene, acetylene and benzene. Electronic effects - inductive - inductomeric - mesomeric - resonance – hyper conjugation and steric effects. Cleavage of bonds - Homolytic and Heterolytic fission of carbon - carbon bond – Reaction intermediates - Carbocations - Carbonations and Free radicals – Structure and stability- introduction about carbine and nitrene.	10	CO3
IV	**Quantum chemistry**: Quantum theory and atomic spectra – Bohr's model of atom – Limitations of Bohr model – Somerfield's model – photoelectric effect - Compton effect – de Broglie equation – Davisson and Germer experiment - Quantum theory of radiation - Planck's theory - Wave mechanical concept of the atom - de Broglie's relationship - wave nature of electron - Heisenberg's uncertainty principle - Schrodinger wave equation (without derivation) - significance of wave functions, ψ and ψ^2 - probability distribution of electrons - radial probability distribution curves.	10	CO4
V	**Volumetric Analysis:** Molecular weight, Formula weight, Equivalent weight-Concentrations of solutions, molarity – molality – normality - weight percentage – volume	10	CO5

	percentage and ppm. Preparation of standard solutions- Primary standards – acid-base titrations – Redox titrations, complexometric titrations (EDTA titration), precipitation titrations – iodometry, iodimetry and permanganometry. Theory of Indicators-selection of suitable indicators- Calculation of strength of solutions and amount of substance.		

Text Books:	
1	*Puri B. R., Sharma L. R.* and *Kalia K. K.,* 2017. **Principles of Inorganic Chemistry**. [Thirty third Edition]. ShobanLal Nagin Chand & Co, New Delhi.
2	*Puri B. R., Sharma L .R.* and *Pathania M.S.,* 2017. **Principles of Physical Chemistry.** [Forty Seventh Edition]. Shoban Lal, Nagin Chand & Co, New Delhi.
3	*Bahl B.S.* and *Arun Bahl*, 2016. **Advanced Organic Chemistry.** [Twenty Second Edition]. Sultan Chand & Co., New Delhi.
4	*Venkateswaran V, Veeraswamy R.* and *Kulandaivelu A.R.,* 2012. **Basic Principles of Practical Chemistry**. [Second Edition]. Sultan Chand & sons, New Delhi.
Reference Books:	
1	*Lee J. D.* 2008. **Concise Inorganic Chemistry.** [Fifth Edition]. Black well science, UK.
2	*Morrison R.T.* and *Boyd R.N.* 2010. **Organic Chemistry.** [Seventh Edition]. Allyn & Bacon Ltd, New York.
3	*Gopalan R., Subramanian P. S.* and *Rengarajan K.,* 2004. **Elements of Analytical Chemistry**. [Third Edition]. Sultan Chand & Sons, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Acquire knowledge of atomic and periodic properties of elements
CO2	Recall the basic principles of acid-base chemistry and about solvents
CO3	Design the geometry of molecules and assess the nomenclature for compounds
CO4	Revise the basic concepts of quantum chemistry and utilize the principles of quantum chemistry
CO5	Formulate the laboratory techniques and prepare solutions for practical

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	M	H	L
CO2	L	H	L	M	H
CO3	M	L	H	M	L
CO4	L	H	M	L	M
CO5	M	M	H	L	H

H-High M-Medium L-Low

18UCHM102	**CORE II: INDUSTRIAL CHEMISTRY**	**SEMESTER-I**

COURSE OBJECTIVES:

The course aims

- To empathize the chemistry of cements
- To cognize the chemistry involved in paints
- To compile the principles involved in the manufacture of glass and paper
- To recognize the chemistry of corrosion
- To provide basic knowledge on electrochemistry

Credits: 4 **Total hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Cement:** Classification of cement. Chemical constitution– hardening of cement - Manufacture of Portland cement - Special cements and their uses. Preparation of gypsum and its role in setting of cement – Preparation and properties of plaster of Paris.	10	CO1
II	**Paint sand Varnishes:** Primary Constituents of Paints, Dispersion medium (Solvent), binder pigments, Formulation of paints and varnishes. Requirements of good paints functions – drying process - varnishes and lacquers. Surface preparation for metallic coatings – electroplating (gold) and electroless plating (Nickel) – anodizing coating – phosphate coating – powder coating – antifouling coating.	10	CO2
III	**Glass**: Physical & chemical properties of glass. Raw materials – characteristics & types of glass – manufacture of glass – Special glass – Optical glass – borosilicate, flint and coloured glasses. **Papers:** Different methods of wood	10	CO3

	pulping – Manufacture – Cases of different qualities of Paper products like cardboard, newsprint, writing paper, tissue paper & filter paper.		
IV	**Corrosion**: Principles of chemical corrosion – Pilling Bedworth rule – Principles of electrochemical corrosion – Difference between chemical and electrochemical corrosion – Galvanic corrosion. Differential aeration corrosion. Factors influencing corrosion. Corrosion control – cathodic protection – sacrificial anodic method – corrosion inhibitors - Protective coatings.	10	CO4
V	**Batteries**: Primary and secondary batteries – Alkaline batteries – lead acid batteries, Ni – Cd and Li batteries – Principles and applications of solar cells – **Fuels cells:** Hydrogen- Oxygen fuel cell - Hydrocarbon-oxygen fuel cell – Mechanism of Charging and Discharging fuel cells – Galvanic cell – Reversible and Irreversible.	10	CO5

Text books:	
1	*Chakrabarty B. N.* 1981. **Industrial Chemistry.** Oxford & IBH Publishing Co., New Delhi.
2	*Sharma B. K.* 2001. **Industrial Chemistry.** Reprinted Edition. Geol Publishing House, Meerut.
Reference book:	
1	*Singh P. P., Joseph T. M.* and *Dhavale R. G.* 2000. **College Industrial Chemistry.** [Fourth Edition]. Himalaya Publishing House, Bombay.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Revise the basic concepts of chemistry of cements
CO2	Analyse the properties of paints
CO3	Predict the chemistry behind the glass and papers
CO4	Utilize the techniques to prevent corrosion
CO5	Get the outline knowledge about the basics of electrochemistry

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	L	L	M
CO2	M	L	H	M	M
CO3	H	H	L	H	L
CO4	L	L	H	M	H
CO5	M	L	M	H	L

H-High M-Medium L-Low

18UMACHA101	ALLIED I: ALGEBRA AND DIFFERENTIAL CALCULUS	SEMESTER – I

COURSE OBJECTIVES:

The Course aims

- To get knowledge about matrices and various method of solving algebraic equations
- To learn basic concepts of differentiation which is instrumental in constructing many of mathematical concepts and also applied in all sciences and social sciences

Credits: 4 **Total Hours : 50**

UNIT	CONTENTS	Hrs	CO
I	Characteristics equation of a matrix – Eigen values and Eigen vectors – Cayley-Hamilton Theorem (Statement only) and its problems – Rank of a matrix – Problems.	10	CO1
II	Polynomial Equations - Imaginary and Irrational roots - Relation between roots and coefficients – Transformation of equations – Descartes's rule of signs – Problems.	10	CO2
III	Successive Differentiation – nth derivative – Leibnitz formula for nth derivative – problems.	10	CO3
IV	Partial differentiation – Partial derivatives of higher orders – Homogeneous functions – Problems.	10	CO4
V	Radius of Curvature in Cartesian and polar coordinates – Pedal equation of a curve – Radius of curvature in p-r coordinates.	10	CO5

Text book:	
1	*Vittal, P.R.* 2002. **Allied Mathematics.** [Third Edition]. Margham Publications, Chennai.
Reference books:	
1	*Manicavachagam Pillay, T.K. and Narayanan, S.* 2004. **Algebra – vol II.** Vijay Nicole Imprints Private Limited, Chennai.
2	*Singaravelu. A.* 2002. **Allied Mathematics.** Meenakshi Publishers, Chennai.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Calculate Eigen values and Rank of a matrix
CO2	Solve algebraic equations
CO3	Understand the variations in variables.
CO4	Understand the difference between partial and total differentiation
CO5	Find the curvature and radius of curvature of a curve

MAPPING:

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	L	M	M
CO2	H	M	H	L	H
CO3	L	H	M	L	M
CO4	M	H	L	M	M
CO5	M	L	M	H	L

H-High M-Medium L-Low

18UCHMP101	**CORE PRACTICAL I: VOLUMETRIC ANALYSIS AND INORGANIC PREPARATIONS**	**SEMESTER-I**

COURSE OBJECTIVES:

The course aims

- To enable the students to acquire the quantitative skills in volumetric analysis.
- To provide cognition about the inorganic preparations

Credits: 3 **Total Hours: 30**

EXPT NO.	**CONTENTS**	**CO**
Titrimetric Quantitative Analysis		
1	Estimation of HCl by NaOH using standard oxalic acid solution (Acidimetry-Alkalimetry)	CO1
2	Estimation of oxalic acid by $KMnO_4$ using standard oxalic acid solution (Permanganometry).	
3	Estimation of Iron (II) sulphate by $KMnO_4$ using standard Mohr's salt solution (Permanganometry)	
4	Estimation of $KMnO_4$ by thio using standard $K_2Cr_2O_7$ solution (Permanganometry)	
5	Estimation of Fe (III) by $K_2Cr_2O_7$ using a standard Mohr's salt solution with Internal and external indicators (Dichrometry)	
6	Estimation of copper (II) sulphate by $K_2Cr_2O_7$ solution	
7	Estimation of Mg by EDTA solution (complexometric method)	
8	Estimation of Ca by EDTA solution (complexometric method)	
Inorganic Preparations		
1	Tetraamine copper (II) sulphate	CO2
2	Hexammine cobalt (II) chloride	
3	Tris (thiourea) copper (I) Chloride	
4	Ferrous ammonium sulphate	

Reference Books:	
1	*Venkateswaran V.* and *Kulandaivelu* A.R. 2012. **Basic Principles of Practical Chemistry.** [Second Edition]. Sultan Chand & Sons, New Delhi.
2	*Bassett J. et al.,* 1989. **Vogel's Textbook of Quantitative Inorganic Analysis.** [Fifth Edition]. ELBS Longman, Newyork.
3	*Bajpai D.N., Pandey O.P.* and *Giri S.* 2012. B.Sc., **Practical Chemistry**, Revised Edition. S. Chand & company, New Delhi.
4	*Singh J.P.* and *Verma G.R.* 1999. **Practical Chemistry Vol. I & II,** [Revised Edition] S. Chand & company, New Delhi.
5	*Thomas. A.O.* 2000. **Practical Chemistry**. [Sixth Edition]. Sharada Press, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Estimate a chemical compound by standard laboratory technique
CO2	Prepare inorganic compounds in the laboratory

18UVE101	**VALUE EDUCATION I: YOGA**	**SEMESTER - I**

COURSE OBJECTIVES:

The course aims

- To understand physical body and Health concepts
- To have the basic Knowledge on Simplified Physical Exercises and Asanas and Meditation
- To Introspect and improve the behaviors
- To inculcate cultural behavioral patterns

Credits: 2 **Total Hours: 30**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	**Yoga and Physical Health:** Health - Meaning and Definition - Physical Structure - Three bodies - Five limitations - Simplified Physical Exercises - Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana 1, 2 , Massage, Acu pressure, Relaxation exercises - Yogasanas – Surya namaskar - Padmasana - Vajrasana - Ardha katti Chakrasana - Viruchasana - Yogamudra - Patchimothasana - Ustrasana - Vakkarasana – Salabasana	**6**	**CO1**
II	**Greatness of Life Force and Mind :** Maintaining youthfulness - Postponing the ageing process - Sex and spirituality - Significance of sexual vital fluid - Married life - Chastity - Development of mind in stages - Mental Frequencies - Methods for Concentration - Meditation and its Benefits	**6**	**CO2**
III	**Personality Development – Sublimation :** Purpose and	**6**	**CO3**

	Philosophy of Life - Introspection - Analysis of Thought - Moralization of Desire - Analysis and practice - Neutralization of Anger - Strengthening of will-power		
IV	**Human Resources Development:** Eradication of Worries - Analysis and Eradication practice - Benefits of Blessings – Effect of good vibrations - Greatness of Friendship - Guidance for good Friendship – Individual Peace and world peace - Good cultural behavioral patterns	**6**	**CO4**
V	**Law of Nature:** Unified force - Cause and effect system - Purity of thought deed and Genetic Centre – Love and Compassion - Gratitude - Cultural Education - Fivefold culture.	**6**	**CO5**

Text Book:	
1.	Value Education - World Community Service centre, Vethathiri Publications, Erode.
Reference Books:	
1	*Vethathiri Maharishi*, 2011, Journey of Consciousness, Erode, Vethathiri Publications.
2	*Vethathiri Maharishi*, 2014, Simplified Physical Exercises, Erode, Vethathiri Publications.
3	*Vethathiri Maharishi*, 2004, Unified force, Erode, Vethathiri Publications
4	Yoga for Modern age - Thathuvagnani Vethathiri Maharishi
5	Sound Health through yoga – Dr. K. Chandrasekaran, November 1999 Prem Kalyan Publications, Madurai

6	Light on yoga - BKS.lyenger
7	Thathuvagnani Vethathiri Maharishi – Kayakalpa yoga – First Edition 2009 –Vethathiri Publications, Erode.
8	Environmental Studies - Bharathidasan University Publication Division

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO1	Understand the physical structure and simplified physical exercises.
CO2	Nurture the life force and mind
CO3	Introspect and improve the moral values
CO4	Realize the importance of human resources development
CO5	Enhance purity of thought and deed

18UTALA201	**Tamil – II:** சமய இலக்கியங்கள்	பருவம் **- II**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

- சமய இலக்கியங்களைஅறிமுகம் செய்தல்
- சமயச் சான்றோர் நிலைப்பாட்டைஉணர்த்துதல்
- சமயங்கள் வளர்த்ததமிழைஅறியச் செய்தல்

Credits: 3 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	சைவ,வைணவ இலக்கியங்கள் அ. சம்பந்தர் தேவாரம் - திருக்கொடிமாடச்செங்குன்றூர்- (முதல் ஐந்துபாடல்கள்) ஆ. மாணிக்கவாசகர் - திருவம்மானை - (முதல் ஐந்துபாடல்கள்) இ. பெரியாழ்வார் - திருப்பல்லாண்டு (முதல் ஐந்துபாடல்கள்) ஈ. ஆண்டாள் - திருமணக் கனவு (முதல் ஐந்துபாடல்கள்)	10	CO1
II	கிறித்துவ, இசுலாமிய இலக்கியங்கள் அ. இரட்சணியயாத்திரிகம் - சிலுவைப்பாடு (முதல் பத்துப்பாடல்கள்) ஆ. நாயகம் ஒருகாவியம்–பாம்பின் நேசமும் தோழரின் பாசமும் (முதல் பத்துப்பாடல்கள்)	10	CO2
III	சமயச் சான்றோர் வரலாறு அ. சைவசமயச் சான்றோர்கள் 1. திருஞானசம்பந்தர், 2. திருநாவுக்கரசர், 3. சுந்தரர், 4. மாணிக்கவாசகர் 5. சேக்கிழார் ஆ. வைணவசமயச் சான்றோர்கள் 1. முதலாழ்வார்கள் 2. திருமங்கையாழ்வார் 3.ஆண்டாள் 4. நாதமுனிகள்	12	CO3
IV	சமய இலக்கியவரலாறு அ.பன்னிரு திருமுறைகள் ஆ. பதினெண்சித்தர்கள்	8	CO4

	இ. நூலாயிர திவ்யபிரபந்தம் ஈ. சைவசித்தாந்தசாத்திரங்கள்		
V	இலக்கணமும் மொழித்திறனும் அ. ஆகுபெயர் ஆ. தொகைச்சொற்கள் இ. மயங்கொலிச்சொற்கள் (ர,ற வேறுபாடுகள்) ஈ. நேர்காணல்	10	CO5

Text Book:	
1	தமிழ்த்துறை. வெளியீடு : கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி (தன்னாட்சி),திருச்செங்கோடு– 637 215

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	தேவார,திவ்யபிரபந்தச் சிறப்பினைஉணர்தல்.
CO2	கிறித்துவ, இசுலாமிய காவியங்களின் சிறப்பினை உணர்தல்.
CO3	சைவசமய, வைணவசமயச் சான்றோர் சிறப்புக்களை உணர்தல்.
CO4	சமயவளர்ச்சி, இலக்கியவளர்ச்சி ஆகியவற்றை உணர்தல்
CO5	ஆகுபெயர் வகைகளை உணர்தல், மொழித்திறன் பெறுதல்.

18UENLA201	**FOUNDATION ENGLISH – II**	**SEMESTER – II**

COURSE OBJECTIVES:

The course aims

- To enable the students to develop their comprehensive skill
- To introduce the students to know about English poetry and short stories

Credits: 3 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I & II	**POETRY** Langston Hughes - I, Too **SHORT STORIES** Vsevolod M. Garshin - The Signal W. Somerset Maugham - The Man with the Scar **GRAMMAR** Tenses (Present, Past & Future) **COMPOSITION** E-mail SMS **COMMUNICATION SKILLS** Asking Questions	**20**	**CO1 & CO2**
III & IV	**POETRY** Chinua Achebe - Refugee Mother and Child Nissim Ezekiel - Goodbye Party for Miss Pushpa T. S **SHORT STORY** H. G. Wells - The Stolen Bacillus **GRAMMAR** Voices (Active and Passive) **COMPOSITION** Note Making, Note Taking	**20**	**CO3 & CO4**

	COMMUNICATION SKILLS Praising and Complimenting Complaining and Apologizing		
V	**POETRY** Tripuraneni Srinivas - I Will Embrace only the Sun **SHORT STORY** O. Henry - One Thousand Dollars **COMPOSITION** Discourse Pattern **COMMUNICATION SKILLS** Expressing Sympathy Phoning	**10**	**CO5**

Text Books:	
1	*G.Damodar, DVenkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli.* 2009. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad –500 029
2	*M.M.Lukose*. 2010. **Images, A hand book of Stories.** Macmillan Publishers Indian Limited. Chennai–600 041
3	*SasiKumarV and SyamalaV*. 2006. **Form and Function A Communicative Grammar for Colleges.** Emerald Publishers. Chennai–600 008
4	*T.M.Farhathullah.* 2006. **Communication Skills For Undergraduates**. Publishers-RBA Publications. Chennai–600 015.

Reference Books:	
1	*Thomas, A.J and Martinet, A.V.* 1994. **A Practical English Grammar.** Oxford University Press. Delhi.
2	*Martin Hewings.* 1999. **Advanced English Grammar.** Cambridge University Press. New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Know the different parts of genres in English
CO2	Identify the famous authors of English
CO3	Enrich their grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

18UCHM201	CORE III: GENERAL CHEMISTRY II	SEMESTER-II

COURSE OBJECTIVES:

The course aims

- To impart knowledge of the chemical bonding
- To recall the reaction of alkene
- To recognize the preparation and properties of alkynes and cycloalkanes
- To evaluate the basic concepts of thermodynamics and gaseous state
- To recognize the basic laws of physical chemistry

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Chemical bonding:** Ionic bond - Lattice energy – Factors affecting lattice energy – Born-Haber cycle – Illustration and calculation only for MX and MX_2 – Fajan's rules with Illustrations – covalent bond – MO theory - LCAO method, MO energy level diagram of H_2, He_2, N_2, O_2 and CO, bond order and stability of molecules - co-ordinate covalent bond – Metallic bond – Hydrogen bond – Octet rule – Sid wig Powell theory – Valance bond theory – Hybridization – VSEPR theory– Illustration of CH_4, H_2O, NH_3, SF_4, XeF_4, XeF_6.	10	CO1
II	**Alkenes**: Preparation - properties of alkenes - Electrophilic and Free radical addition. Addition of hydrogen with Mechanism – addition of halogens with Mechanism - Markownikoff's rule and Anti-Markownikoff's rule.Addition of water Oxymercuration - Demercuration, Hydroboration - oxidation - Reduction – Diels - Alder reaction. Hydroboration, ozonolysis - hydroxylation with	10	CO2

	$KMnO_4$ – allylic substitution by NBS - Epoxidation - Self-addition or polymerization – Test for unsaturation.		
III	**Alkynes**: Preparation of Alkynes - Acidity of alkynes - Addition of hydrogen -Hydroboration – Hydrohalogenation - Addition of hypohalous acid - Hydration - addition of water with $HgSO_4$catalyst-Addition of alcohols and carboxylic acids. Formation of acetylides - alkylation of alkynes with mechanism - oxidation with $KMnO_4$ - ozonolysis - Polymerisation to benzene - Oxidative coupling - Isomerization. **Cycloalkanes:** Preparation using Wurtz's reaction - Dieckmann's ring closure and reduction of aromatic hydrocarbons - Substitution and ring opening reactions - Rearrangements. Bayer's strain theory - Theory of stainless rings - Preparation and stability of conjugated dienes.	10	CO3
IV	**Thermodynamics:** Definition - System, surroundings, Isolated, Closed and Open system - Homogeneous and heterogeneous system - Intensive and extensive properties - State of a system - Independent and Dependent state variable - Thermodynamic equilibrium - Thermodynamic processes and their types – isothermal, isobaric, adiabatic, reversible and irreversible. Nature of work and heat. First law of thermodynamics - statement and equation - Internal energy – Enthalpy of the system. C_p-C_v relationship - Joule Thomson effect.	10	CO4
V	**Gaseous state:** Gas laws – Boyle's law, Charles law, Avogadro's law – Ideal gas equation – gas constant - Deviation of real gas from ideal behavior – Van der Waals	10	CO5

	equation for real gases – critical phenomenon – P-V isotherm of real gases, critical temperature – Critical volume – Types of molecular velocities – RMS velocity, average and most probable velocities – Maxwell distribution law-Collision number and mean free path – Collision diameter – collision cross-section.		

Text Books:	
1	*Bahl B.S.* and *Arun Bahl,* 1997. **Advanced Organic Chemistry.** [22nd Edition]. Sultan.
2	*Puri P. R., Sharma L. R.* and *Pathania M. S.*2010. **Principles of Physical Chemistry.** Vishal Publishing Co, Jalandhar.
Reference Books:	
1	*Morrison R.T.* and *Boyd R.N.* 2010. **Organic Chemistry.** [Seventh Edition]. Allyn & Bacon Ltd, New York.
2	*Lee J. D.* 2008. **Concise Inorganic Chemistry.** [Fifth Edition]. Black well science, UK.
3	*Pine S. H.* 2010. **Organic Chemistry.** [Fifth Edition]. McGraw- Hill International Book Company, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Emphasis the properties of atoms, molecules, and the various states of matter
CO2	Develop an understanding of nucleophiles, electrophiles, electronegativity, and Resonance
CO3	Predict the mechanisms of organic reactions
CO4	Apply the mathematical tools to calculate thermodynamic and kinetic Properties
CO5	Describes the concepts of ideal and real gases and the critical state, adapts critical state equation to the problems

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	M	H	L
CO2	L	H	M	M	L
CO3	M	M	L	H	M
CO4	H	M	H	L	H
CO5	M	L	M	L	H

H-High M-Medium L-Low

18UCHM202	**CORE IV: PHARMACEUTICAL CHEMISTRY**	**SEMESTER-II**

COURSE OBJECTIVES:

The course aims

- To effectively impart knowledge about various diseases and their treatment
- To convey about the importance of Indian medicinal plants
- To impel the information about the different types of drugs
- To provide knowledge of chemistry behind the drugs
- To recognize the chemistry of anaesthetics

Credits: 4 **Total hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Definition of the following terms:** drug, pharmacophore, pharmacology, pharmacopoeia, bacteria, virus, chemotherapy and vaccine. Causes, symptoms and drug for jaundice, cholera, malaria and filarial - antidotes for poisoning. Routes of drug administration - local, enema, oral or external, parental advantages and disadvantages- Oral and parental routes-inhalation, intradermal, subcutaneous, intramuscular, intravenous - intrathecal – intraarticular transcutaneous - transmuscusal.	10	CO1
II	**Indian medicinal plants**: Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothavelai- uses. Causes, detection and control of anaemia and diabetics. Diagnostic test for sugar, salt and cholesterol in serum and urine. **Antibacterial Drugs**: Sulpha drugs - examples and actions – prontosil sulphathiazole, sulphafurazole	10	CO2
III	**Antibiotics** - Definition and action of penicillin, streptomycin, chloramphenicol - SAR of chloramphenicol only - Antiseptics and disinfectants - definition and	10	CO3
	distinction- Phenolic compounds, chloro compounds and cationic surfactant. **Sulphonamides:** Definition-mechanism of action-classification - SAR synthesis and use of sulphacetamide, sulphathiazole, phthalylsulphathiazole - sulphadiazine and sulpha pyridine - assay		

IV	**Analgesics, Antipyretics and anti-inflammatory agents:** Definition and actions - narcotic and non-narcotic - Morphine and its derivatives, pethidine and methadone - Salicylic derivative, paracetamol, ibuprofen - disadvantages and uses. Causes and treatment of cancer. AIDS – cause of HIV – Propagation - prevention and treatment	10	CO4
V	**Anaesthetics:** Definition - local and general-Volatile nitrous oxide, ether, Chloroform, cyclopropane- trichloroethylene - uses and disadvantages- Drugs affecting CNS - Definition, distinction and examples for tranquilizers, sedatives, hypnotics, psychedelic drugs - LSD Hashish- their effects.	10	CO5

Text Books:	
1	G*hosh J.* and *Chand. S.* 2012. **A Text book of pharmaceutical Chemistry.** [Third Edition]. S. Chand and Company Ltd., Ram Nagar, New Delhi.
2	*Lakshmi S.* 1998. **A textbook of Pharmaceutical Chemistry.** [First edition]. Sulthan Chand sons, New Delhi.
Reference Books:	
1	*Bentleys, E. A. Raubins.* 2010, **Text book of pharmaceutics.** [Eighth Edition]. All India
2	*Kar A.* 2018. **Medicinal Chemistry.** [Seventh Edition]. New Age International, Wiley-Eastern Ltd., Delhi

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Assess the basic concepts about drugs
CO2	Recognize the chemistry behind medicinal plants and anti-bacterial drugs
CO3	Formulate the usage of antibiotics and sulphonamides
CO4	Analyse analgesics, antipyretics drug and its usage
CO5	Predict the basic idea of anaesthetic drugs

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	H	L
CO2	H	M	M	L	H
CO3	M	L	H	M	M
CO4	L	M	H	L	M
CO5	H	H	M	M	H

H-High M-Medium L-Low

18UMACHA201	**ALLIED II: INTEGRAL CALCULUS AND VECTOR CALCULUS**	**SEMESTER – II**

COURSE OBJECTIVES:

The Course aims

- To learn the concepts about integration
- To introduce the concept of Fourier series
- To study in detail about vector differentiation and vector integration

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Integral Calculus – Integration by parts - $\int_0^{\pi/2} \sin^n x dx$; $\int_0^{\pi/2} \cos^n x dx$; $\int_0^{\pi/2} \tan^n x dx$ - Definite integrals – Properties – Reduction formula – Problems.	10	CO1
II	**Fourier series**: Definition – To find Fourier coefficients of Periodic functions with period 2π - Even and odd functions – Half range series – Problems.	10	CO2
III	**Vector Differentiation**: Definition of gradient of a scalar point function – Directional derivative of a vector point function – Unit normal vector. **Vector point function**: Divergent and curl of a vector point function – Definitions – Solenoidal and irrorational vector – Problems.	10	CO3
IV	Line integrals – Surface integrals and volume integrals - Problems.	10	CO4
V	Gauss Divergence theorem – Stoke's theorem – Green's theorem (Statement only) - Problems.	10	CO5

Text books:	
1	*Vittal, P.R.* 2002. **Allied Mathematics.** [Third Edition]. Margham Publications, Chennai.
Reference books:	
1	*Manicavachagam Pillay, T.K. and Narayanan, S.* 2004. **Algebra – vol II.** Vijay Nicole Imprints Private Limited, Chennai.
2	*Singaravelu. A.*2002. **Allied Mathematics.** Meenakshi Publishers, Chennai.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Integrate trigonometric functions and integrations involving more than one Factor
CO2	Expand a given function in terms of Fourier series
CO3	Identify conservative field and Solenoidal vector
CO4	Find work done by the force, area and volume of different regions
CO5	Discuss the relations between line integral, surface integral and volume integral

MAPPING:

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	L	M
CO2	H	L	M	H	H
CO3	L	H	M	L	M
CO4	M	H	L	M	M
CO5	M	L	M	H	L

H-High M-Medium L-Low

18UCHMP201	**CORE PRACTICAL II: ORGANIC QUALITATIVE ANALYSIS**	**SEMESTER – II**

COURSE OBJECTIVES:

The course aims

- To enable the students to develop skills in analysing organic qualitative compounds
- To enable the students to identify various organic compounds systematically

Credits: 3 **Total Hours: 30**

CONTENTS	**CO**
Organic analysis:	
Identification of acidic, basic, phenolic and neutral organic substances Detection of N, S and halogens. Test for aliphatic and aromatic nature of substances. Test for saturation and unsaturation Identification of functional groups: i) Carboxylic acids ii) Phenols iii) Aldehydes iv) Ketones v) Esters vi) Carbohydrates vii) Amines viii) Amides. Preparation of derivatives for the functional groups.	CO1& CO2

Reference Books:

1	*Gnanapragasam N. S., Viswanathan S.* and *Ramamurthy G.* 2009. **Organic Chemistry – Lab manual.** Viswanathan printers and publishers Pvt Ltd.
2	*Gurthu J.N.* and *Kapoor, R.* 2012. **Advanced Experimental Chemistry (Organic).** [Eighth Edition]. Chand and Co., New Delhi.
3	*B.S. Furniss, A.J. Hannaford. P.W.G. Smith* and *Tatchell, A.R*. 2003.**Vogel's Practical Organic Chemistry**. [Fifth Edition]. ELBS & Longman, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the type of organic compound by suitable laboratory techniques
CO2	Prepare the derivative of a basic organic compound

18UVE201	VALUE EDUCATION II: ENVIRONMENTAL STUDIES	SEMESTER – II

COURSE OBJECTIVES:

The course aims

- To enable the students acquire knowledge, values, attitudes, commitment and skills needed to protect and improve the environment
- To implicate awareness among young minds for safeguarding environment from manmade disasters

Credits: 2 **Total Hours: 30**

UNIT	CONTENTS	Hrs	CO
I	Environment– Definition– Scope– Structure and function of ecosystems- producers, consumers and decomposers- Energy flow in the ecosystem- Ecological succession– food chain, food webs and ecological pyramids– Concept of sustainabledevelopment.	06	CO1
II	Natural resources: Renewable- air, water, soil, land and Wildlife resources. Non–renewable – Mineral coal, oil and gas. Environmental problems related to the extraction and use of natural resources.	06	CO2
III	Biodiversity– Definition– Values– Consumption use, productive social, ethical, aesthetic and option values threats to bio diversity – hotspots of bio diversity– conservation of bio- diversity: in– situ Ex– situ. Bio– wealth - National and Global level.	06	CO3
IV	Environmental Pollution :Definition– causes, effects and mitigation measures– Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution– Nuclear hazards – Solid wastes acid rain–Climate change and global warming environmental laws and regulations in India– Earth summit	06	CO4

V	Population and environment – Population explosion – Environment and human health – HIV/AIDS – Women and Child welfare – Disaster Management - Resettlement and Rehabilitation of people, Role of information technology in environmental health – Environmental awareness.	**06**	**CO5**

Text Book:	
1	Department of Biochemistry. Environmental Studies (Study Material). Published by K.S.Rangasamy College of Arts & Science (Autonomous). Tiruchengode.
Reference Book:	
1	*Erach Bharucha*. 2005. **Textbook of Environmental studies**. Universities press. PVT. Ltd

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO1	Describe the types of ecosystem and concepts in sustainable development
CO2	Explain the importance of natural resources and environmental problems
CO3	Recite about the biodiversity, hot spots of biodiversity and its conservation
CO4	Be conscious on the effects of pollution and population explosion
CO5	Implement the preventive measures for environmental issues

18UTALA301	**TAMIL – III:** காப்பியம் - சிற்றிலக்கியம**;**	பருவம் **- III**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

- தமிழ்க் காப்பியங்கள் தோற்றத்தையும்,காப்பிய இலக்கணத்தையும் காப்பியவகைகளையும் அறிமுகம் செய்தல்.
- சிற்றிலக்கியங்கள் தோற்றம்,வளர்ச்சிநிலைகளையும்,சிற்றிலக்கியங்களையும் அறிமுகம் செய்தல்.
- பகுபதஉறுப்புக்களைக் கற்பித்தல்.

Credits: 3 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	காப்பியங்கள் - சிலப்பதிகாரம் - வழக்குரைகாதை மணிமேகலை - மலர்வனம் புக்ககாதை.	10	**CO1**
II	பிறகாப்பியங்கள் - கம்பராமாயணம் - குகப் படலம் பெரியபுராணம் - இளையான்குடிமாறநாயனார் புராணம்.	10	**CO2**
III	சிற்றிலக்கியங்கள் - குற்றாலக் குறவஞ்சி– வசந்தவல்லியின் காதல் (1-10 பாடல்) கலிங்கத்துப் பரணி - பேய்களைப் பாடியது.	10	**CO3**
IV	இலக்கியவரலாறு - காப்பியங்கள் - ஐம்பெருங்காப்பியங்கள் - ஐஞ்சிறுகாப்பியங்கள் -புராணங்கள் - சிற்றிலக்கியங்கள்.	10	**CO4**
V	இலக்கணமும் மொழிப்பயிற்சியும் - பகுபதஉறுப்பிலக்கணம் - சீர் வகைகள் - வழூஉச் சொற்கள் - கடிதம் எழுதுதல்.	10	**CO5**

Text Book:

1	தமிழ்த்துறைவெளியீடு, கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி(தன்னாட்சி), திருச்செங்கோடு-637 215.

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	இரட்டைக் காப்பியங்களின் மேன்மைநிலையை உணர்தல்.
CO2	காப்பியக்காலகுடிகளின் நிலையை,உரிமையையுணர்தல்.
CO3	சிற்றிலக்கியங்களின் சிறப்பை உணர்தல்.
CO4	காப்பிய,சிற்றிலக்கியங்களின் வரலாறு குறித்த செய்திகளைஅறிதல்.
CO5	இலக்கணம் மற்றும் மொழிப்பயிற்சியின் அமைப்பை உணர்தல்.

18UENLA301	**FOUNDATION ENGLISH – III**	**SEMESTER – III**

COURSE OBJECTIVES:

The course aims

- To enable the students to develop their comprehensive skill
- To promote language skills through literature

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I & II	**ONE ACT PLAY** A. Ball - The Seven Slaves **PROSE** Somerset Maugham - Mr. Know –All **GRAMMAR** Degrees of Comparison **COMPOSITION** Advertisement **COMMUNICATION SKILLS** Speaking About Oneself The Media	**20**	**CO1 & CO2**
III & IV	**ONE ACT PLAY** R.H. Wood - Post Early for Christmas **PROSE** Satyajit Ray - Film Making **GRAMMAR** Determiners **COMPOSITION** Resume Writing	**20**	**CO3 & CO4**
	COMMUNICATION SKILLS Imagining Context specific expression - Master of Ceremonies		

V	**PROSE** Isai Tobolsky - Not Just Oranges **GRAMMAR** Reported Speech **COMPOSITION** Precise Writing **COMMUNICATION SKILLS** Inviting Personalities.	**10**	**CO5**

Text Books:	
1	*G.Damodar, D.Venkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli.* 2009. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad –500 029.
2	*Ramamurthy.K.S. 1984.* **Seven-Act Plays**. Published in India by Oxford University. New Delhi–110 001.
3	*Sasi Kumar V and Syamala V*. 2006. **Form and Function - A Communicative Grammar for Colleges.** Emerald Publishers. Chennai–600 008.
4	*T.M.Farhathullah.* 2006. **Communication Skills For Undergraduates**. Publishers-RBA Publications. Chennai–600 015.
Reference Books:	
1	*Raymond Murphy*. 1994. **Intermediate English Grammar.** Cambridge University India Pvt. Ltd, Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Know the different parts of genres in English
CO2	Trace the famous authors of English
CO3	Enrich their grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

18UCHM301	CORE V: GENERAL CHEMISTRY III	SEMESTER-III

COURSE OBJECTIVES:

The course aims

- To impart the properties of boron and carbon family elements
- To provide the basics of nuclear chemistry and its applications
- To recognize the preparation and properties of aldehydes, ketones and benzene
- To analyze the entropy and thermodynamic laws
- To recognize the qualitative techniques in laboratory and lab skills

Credits: 4 **Total hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Alkali metals** - Li, Na, K, Rb and Cs - Occurrence - comparative study of the elements with respect to oxides, hydroxides, halides and carbonates - Exceptional property of Lithium – Diagonal relationship of Li with Mg. **Alkaline earth metals** - Be, Mg, Ca, Sr and Ba - Occurrence - comparative study of the elements with respect to oxides, hydroxides, halides, sulphates and carbonates - Exceptional property of Beryllium - Diagonal relationship of Be with Al - Comparison of alkaline earth metals with alkai metals - Magnesium acting as bridge element between II-A and II-B groups.	8	CO1
II	**Alkyl halides:** General methods of preparation and properties - Nucleophilic substitution reactions SN_1 and SN_2 – Comparison of SN_1 and SN_2. Unsaturated halides: Vinyl chloride and Allylchloride - preparation, properties and uses. Nucleophilic substitution of Vinyl chloride and Allylchloride. **Alcohols:** Synthesis by Grignard method and	8	CO2

	oxomercuration method. Unsaturated alcohols: preparation, properties and uses of allyl alcohol. Thioalcohols - preparation, properties and uses.		
III	**Benzene:** Preparation – Aromatic character- Huckel's rule of aromaticity - Aromatic electrophilic substitution reactions of benzene - Mechanism of Nitration, sulphonation, halogenations, Friedel-Craft's Alkylation and Acylation. **Phenols:** Preparation, properties and uses - Kolbe's reaction - Reimer-Teiman reaction, Acidity of phenol. Napthol - Preparation and properties of α-napthol and β-napthol.	8	CO3
IV	**Thermodynamics:** Concept of entropy - Entropy change in isothermal expansion of an ideal gas - Entropy change in reversible and irreversible process - Entropy change of an ideal gas with change in P, V and T. Entropy of mixing. **Second law of thermodynamics:** Limitations of first law and need for second law. Cyclic process – Carnot's cycle - Carnot's theorem -Efficiency of a heat engine. Third law of thermodynamics - determination of absolute entropies - Exceptions to third law of thermodynamics – Zeroth law of thermodynamics.	8	CO4
V	**Qualitative Inorganic Analysis:** Dry test, flame test, Cobalt nitrate test - Wet confirmatory tests for acid radicals- Interfering acid radicals – Theory of Interference - Elimination of Interfering acid radicals. Group separation and confirmatory tests for basic radicals - Uses of complexing agents in qualitative analysis - common ion effect and solubility product - Role of solubility product in	8	CO5

	the precipitation of various cations in different groups in qualitative analysis.		

Text Books:	
1	*Bahl B.S.* and *Arun Bahl,* 1997. **Advanced Organic Chemistry.** [22nd Edition]. Sultan.
2	*Puri B. R., Sharma L. R.* and *Kalia K. K.,* 2017. **Principles of Inorganic Chemistry**. [Thirty third Edition]. Shoban Lal Nagin Chand & Co, New Delhi.
3	*Puri B. R., Sharma L. R.* and *Pathania M .S.,* 2017. **Principles of Physical Chemistry.** [Forty Seventh Edition]. ShobanLal, Nagin Chand & Co, New Delhi.
Reference Books:	
1	*Morrison R.T.* and *Boyd R.N.* 2010. **Organic Chemistry.** [Seventh Edition]. Allyn & Bacon Ltd, New York.
2	*Pine S. H.* 2010. **Organic Chemistry.** [Fifth Edition]. McGraw- Hill International Book Company, New Delhi.
3	*Lee J. D.* 2008. **Concise Inorganic Chemistry.** [Fifth Edition]. Black well science, UK.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the alkali metals and alkali earth metals
CO2	Knowledge about Alkyl halides and alcohols
CO3	Illustrate the Aldehyde, Ketone and Benzene
CO4	Identify the entropy change in chemical reactions
CO5	Demonstrate the inorganic qualitative analysis

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	L
CO2	L	H	M	L	M
CO3	M	L	H	H	L
CO4	M	M	L	M	H
CO5	M	H	H	L	H

H-High M-Medium L-Low

18UPHCHA301	ALLIED III: PHYSICS I	SEMESTER – III

COURSE OBJECTIVES:

The course aims

- To impart knowledge on the basic principles of Mechanics
- To inculcate the concepts of various properties of matter

Credits: 2 **Total hours: 35**

UNIT	CONTENTS	Hrs	CO
I	**Mechanics:** Projectile - Range up and down an inclined plane - Maximum range - Impulse and impact - Laws of impact - Coefficient of restitution - Direct impact between two spheres - Compound pendulum – Theory – Determination of acceleration due to gravity.	7	CO1
II	**Properties of Matter:** Newton's law of gravitation – Determination of gravitational constant – Boy's method – Bending of beams – Expressions for bending moment – Theory of uniform and nonuniform bending - Torsion expression for couple per unit twist - Torsion pendulum – Theory - Surface tension and interfacial surface tension by drop weight method.	7	CO2
III	**Heat:** Postulates of kinetic theory of gases – Vander Waal's equation - Derivation of critical constants in terms of Vander Waal's constants – Expressions for Vander Waal's constants - Thermal conductivity of a bad conductor - Lee's disc method – Joule-Thomson effect - Porous plug experiment - Theory - Liquefaction of Helium by K. Onnes method - Properties of Helium I and Helium II.	7	CO3
IV	**Optics:** Interference - Air wedge - Thickness of a wire - Jamin's Interferometer - Rayleigh's Interferometer -	7	CO4

	Polarization - Nicol prism as a polarizer and analyzer - Specific rotary power and its determination – Diffraction – Principle – Bragg's law - Fresnel's and Fraunhofer diffraction. **Sound:** Laws of transverse vibration of strings - Sonometer - Musical sound and noise - Characteristic of musical sound.		
V	**Electricity and Magnetism:** Potentiometer - Low range voltmeter and ammeter calibration - Theory of moving coil ballistic galvanometer – Determination of current and voltage sensitivities - Comparison of capacitances – Magnetic susceptibility - magnetic permeability - Properties of dia, para, ferro magnetic materials.	7	CO5

Text Books:	
1	*Murugesan, R. 2007.* **Allied Physics - I.** S. Chand & Company. New Delhi.
2	*Kamalakannan, D.* and *Rangarajan. C.* 1992. **Allied Physics Part - I.** [First Edition] S. Viswanathan Printers and Publishers Pvt. Ltd., Chennai.
Reference Books:	
1	*Brijlal* and *Subramanian.* 2004. **Optics.** S. Chand & Company. New Delhi.
2	*Mathur, D.S.* 1991. **Heat and Thermodynamics.** [Fifth Edition] Sultan Chand & Sons. New Delhi.
3	*Murugesan. R.* 2005. **Mechanics and Mathematical Method.** [Second Edition]. S. Chand & Company, New Delhi.
4	*Murugeshan. R.* 1995. **Electricity and Magnetism.** [First Edition]. S. Chand & Co, New Delhi
Web References:	
1	http://www.nptel.ac.in
2	https://ocw.mit.edu/courses/physics/

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Comprehend the motion of objects in various range and collision between them with suitable law
CO2	Apply knowledge of the properties of matter to understand the natural physical processes and related technological advances
CO3	Explain the basic concepts of heat like temperature measurement and specific heat measurement
CO4	Acquire the knowledge on light and sound
CO5	Describe the fundamentals of electricity and magnetism

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	L
CO2	H	H	M	M	L
CO3	M	L	H	H	M
CO4	M	H	M	L	H
CO5	L	M	H	H	M

H-High, M-Medium, L-Low

18UCHMP301	CORE PRACTICAL III: INORGANIC QUALITATIVE ANALYSIS	SEMESTER-III

COURSE OBJECTIVES:

The course aims

- To enable the students to develop analytical skills in inorganic qualitative analysis
- To appreciate the various coloured chemical reactions of metal ions

Credits: 3 **Total hours: 30**

CONTENTS	CO
Semi micro qualitative analysis:	
1. Mixture of cations of simple radicals to familiarize with the inter group separation techniques. 2. Semi micro qualitative analysis of inorganic salt mixtures containing one interfering acid radical. 3. Simple anions: Carbonate, nitrate, sulphate and chloride. 4. Interfering anions: Borate, fluoride, oxalate and phosphate. Cations: Group I cations: Lead, silver, mercurous. Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin. Group III cations: Aluminium, ferrous, ferric Group IV cations: Cobalt, nickel, manganese, zinc. Group V cations: Barium, strontium, calcium Group VI cations: Magnesium, ammonium (8 mixtures)	CO1& CO2

Reference Books:

1	V.V. Ramanujam, 1974. **Inorganic Semi Micro Qualitative Analysis** [3rd edition], The National Publishing Company, Chennai.
2	*Svehla, G.*, Sivasankar, B., 2012. **Vogel's qualitative Inorganic analysis.** [Seventh Edition]. Pearson Education India.
3	Basic Principles of Practical Chemistry V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Evaluate the difference between common and rare cations and analyse them by laboratory techniques
CO2	Differentiate the Cations systematically by intergroup separation technique

18UPHCHAP301	**ALLIED PRACTICAL I: PHYSICS I**	**SEMESTER – III**

COURSE OBJECTIVES:

The course aims

- To provide basic skills in measurements using microscope, telescope, spectrometer, potentiometer etc.
- To impart knowledge in properties of matter, light and electricity

Credits: 2 **Total Hours: 30**

EXPT NO.	**LIST OF EXPERIMENTS**	**CO**
1	Young's modulus - Non - uniform bending – Scale and telescope	CO1
2	Torsion pendulum – Rigidity modulus - without masses	
3	Compound pendulum – Gravity and radius of gyration	
4	Surface tension and interfacial surface tension – Drop weight method	
5	Potentiometer – Calibration of low range voltmeter	
6	Figure of merit of a galvanometer (Table galvanometer)	
7	Thermal Conductivity – Lee's disc method	
8	Spectrometer - Dispersive power of a prism (Angle of prism is given)	CO1
9	Sonometer - Frequency of a fork	
10	Air wedge – Thickness of a wire	

Text books:	
1	*Srinivasan, M.N, Balasubramanian, S* and *Ranganathan, R.* 2004. **A Book for Study of Practical Physics**. S. Chand & Co. New Delhi.
Reference Books:	
1	*Usha Rani, Subbarayan, A* and *Somasundaram.* 2007. **Practical Physics**. APSARA Publication, Trichy.
2	B.Sc., Physics Laboratory Manual of the year 2018 – 2019

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

Course outcome	
CO 1	Analyze the various physical parameters such as length and thickness, stress, strain and elastic limit needed to achieve a given amount of deformation in the given material using vernier scale, micrometer screw gauge and the travelling microscope, pin & microscope method and scale & telescope method

18UCHSB301	SBC I : FOOD CHEMISTRY	SEMESTER-III

COURSE OBJECTIVES:

The course aims

- To empathize adulteration in food
- To cognize the chemistry of food poisoning
- To compile the principles of food additives
- To recognize the chemistry of beverages
- To provide basic knowledge about edible oils

Credits: 2 **Total hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Food adulteration**- Sources of food, types, advantages and disadvantages. Food adulteration- Contamination of Wheat, Rice, Alial, Milk, Butter etc. with clay stones, water and toxic chemicals –Common adulterants-Ghee adulterants and their detection. Detection of adultered food by simple analytic techniques.	5	CO1
II	**Food poison** - Food poisons- Natural poisons (alkaloids – nephrotoxing)- Pesticides. (DDT, BHC, Malathion)- Chemical poisons-First aid for poison consumed victims.	5	CO2
III	**Food additives-**Food additives-Artificial sweeteners- Saccharin - Cyclomate and aspartate. Food flavours- esters, aldehydes and heterocyclic compound. Food colours- Emulsifying agents- Preservatives learning agents-Baking powder yeast- taste makers- MSG-vinegar	5	CO3
IV	**Beverages-**Soft drinks - soda-fruit juices - alcoholic beverages – Carbonation - addiction to alcohol - Cirrhosis of liver and social problems	5	CO4
V	**Edible oils -** Fats, Oils, - Sources of oils-Production of refined vegetable oils- preservation - Saturated and unsaturated fatty acids- Iodine value - Role of MUFA and PUFA in preventing heart diseases - Determination of iodine value and RM value, saponification values and their significance - Estimation of iodine and RM values in edible oils	5	CO5

Text books:	
1	*Seema Yadav,* 2006, **Food Chemistry**, Anmol publishing (P) Ltd, New Delhi
2	*Car H. Synder*, 1992, **The Extraordinary Chemistry for ordinary things**, John Wiley and Sons, New York
3	*Jayashree Ghosh*, 2008. **Fundamental concepts of applied chemistry**, S. Chand & Co., New Delhi.
Reference books:	
1	*Sivasankar, B*. 2005. **Food Processing and Preservation**. Prentice Hall of India (P) Ltd, New Delhi.
2	*Hosahalli Ramaswamy* and *Michele Marcotte*, 2009. **Food Processing – Principles**. CRC Press/Taylor & Francis, New York
3	*Garrow J. S* and *James W.P.T.* 1993. **Human Nutrition and Dietetics**. [Ninth Edition]. Churchill Livingstone,Tokyo
4	*Swaminathan M.* 1985. The Essential of Food and Nutrition, Ganesh and Company, Bangalore

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Revise the basic concepts of food adulteration
CO2	Analyse the chemistry of food poisoning
CO3	Predict the chemistry behind food additives
CO4	Recall the chemistry of beverages
CO5	Get the outline knowledge about the edible oils

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	L	H	M
CO2	M	L	H	M	L
CO3	L	H	M	H	M
CO4	M	L	H	L	H
CO5	M	M	L	H	M

H-High M-Medium L-Low

18ULS301	**CAREER COMPETENCY SKILLS I**	**SEMESTER – III**

COURSE OBJECTIVES:

The course aims

- To understand the basic needs of Communication
- To utilize the communication skills for achieving at the time of Interview

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar – Usage of English – Listening and Speaking (Level-1) Tenses and Voices (Present, Past and Future)	3	CO1
II	Sentence Correction – Sentence Pattern - Reading Comprehension (Level -1)	3	CO2
III	Expansion of Proverbs – Closet Test (Level -1)	3	CO3
IV	Sentence Improvement (Essay Writing, Now- a –Days Vocabulary), Story Writing	3	CO4
V	E-Mail Building (Sending call letters), Letters (Formal and Informal)	3	CO5

Text Books:

1. *Anne Seaton, Mew Y. H.* **Basic English Grammar for English-Book 1.** Learners Saddle point Publishers.
2. *Mark Newson.* **Basic English Syntax with Exercises.** (E-Copy)

Reference Book:

1. *Chand S, Agarwal R. S.* **Objective General English.** Arihant Publications (India) Limited.

After completion of the course, the students will be able to

CO1	Recall the basic grammar in English
CO2	Concentrate on Sentence Correction
CO3	Understand Paragraph Writing
CO4	Improve the ability of Sentence Construction and Story Writing
CO5	Format Web Writing and Formal Writing of letters.

18UCHAC301	ADD-ON COURSE : WATER QUALITY ANALYSIS AND TREATMENT	SEMESTER-III

COURSE OBJECTIVES

The course aims

- To provide knowledge about various characteristics of water
- To know the water softening and purification techniques
- To recognize the water treatment procedures and physical properties of water
- To estimate the quality of water by analysing techniques
- To evaluate the toxic behaviour of chemicals in water contamination

Total hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Introduction** - characteristics of water – Hard water- Soft water - alkalinity – hardness – Temporary & Permanent hardness– Unit of hardness - Total solids – Total Dissolved Solids.	5	CO1
II	**Water softening methods** - Clark's process - lime soda process - Permutit or zeolite process - Ion exchange process - demineralization of water.	5	CO2
III	**Hard water and industries** - industrial water treatment - boiler feed water - scales in boilers - Sludge. **Desalination of brackish water** - electrodialysis - Reverse osmosis.	5	CO3
IV	**Purification of water** - clarification - coagulation - sterilization & disinfection of water - precipitation - aeration - ozonisation - Chlorination.	5	CO4
V	**Determination of hardness of water** - Titration method - Complexometric method. **Analysis of water parameters** indicative of pollution - Dissolved oxygen - Bio Chemical Oxygen Demand (BOD) - Chemical Oxygen Demand (COD).	5	CO5

Reference Books:	
1	*Sharma B.K.,* 2014. **Industrial Chemistry (including chemical - engineering)**, Goel Publishing house, Meerut.
2	*Mahajan S.P.,* 2017. **Pollution control in process industries**, Tata McGraw - Hill Publishing Company Ltd., New Delhi.
3	*Varashney C.K.,* 2018. **Water Pollution and Management** [Second edition]. New Age International.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the source of fibres, Natural Cellulose fibre, Natural protein fibres
CO2	Explain the impurities of raw material fabrics
CO3	Illustrate the textile finishing of fabrics and methods
CO4	Discuss the Fastness properties of dyed material
CO5	Recognize the chemical structure, properties, production, uses of fibres

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	L
CO2	L	H	M	L	M
CO3	M	L	H	M	L
CO4	H	M	H	L	M
CO5	L	M	L	M	H

H-High M-Medium L-Low

18UTALA401	**TAMIL – IV:** சங்க இலக்கியம் - நீதி இலக்கியம்	பருவம் **- IV**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன :

- சங்க இலக்கியம், அற இலக்கியங்களின் சிறப்பைஉணர்த்துதல்.
- இலக்கண நூல்களைகாலவரிசைப்படிஅறியச் செய்தல்.
- அணி இலக்கணத்தின் சிறப்பைஉணரச் செய்தல்.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	எட்டுத்தொகை அ.நற்றிணை–அன்னாய் வாழிப்பத்து (பாடல் எண். 208, 209, 210) ஆ. குறுந்தொகை–யாயும் ஞாயும் (பாடல் எண்.40) இ. கலித்தொகை– ஆற்றுதல் என்பதொன். (பாடல் எண்.103) ஈ. புறநானூறு –பல்சான்றீரேபல்சான்றீரே (பாடல் எண்.195)	**10**	**CO1**
II	பத்துப் பாட்டு அ. குறிஞ்சிப்பாட்டு (1 முதல் 106 அடிகள் வரை) -கபிலர்	**12**	**CO2**
III	அற இலக்கியங்கள் அ. நாலடியார் -பாடல் எண் (35,59,94,141,333) ஆ. நான்மணிக்கடிகை - பாடல் எண் (04,09,59,69,80) இ. பழமொழி-பாடல் எண் (05,21,120,149,361) ஈ. சிறுபஞ்சமூலம் - பாடல் எண் (05,17,48,83,99)	**10**	**CO3**
IV	இலக்கியவரலாறு அ. சங்க இலக்கிய நூல்கள் அறிமுகம் ஆ. முச்சங்கவரலாறு இ. தமிழ் இலக்கண நூல்கள் அறிமுகம் ஈ. அற இலக்கியங்கள் அறிமுகம்	**10**	**CO4**
V	இலக்கணம் அ. அணி இலக்கணம் 1. உவமைஅணி 2. உருவகஅணி 3. வேற்றுமைஅணி 4. வஞ்சப்புகழ்ச்சிஅணி ஆ. அகத்திணைகள்,புறத்திணைகள் - விளக்கம்	**08**	**CO5**

Text Book:	
1	தமிழ்த்துறைவெளியீடு,கே.எஸ்.ரங்கசாமிகலைஅறிவியல் கல்லூரி(தன்னாட்சி), திருச்செங்கோடு– 637 215.

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	எட்டுத்தொகை நூல்களின் சிறப்பை அறிதல்
CO2	பத்துப்பாட்டு நூல்களின் சுவை அறிதல்
CO3	அற இலக்கியங்கள் பற்றிஅறிதல்
CO4	இலக்கியங்கள் தோற்றமுறையை அறிதல்
CO5	அணி இலக்கணத்தின் பயன் பற்றிஅறிதல்.

18UENLA401	**FOUNDATION ENGLISH – IV**	**SEMESTER – IV**

COURSE OBJECTIVES:

The course aims

- To promote communication skills through literature
- To enhance the language learning through activities

Credits: 3 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I & II	**ONE ACT PLAY** Monica Thorne - The King Who Limped **PROSE** A.G.Gardiner - On Shaking Hands **GRAMMAR** Punctuation **COMPOSITION** Hints Development **COMMUNICATION SKILLS** Breaking the Law Honoring the Person	**20**	**CO1 & CO2**
III & IV	**ONE ACT PLAY** Ella Adkins – The Unexpected **PROSE** Minoo Masani - No Man is an Island **GRAMMAR** Conditional Clause **COMPOSITION** Report Writing **COMMUNICATION SKILLS**	**20**	**CO3 & CO4**
	Brain Storming		

V	**PROSE** Arnold Toynbee - India's Contribution to World Unity **GRAMMAR** Simple, Compound and Complex Sentences **COMPOSITION** Jumbled Sentence **COMMUNICATION SKILLS** Role-Play	**10**	**CO5**

Text Books:	
1	*Ramamurthy*.K.S. 1984. **Seven-Act Plays**. Published in India by Oxford University. New Delhi–110 001.
2	*Damodar.G, D.Venkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli. 2009*. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad –500 029.
3	*SasiKumarV and SyamalaV*. 2006. **Form and Function - A Communicative Grammar for Colleges.** Emerald Publishers. Chennai–600 008.
4	*Farhathullah.T.M.* 2006. **Communication Skills for Undergraduates**. RBA Publications. Chennai–600 015.
Reference Books:	
1	*Raymond Murphy*. 1994. **Intermediate English Grammar.** Cambridge University India Pvt. New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Understand the text on the basis of close reading analytically and critical views.
CO2	Ability to construct a sustained sophisticated and original argument on a specific topic.
CO3	Acquire language skills through composition.
CO4	Acquire both composition and communication skills.
CO5	Apply basic communication skills.

18UCHM401	CORE VI: GENERAL CHEMISTRY IV	SEMESTER-IV

COURSE OBJECTIVES:

The course aims

- To recognize the properties of nitrogen and oxygen group elements
- To estimate the properties and preparations of carboxylic acids, dicarboxylic acids, ethers and nitro compounds
- To evaluate the free energy functions
- To recall the principles involving in the qualitative inorganic analysis
- To cognize the basic gas laws of physical chemistry

Credits: 4 **Total hours: 40**

UNIT	CONTENTS	Hrs.	CO
I	**Boron family** - General Characteristics – oxidation states, metallic character and inert pair effect – Acid strength of trihalides of boron – Preparation properties and structure of boric acid, diborane, Borazole and boron nitride. Uses. **Carbon family** - General characteristics - oxidation states, metallic character, inert pair effect and catenation. Allotropy - graphite, diamond and fullerenes. Differences between CO_2 and SiO_2. Silicones - Preparation and applications.	8	CO1
II	**Nitrogen family** – General characteristics - Anomalous behavior of nitrogen - a comparative study on hydrides, halides and oxides of nitrogen group elements. Oxyacid of nitrogen (HNO_2, HNO_3). Preparation and properties of hydrazine. **Oxygen family** - General characteristic - Anomalous behavior of oxygen - Preparation, properties, structure and uses of sulphuric acid, Caro's acid, Marshall's acid -	8	CO2

	Classification of oxides based on oxygen content-normal oxides, peroxides, superoxide, dioxides, sub oxides and mixed oxides.		
III	**Aldehydes and ketones:** Structure and Bonding - General methods of preparation - Properties of aliphatic aldehydes and ketone. Hydration of Aldehydes and Ketones – In acid solution and In basic solution – Cyanohydrin formation - Preparation, properties and uses of formaldehyde and benzaldehyde – Acetal formation. Aldol Condensation – Pinacol Pinacolone rearrangement.	8	CO3
IV	**Carboxylic acids** - Preparation - properties - acidity of carboxylic acids - Influence of substituents on acidity. Benzoic acid - Preparation and properties. **Dicarboxylic acids:** Preparation and properties of oxalic acid and succinic acid - Action of heat on dicarboxylic acids. **Unsaturated acids**: Preparation and properties of crotonic, acrylic and cinnamic acids**. Hydroxy acids:** Preparation and properties of lactic acid.	8	CO4
V	Free energy functions - Gibbs and Helmholtz free energy - Free energy variation with T, P and V. Criteria for spontaneity and equilibrium. Gibbs - Helmholtz equations - Maxwell relations. Partial molar properties - Chemical potential - variation of chemical potential with T and P. Gibbs Duhem equation - Chemical potential in a system of ideal gases. Reaction isotherm variation of equilibrium constant with temperature - Van't Hoff equation - Van't Hoff isochore.	8	CO5

Text Books:	
1	*Bahl B.S.* and *Arun Bahl,* 1997. **Advanced Organic Chemistry.** Sultan.
2	*Puri P. R., Sharma L. R.* and *Pathania M. S.* 2010. **Principles of Physical Chemistry**, Vishal Publishing Co, Jalandhar.
3	*Venkateswaran V, Veeraswamy R., Kulandaivelu A.R.,* 1997. **Basic Principles of Practical Chemistry**, (Second edition), New Delhi, Sultan Chand & sons.
Reference Books:	
1	*Morrison R.T.* and *Boyd R.N.* 2010. **Organic Chemistry.** [Seventh Edition]. Allyn & Bacon Ltd, New York.
2	*Pine S. H.* 2010. **Organic Chemistry.** [Fifth Edition]. McGraw- Hill International Book Company, New Delhi.
3	*Lee J. D.* 2008. **Concise Inorganic Chemistry.** [Fifth Edition]. Black well science, UK.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse the characteristics, preparation, uses of Boron family and Carbon Family
CO2	Recognize source of Nitrogen family, Anomalous behaviour of nitrogen, oxyacids of nitrogen
CO3	Illustrate the preparation, properties, structure and uses of sulphuric acid, Caro's acid, Marshall's acid
CO4	Explain the chemistry of dicarboxylic acid and unsaturated acids
CO5	Distinguish the primary, secondary and tertiary amines

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	L	H	L
CO2	L	H	M	M	M
CO3	M	L	H	M	L
CO4	M	H	L	H	M
CO5	L	M	M	L	H

H-High M-Medium L-Low

18UPHCHA401	ALLIED IV: PHYSICS II	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To impart knowledge on the basic principles of Atomic Physics, Nuclear Physics, Basic Electronics and Digital Electronics
- To impart knowledge on the basic principles of laser optics and spectroscopy

Credits: 2 **Total hours: 35**

UNIT	CONTENTS	Hrs.	CO
I	**Atomic Physics:** Bohr Atom model - Spectral series of hydrogen - Vector atom model - Spatial quantization - Spinning electron - Quantum numbers associated with vector atom model - Coupling schemes – LS coupling - JJ Coupling – Pauli's exclusion principle - Example of electron configuration - Photoelectric effect - Laws - Einstein's equation.	7	CO 1
II	**Nuclear Physics:** Radioactivity - Properties of α, B, γ rays – Laws of radioactivity - Half-life and Mean-life - Nuclear models –Liquid drop model - Semi-empirical mass formula - Merits and demerits - Shell model – Evidences - Nuclear radiation detectors – Ionization chamber – G.M counter - Particle accelerator - Cyclotron – Synchrocyclotron.	7	CO 2
III	**LASER Physics:** LASER - Characteristics of laser – Theory of laser – Population inversion – Optical pumping – Construction and working of: Ruby laser – He-Ne laser – Semiconductor laser – Application of laser. **Spectroscopy:** Types of spectra - Emission and absorption spectra - Raman Effect – Quantum theory of Raman Effect – Experimental study of Raman Effect – Application of Raman effect.	7	CO 3
IV	**Basic Electronics:** Junction diode - Zener diode – Characteristics – Half & Full wave rectifiers - Construction and characteristics of transistors (common emitter only) - Oscillators - Hartley oscillator - Astable multivibrator - Construction and characteristics of FET.	7	CO 4

V	**Digital Electronics:** Binary, Octal, Hexadecimal numbers and their conversion – Basic logic gates, their truth tables - Laws of Boolean algebra – De'Morgan's theorem - NAND/NOR as universal blocks.	7	CO 5

Text Books:	
1	*Murugesan. R. 2007.* **Allied Physics - II.** S. Chand & Company. New Delhi.
Reference Books:	
1	*Murugesan, R.* 2007. **Modern Physics.** S. Chand & Company Limited, New Delhi.
2	*Metha, V.K.* 2002. **Principles of Electronics**. [Eleventh Edition] S. Chand & Company Limited, New Delhi.
3	*Avadhanula, M.N.* 2001. **An Introduction to Laser Theory and Application.** S. Chand & Company, New Delhi.
4	*Brijlal and Subramanian.* 2005. **Atomic and Nuclear Physics.** S. Chand & Company Limited, New Delhi.
Web References:	
1	http://www.nptel.ac.in
2	https://ocw.mit.edu/courses/physics/

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Know the basic principles of atomic structure of atom, photo electricity and atom models
CO2	Acquire knowledge in nuclear physics related various theoretical models
CO3	Assess the properties of new laser systems based on knowledge of their design and spectroscopy applications.
CO4	Know the unique vocabulary associated with electronics and explain the basic concepts of semiconductor devices.
CO5	Comprehend the concepts of number systems, logic gates and Boolean algebraic functions.

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	M	M
CO2	H	M	M	M	M
CO3	M	L	M	H	M
CO4	M	H	M	L	H
CO5	L	M	H	H	H

H-High M-Medium L-Low

18UCHMP401	CORE PRACTICAL IV: PHYSICAL PRACTICAL	SEMESTER - IV

COURSE OBJECTIVES:

The course aims

- To provide practical skills on Experiments in chemical kinetics, phase rule, Chemical equilibrium
- To study the kinetics reactions practically
- To practically conduct Conductivity measurements by different types of chemicals
- To learn the fundamentals of conductometric and potentiometric titrations
- To impart the basic principles of acid hydrolysis and phase diagram

Credits: 3 **Total Hours : 30**

EXPT NO.	CONTENTS	CO
Titrimetric Quantitative Analysis		
1	**Distribution Law**: Partition coefficient of Iodine between water and carbon tetrachloride.	CO1
2	Determination of rate constant-Acid catalysed hydrolysis of an ester (methyl acetate or ethyl acetate)	CO1
3	Determination of rate constant for the reaction between potassium iodide and potassium persulphate	CO1
4	Molecular weight determination by Rast method	CO1
5	Effect of impurity on CST of Phenol-water system and determination of concentration of sodium chloride, succinic acid	CO1
6	Phase diagram of a simple eutectic system and determination of unknown composition	CO1
7	Determination of transition temperature of hydrated salts-sodium thiosulphate, sodium acetate, strontium chloride and manganous chloride.	CO2
8	Conductivity measurement by determination of cell constant	CO2
9	Conductometric titration - acid base titration	CO2
10	Potentiometric titration - acid base titration	CO1

Text books:	
1	*Gurthu J.N.* and *Kapoor R.,* 1987. **Advanced Experimental Chemistry**, S.Chand& Co., New Delhi.
2	*Sundaram*, *Krishnan* and Raghavan. 1996. **Practical Chemistry (Part II), S**. Viswanathan Co. Pvt, Chennai.
Reference Books:	
1	*David P., Shoemaker,* Garl and C. W. and *Nibler J. W.* 1989. **Experiments in Physical Chemistry**, [Fifth edition], McGraw-Hill Book Company, New Delhi

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize various physical techniques and principles of kinetics
CO2	Estimate the conductometric and potentiometric titrations using different chemicals at various concentrations

18UPHCHAP401	ALLIED PRACTICAL II: PHYSICS II	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To provide basic skills in physical properties of the materials using microscope, telescope, spectrometer, potentiometer etc.
- To impart knowledge in properties of matter, light and electricity

Credits: 2 **Total Hours : 30**

EXPT NO.	CONTENTS	CO
Titrimetric Quantitative Analysis		
1	Torsion pendulum – Rigidity modulus – with masses	CO1
2	Young's modulus - Uniform bending – Scale and telescope	
3	Potentiometer –Calibration of high range Ammeter.	
4	Spectrometer - Grating - wavelength of Mercury spectrum.	
5	Newton's ring –Radius of curvature.	
6	Zener diode – VI–Characteristics, Breakdown voltage and voltage regulator.	CO2
7	Bridge rectifier with voltage regulator.	
8	Characteristics of FET.	CO3
9	Basic logic gates - Verification of truth tables.	
10	NAND and NOR as universal gates.	

Text books:	
1	*Srinivasan, M.N, Balasubramanian, S* and *Ranganathan, R.* 2004. **A Book for Study of Practical Physics**. S. Chand & Co. New Delhi.
Reference Books:	
1	*Usha Rani, Subbarayan, A* and *Somasundaram.* 2007. **Practical Physics**. Apsara Publication, Trichy
2	*Arora, C.L.* 1995**. B.Sc., Practical Physics.** S. Chand & Co. New Delhi.
3	*Ouseph.C.C, Rao.U.J, Vijayendran, S.* 2009. **Practical Physics and Electronics.** Viswanathan, S., Printers & Publishers Pvt Ltd, Chennai
4	B.Sc., Physics Laboratory Manual of the year 2018 – 2019

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse the various physical properties of the various materials
CO2	Analyse the basic characterization of semiconductor devices
CO3	Examine the arithmetic and logical operations through the digital circuits

18UCHSB401	SBC II: TEXTILE CHEMISTRY	SEMESTER-IV

COURSE OBJECTIVES:

The course aims

- To impel knowledge about the textile terminology.
- To estimate the characteristics of different textile fibres, yarn and fabric
- To evaluate the purification techniques from impure fibre
- To cognize the dyeing processes of various fibres
- To evaluate the finishing processes in textile processing

Credits: 2 **Total hours: 25**

UNIT	CONTENTS	Hrs	CO
I	General classification of fibres - Chemical structure – production – properties - uses of the following natural fibres - Natural cellulose fibres (cotton and jute) - natural protein fibre (wool and silk).	5	CO1
II	Chemical structure – production – properties - uses of the following synthetic fibres - Man made cellulose fibres (Rayon, modified cellulose fibres) - polyamide fibres (different types of nylons) - poly ester fibres.	5	CO2
III	Impurities in raw cotton and grey cloth – wool – silk - General principles of the removal – scouring – bleaching – Desizing - Kier boiling - Chemicking.	5	CO3
IV	Dyeing - Dyeing of wool and silk - fastness properties of dyed materials - dyeing of nylon, terylene and other synthetic fibres.	5	CO4
V	**Textile Finishes:** Mechanical and functional finishes and their importance; Finishing - finishes given to fabrics - Mechanical finishes on cotton, wool and silk - method used in process of mercerizing – Anti - crease and Anti-shrink finishes - water proofing.	5	CO5

Text Books:	
1	*Hall, A. J.*, 1966**. Student Text book of Textile Science.** Allman and sons, Kingsley.
2	*Kapur, K.*, 2011. **Text book of Applied Chemistry**. Macmillan Publishers India.
Reference Books:	
1	*Sadov, F, Korchagin, M.,* and *Matetshy, A.* 1973. **Chemical Technology of Fibrous Materials**, Mir Publishers.
2	*Marjory L. Joseph, Peyton Hudson, Anne Clapp*. 1992. **Introduction to Textile Science** [Sixth edition] Holt, Rinehart and Winston, Incorporated.
3	*Peters, R.H.* 1963. **Textile Chemistry, Vol II**. Elseries, Avesterdam.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the source of fibres, Natural Cellulose fibre, Natural protein fibres
CO2	Explain the impurities of raw material fabrics
CO3	Illustrate the textile finishing of fabrics and methods
CO4	Discuss the Fastness properties of dyed material
CO5	Recognize the chemical structure, properties, production, uses of fibres

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	L	H	L
CO2	L	H	M	M	M
CO3	M	L	H	H	L
CO4	H	M	L	L	M
CO5	M	L	H	M	H

H-High M-Medium L-Low

18UCHAC401	ADD-ON COURSE: CHEMISTRY OF MILK AND MILK PRODUCTS	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To provide information about contents of milk
- To enable the students to know about lipids and proteins
- To agnize the processing techniques of milk
- To impart knowledge about categories and contents of milk

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Milk:** Composition and structure. Properties: Flavour and aroma – Density – viscosity – Freezing point – optical properties – effect of heat on milk. **Milk Lipids:** Structure – Chemical properties – physical properties – Fat globules - functional properties.	5	CO1
II	**Milk Proteins:** Fractionation – Casein- structure and types – Micelle aggregation. Whey proteins and its types. Enzymes: Lipoprotein lipase (LPL), Plasmin, Alkaline phosphate. SNF Contents in Milk.	5	CO2
III	**Milk Processing**: Clarification – Pasteurization – Homogenized Milk –Whole Milk. Test for adulteration in Milk. Estimation of fat content in milk – Lactose crystallization.	5	CO3
IV	**Milk catagories :** Skimmed milk powder – Whole Dry Powder – Buttermilk Powder – Condensed milk – Evaporated milk – Dried milk – Manufacture of Dry Whole milk powder. Spray Drying – Drum Drying .	5	CO4
V	**Milk contents :** Milk fat – Milk SNF – Sweeteners – Stabilizers – Emulsifiers – Polysorbate 80. Preparation : Butter, Ghee, Cheese, Ice cream.	5	CO5

Text books:	
1	*Sharma, B. K.,* 2014. **Industrial Chemistry.** Goel Publishing House.
2	*K Bagavathi Sundari* **Applied Chemistry** Mjp publishers
3	Dr. Jayashree ghosh, 2006. **Fundamental concepts of applied chemistry**. S. Chand publications.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the composition and structure of milk
CO2	Explain the properties of lipids and proteins
CO3	Illustrate the milk processing techniques
CO4	Discuss the categories of milk
CO5	Recognize the contents of milk and products prepared from milk

MAPPING:

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	L	M	L	H
CO2	H	L	H	H	L
CO3	M	H	L	H	M
CO4	M	L	H	M	M
CO5	L	M	H	L	M

H-High M-Medium L-Low

18ULS401	CAREER COMPETENCY SKILLS II	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To impart knowledge on the aptitude skills
- To enhance employability skills and to develop career competency

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Aptitude: Speed Maths - Multiplication of Numbers - Simplification - Squaring of numbers - Square roots and cube roots – HCF & LCM –Decimals - Averages, Powers and Roots.	3	CO1
II	Aptitude: Problems on Numbers – Problems on Ages – Surds & Indices – Percentage – Profit & Loss – Ratio & Proportion – Partnership – Chain Rule.	3	CO2
III	Aptitude: Simple & Compound Interest – Alligation or Mixture - Permutation and Combination.	3	CO3
IV	Aptitude: Probability – Missing Number series – Wrong Number Series – Races & Games of Skill.	3	CO4
V	Aptitude: Time & Work – Pipes & Cistern – Time & Distance – Problems on Trains – Boats and Streams.	3	CO5

Text Book:	
1	*R.S. Aggarwal.* 2017. **Quantitative Aptitude**, *S Chand and Company Limited, New Delhi.*
Reference Book:	
1	*Abhijith Guha.* 2015. **Quantitative Aptitude for Competitive Examinations**, *5th Edition, Tata McGraw Hill, New Delhi.*

COURSE OUTCOMESS (CO)

After completion of the course, the students will be able to

CO1	Carry out mathematical calculations using shortcuts.
CO2	Calculate problems on age, surds and indices with shortcuts
CO3	Understand the core concepts of SI and CI, Permutation and Combination.
CO4	Obtain knowledge on shortcuts to calculate number series.
CO5	Perform new methods for aptitude calculations.

18UCHNM301	**NMEC I: APPLIED CHEMISTRY I**	**SEMESTER – III**

COURSE OBJECTIVES:

The course aims

- To provide a valuable theoretical introduction about the chemicals which are used in our daily life
- To strengthen the background of the students and provide basic knowledge in chemical substances which deals with Food Chemistry, Detergents, Flavours, effect of smoking and polymers products used in our daily life
- To provide the basic concepts of polymer manufacture and its impact on society

Credits: 2 **Total hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Food Chemistry:** Adulteration Definition - common adulterants in food - simple screening test for adulteration. Food additives – Introduction – types - function – Acidulants - Antimicrobial agent – Emulsifying - Texturing agent - Anti oxidant – Humectants - Colouring agent - Flavouring agent - Sweetener.	5	CO1
II	**Leather Chemistry :** Introduction - chief processes used in leather manufacture, structure of hide and skin, leather processing - process before tannage - tanning process - vegetable tanning and chrome tanning - tannery effluent treatment.	5	CO2
III	**Dairy Chemistry:** Milk - Definition, properties of milk, constituents of milk, chemical change taking place in milk while heating - boiling, pasteurization, sterilization and homogenization. Definition and composition of creams, butter, ghee and ice creams. Milk powder definition. Drying processes. Spray drying and drum drying.	5	CO3
IV	**Soil Chemistry:** Introduction – Classification – physical & chemical properties of soil – soil minerals – pH – acidity – salinity – alkalinity- soil fertility	5	CO4

V	**Chemistry in daily life:** Manufacture- composition – uses - Safety matches – Agarbattis - Naphthalene balls - Wax – candles - Shoe polish - Gum paste - Writing/fountain pen ink - Chalk crayons.	5	CO5

Text books:	
1	*Jayashree Ghosh.* 2006. **Fundamental concepts of Applied chemistry** [First edition]. *S.Chand* and Company Ltd, New Delhi.
Reference Books:	
1	*Belitz H. D.* and *Grosch W.* Peter Schieberle, 2009. **Food Chemistry** [Fourth edition], Springer.
2	*Damodaran S., Parkin K. L.* and*Fennema O. R.,* 2017. **Fennema's Food Chemistry** [Fifth edition], CRC Press.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the source of fibres, Natural Cellulose fibre, Natural protein fibres
CO2	Explain the impurities of raw material fabrics
CO3	Illustrate the textile finishing of fabrics and methods
CO4	Discuss the Fastness properties of dyed material
CO5	Recognize the chemical structure, properties, production, uses of fibres

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	M	H	L
CO2	L	H	L	M	M
CO3	M	L	H	H	L
CO4	L	M	H	M	L
CO5	M	H	L	L	M

H-High M-Medium L-Low

18UCHNM401	NMEC II: APPLIED CHEMISTRY II	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To provide a valuable theoretical introduction about the nanomaterials.
- To strengthen the background of the students and provide basic knowledge about water analysis, quality, agrochemicals, pesticides, lubricants and chemicals which are used in our daily life.
- To empathize the vitality of chemistry in daily life and its prime importance

Credits: 2 **Total hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Nano-materials**: Introduction to nano – materials – Graphite – fullerenes - carbon nanotubes – nanowires - Nano cones – Haeckelites - Their electronic & mechanical properties - Applications of nano-materials.	5	CO1
II	**Water-Water quality parameters**: Definition - expression - Estimation of hardness (EDTA method) – Alkalinity (Titrimetry) - Water softening (zeolite) - Demineralisation (Ion- exchangers) and desalination - Domestic water treatment.	5	CO2
III	**Chemistry of agrochemicals**: Insecticides – DDT – BHC -, Malathion - parathion. Herbicides - 2,4-dichloro phenoxy acetic acid - Fungicides - Boardeaux mixture - Copper oxychloride – Rodenticides - Sodium monofluoroacetate - Zinc phosphide – Plant growth Modifiers - Growth Regulators.	5	CO3
IV	**Lubricants**: Definitions – classification - Characteristic properties - Problems on acid value - saponification value - Theories of lubrication - Additives of lubricants - selection of lubricant – Flash point – Fire point.	5	CO4
V	**Chemicals in daily life:** Preparation – properties – uses of Soap, Detergent, Shampoo, Tooth paste – Whitener – Fragrance – Insecticide – Paint - Fertilizer.	5	CO5

Text books:	
1	*Jayashree Ghosh.* 2006. **Fundamental concepts of Applied chemistry**, S.Chand and Company Ltd, New Delhi.
2	*Roussak, O.V. and Gesser, H. D.,* 2013. **Applied Chemistry, a textbook for engineers and technologists,** [Second edition]. Springer.
3	*Chautan, B. S.,* 2013. **Applied Chemistry**. Vayu Education of India.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the source of fibres, Natural Cellulose fibre, Natural protein fibres
CO2	Explain the impurities of raw material fabrics
CO3	Illustrate the textile finishing of fabrics and methods
CO4	Discuss the Fastness properties of dyed material
CO5	Recognize the chemical structure, properties, production, uses of fibres

MAPPING:

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	L	M	H	L
CO2	L	H	M	H	M
CO3	M	L	H	H	M
CO4	L	M	L	M	H
CO5	M	H	M	L	M

H-High M-Medium L-Low

18UCHAL401	ADVANCED LEARNERS COURSE: CHEMISTRY IN DAILY LIFE I	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To provide the importance of chemistry in daily life
- To enable the students to know the working and chemistry behind batteries
- To agnize the preparation and properties of glass and ceramics
- To impart knowledge about global warming

UNIT	CONTENTS	CO
I	**Glass:** General properties of glass - types of glass - manufacture of glass – **Ceramics:** classification and manufacturing process. **Paints and varnishes:** definition – classification – characteristics – constitution - requisites of good paint - uses of paints and varnishes.	CO1
II	**Batteries:** Definition – classification - primary battery & secondary battery – examples - lead acid battery - Dry Battery – Li ion Battery - F**uel cells -** working – types - Hydrogen oxygen fuel cell.	CO2
III	**Chemistry of global warming**: Greenhouse effect - earth's energy balance - vibrating molecules and the greenhouse effect - molecular response to radiation - methane and other greenhouse gases - climate modelling.	CO3
IV	**Radiation chemistry**: Nuclear fission - nuclear fusion – Hydrogen bomb – atom bomb - nuclear reactor - radioactivity and the hazards of radioactivity.	CO4
V	**Fuels:** Definition, calorific value, determination of calorific value - Classification of fuels – solid, liquid and gaseous fuels, Fossil fuels, Rocket fuels and nuclear fuels - advantages and disadvantages of solid fuels over liquid and gaseous fuels. Energy – unit of energy, sources of energy, renewable and non-renewable, conventional and non-conventional energies	CO5

Text books:	
1	*Sharma, B. K.,* 2014. **Industrial Chemistry.** Goel Publishing House.
2	M.Gopala Rao & Marshall Sittig, 1997. **Outlines of Chemical Technology -** [Third Edition]. East-west press.
3	Dr. Jayashree ghosh, 2006. **Fundamental concepts of applied chemistry**. S. Chand publications.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the source of glass and ceramics
CO2	Explain the principles and working of battery
CO3	Illustrate the causes and prevention of global warming
CO4	Discuss the properties of radiation and its effects
CO5	Recognize the impact of pollution and its prevention

MAPPING:

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	H	L	H	L
CO2	L	H	H	M	M
CO3	H	L	M	L	H
CO4	L	M	H	L	M
CO5	M	L	M	H	L

H-High M-Medium L-Low

18UCHAL402	ADVANCED LEARNERS COURSE: CHEMISTRY IN CONTEXT	SEMESTER – IV

COURSE OBJECTIVES:

The course aims

- To provide knowledge about the chemistry of leathers
- To estimate the properties of milk and milk products
- To impart the vital role of amino acids and proteins
- To gain knowledge about the Hormones
- To recognize the biological importance of inorganic elements and its compounds

UNT	CONTENTS	CO
I	**Leather Chemistry :** Introduction - chief processes used in leather manufacture, structure of hide and skin, leather processing - process before tannage - tanning process - vegetable tanning and chrome tanning - tannery effluent and by-products treatment.	CO1
II	**Soil Chemistry:** Classification of Soil colloids – organic colloid – inorganic colloid – types of inorganic colloid – anion exchange – cation exchange. **Properties of Soil Colloids:** Electrical properties – Dispersion – Coagulation – Tyndal phenomenon – Brownian movement – Dialysis.	CO2
III	**Role of Medicinal Inorganic Compounds:** Alum – Phosphoric acid – Ferric Ammonium Citrate – Preparation, properties and uses.	CO3
IV	**Biological role of Inorganic compounds**: Sodium and its compounds - potassium and its compounds - calcium and its compound - Iodine and its compound - Plaster of Paris - Copper and its compound - Zinc	CO4
V	**Oils:** Definition – Classification – Properties and uses – Animal oil – Vegetable oil – Mineral Oil . **Fat:** Definition – functional properties – types – uses – effects on health	CO5

Text books:	
1	*Sharma, B. K.,* 2014. **Industrial Chemistry.** Goel Publishing House.
2	Dr. Jayashree ghosh, 2006. **Fundamental concepts of applied chemistry**. S. Chand publications.
3	*Bahl B.S.* and *Arun Bahl*, 2016. **Advanced Organic Chemistry.** [Twenty Second Edition]. Sultan Chand & Co., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recognize the source of glass and ceramics
CO2	Explain the principles and working of battery
CO3	Illustrate the causes and prevention of global warming
CO4	Discuss the properties of radiation and its effects
CO5	Recognize the impact of pollution and its prevention

MAPPING:

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	H	L	H	L
CO2	L	H	H	M	M
CO3	H	L	M	L	H
CO4	L	M	H	L	M
CO5	M	L	M	H	L

H-High M-Medium L-Low

GUIDELINES

1. Submission of Record Note Books:

Candidates appearing for Practical Examinations and Project Viva-voce shall submit Bonafide Record Note Books otherwise the candidates will not be permitted to appear for the Practical Examinations.

2. Passing Minimum and Internal Mark Distribution (Theory and Practical) I. Theory

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Theory paper with a passing minimum of 30 marks in External out of 75.

Internal Mark Distribution [CA-Total Marks: 25]

Attendance : 05
Marks Assignment :
05 Marks Internal Examinations
: 15 Marks **Total**
: 25 Marks

II. Practical

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Practical paper with a passing minimum of 24 marks in External out of 60.

Internal Marks Distribution [CA- Total Marks: 40]

Experiment : 10
Marks Attendance :
5 Marks Record
: 5 Marks Internal Examinations
: 20 Marks
Total : 40 Marks

3. CAREER COMPETENCY SKILLS

- **Viva voce– Semester III**
  - The student has to come in proper dress code for the Viva Voce
  - Questions will be asked to evaluate the reading, speaking and listening skills of the students.
  - E-mail and Letter drafting exercises will be given.

- **On Line Objective Examination (Multiple Choice questions) – Semester IV**
  - 100 questions-100 minutes
  - Twenty questions from each UNIT.
  - Online examination will be conducted at the end of the IV Semester.

4. PRACTICALS

Core Practical I: Volumetric Analysis and Inorganic Preparations (18UCHMP101) Marks distribution: 60 Marks

Volumetric analysis	
Experiment	: 40
Procedure	: 10
Inorganic Preparation	
Crude preparation	: 05
Recrystallization	: 05
Total marks	**: 60 Marks**

Percentage of error allowed in Results

0-2% -40 marks
2-3% -35 marks
3-4% -30 marks
4-5% -25 marks
>5% -10 marks

Core Practical II: Organic Qualitative Analysis (18UCHMP201) Marks distribution: 60 Marks

Organic analysis

Procedure : 10
Marks Aromatic/Aliphatic :
5 Marks Saturated/Unsaturated
: 6 Marks Special elements (N/S/X)
: 9 Marks Function groups

: 10 Marks Confirmation test
: 10 Marks Derivative
: 10 Marks **Total marks**
: 60 Marks

Core Practical III: Inorganic Qualitative Analysis (18UCHMP301) Marks distribution: 60 Marks

Procedure : 10
Marks Group separation : 20 Marks
Cations & Anions (4x5) : 20 Marks
Results : 10 Marks
Total marks : 60 Marks

Core Practical IV: Physical Chemistry Practical (18UCHMP401)

Formula, Table & Model graph : 20 marks Experiment : 40 marks **Total marks : 60 Marks**

Experiment which is done using instrument, the instrumental error also included and then error calculated based on the precise of the instrument by examiners during examination.

Mark Distribution: 60 Marks

Procedure : 10
Table & Calculation : 20
Experiment : 30

ALLIED PRACTICAL I: Volumetric and Organic Analysis (18UCHBCAP101/ 18UCHMBAP101) (For B.S., Biochemistry and Microbiology) Mark Distribution: 60 Marks

Estimation	: 30
Procedure	: 10
Aliphatic/aromatic	: 4
Saturated/unsaturated	: 4
Special elements (N/S/X)	: 6
Functional groups	: 6
Total marks	**: 60 Marks**

Percentage of error allowed in results

<2 % - 30 marks
2-3% - 25 marks
3-4 % - 20 marks
>5% - 10 marks

Allied Practical II: Volumetric and Organic Analysis
(18UCHBTAP201) (For B.Sc., Biotechnology)
Mark Distribution: 60 Marks

Estimation	: 30
Procedure	: 10
Aliphatic/aromatic	: 4
Saturated/unsaturated	: 4
Special elements (N/S/X)	: 6
Functional groups	: 6
Total marks	**: 60**
Marks	

Percentage of error allowed in results

<2 % - 30 marks
2-3% - 25 marks
3-4 % - 20 marks
>5% - 10 marks

Allied Practical II: Volumetric Analysis
(18UCHPHAP401) (For B.Sc., Physics)
Mark distribution: 60 Marks

Procedure	: 10
Experiment	: 50

Total marks : 60

Marks

Percentage of error allowed in results

<1 % - 50 marks

1-2% - 45 marks

2-3% - 35 marks

3-4 % - 30 marks

>5% - 20 marks

5. QUESTION PAPER PATTERN AND MARK DISTRIBUTION THEORY

Question Paper Pattern and Mark Distribution (For 75 marks)

1. PART – A (10 x 2 = 20 Marks)

Answer ALL questions

Two questions from each UNIT

2. PART – B (5 x 5 = 25 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART – C (3 x 10 = 30 Marks)

Answer ANY THREE questions

Open Choice – 3 out of 5 questions

Question Paper Pattern and Mark Distribution (For 100 marks)

1. PART – A (10 x 2 = 20 Marks)

Answer ALL questions

Two questions from each UNIT

2. PART – B (5 x 7 = 35 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART – C (3 x 15 = 45 Marks)

Answer ANY THREE questions

Open Choice – 3 out of 5

questions

ALLIED COURSES OFFERED BY THE DEPARTMENT

S.No	Subject code	Subject	Class
SEMESTER – I			
1	18UCHBCA101/ 18UCHMBA101	Allied I: Chemistry	I-B.Sc., Biochemistry / I-B.Sc., Microbiology
2	18UCHBCAP101/ 18UCHMBAP301	Allied Practical I: Volumetric and Organic Analysis	I-B.Sc., Biochemistry / I-B.Sc., Microbiology
SEMESTER – II			
3	18UCHBTA201	Allied II: Chemistry	I-B.Sc., Biotechnology
4	18UCHBTAP201	Allied Practical II: Volumetric and Organic Analysis	I-B.Sc., Biotechnology
SEMESTER – IV			
5	18UCHPHA401	Allied IV: Chemistry	II-B.Sc., Physics
6	18UCHPHAP401	Allied Practical II: Volumetric Analysis	II-B.Sc., Physics

18UCHBCA101	ALLIED I: CHEMISTRY (For B.Sc., Biochemistry)	SEMESTER-I

COURSE OBJECTIVES:

The course aims

- To understand the bonding in organic molecules and the factors affecting it
- To provide information about the mechanism of substitution reactions
- To acknowledge the basic ideas in Co-ordination compounds
- To evaluate the chemistry behind polymers
- To recognize the elementary ideas in Electrochemistry

Credits: 2 **Total hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Chemical Bonding:** Covalent bonds - Orbital overlap - Hybridisation - SP, SP^2, SP^3 - Electron displacement effect - Inductive effect – Resonance – Hyperconjugation - Steric effect - Their effects on the properties of compounds – Stereoisomerism - Optical isomerism - Elements of symmetry - Causes of optical activity - Tartaric acid - Geometrical isomerism of Maleic acid and Fumaric acid.	8	CO1
II	**Reaction and Mechanism:** Aliphatic Nucleophilic substitution reaction - Mechanism of SN^1 and SN^2 reaction -Aromatic compounds – Aromaticity - Huckel's rule - Electrophilic substitution reaction in Benzene - Mechanism of nitration, halogenation, sulphonation, Friedel-craft alkylation and Friedel-craft acylation	8	CO2
III	**Co-ordination Chemistry:** Definition - classification of ligands - Werner's theory - Sidgwick's theory - Effective atomic number - Pauling's theory (VB theory) – Chelation - Chelate effect – Haemoglobin - definition and biological role – Chlorophyll - definition and biological role – EDTA - its applications.	8	CO3
IV	**Polymer Chemistry:** Natural Polymer – Types of polymers – Homopolymer – Heteropolymer – Additional and	8	CO4

	Condensation polymers – polymerization reactions - Manufacture of film sheets – Rayon and Polyacrylicfibers – PVC – Uses of polymers.		
V	**Electrochemistry:** Kohlrausch's law - measurement of conductance – determination of pH - Conductometric titration - Hydrolysis of salts - Elementary ideas – Examples - Galvanic cell - **Galvanic cell –** EMF - Standard electrode potential - Electrochemical series - its applications – Principles of electroplating – Corrosion - Corrosion prevention.	8	CO5

Text Books:

1	*Madan.R.L. and Tuli G. D.* 2005. **Simplified course in Physical chemistry.** [Sixth Edition]. S.Chand and company Ltd., New Delhi.

Reference Books:

1	*Lee J.D*. 2008. **A New Concise Inorganic Chemistry**. [Fifth Edition]. Chapmann and Hall, London.
2	*Morrison R.T. and Boyd. R.N*. 2010. **Organic Chemistry**. [Seventh Edition]. Prentice-Hall of India (P) Ltd, New Delhi.
3	*Mukherjee. S. M. Singh .S. P. and Kapoor, R .P*. 1985. **Organic Chemistry.** [Fifth Edition]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse the bond formation in organic molecules
CO2	Recognize the mechanism of the reactions
CO3	Compute the chemistry of co-ordination compounds
CO4	Predict the chemistry behind polymers
CO5	Demonstrate the working principles of cells and batteries

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	L
CO2	M	M	H	H	H
CO3	H	M	H	M	M
CO4	H	M	H	M	M
CO5	L	H	L	M	H

H-High M-Medium L-Low

18UCHMBA101	ALLIED I: CHEMISTRY (For B.Sc., Microbiology)	SEMESTER-I

COURSE OBJECTIVES:

The course aims

- To understand the bonding in organic molecules and the factors affecting it
- To study the mechanism of substitution reactions
- To recall the basic ideas in Co-ordination compounds
- To evaluate the chemistry behind polymers
- To recognize the elementary ideas in Electrochemistry

Credits: 2 **Total hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Chemical Bonding:** Covalent bonds - Orbital overlap – Hybridisation - SP, SP^2, SP^3 - Electron displacement effect - Inductive effect – Resonance – Hyperconjugation - Steric effect - Their effects on the properties of compounds – Stereoisomerism - Optical isomerism - Elements of symmetry - Causes of optical activity - Tartaric acid - Geometrical isomerism of Maleic acid and Fumaric acid.	8	CO1
II	**Reaction and Mechanism:** Aliphatic Nucleophilic substitution reaction - Mechanism of SN^1 and SN^2 reaction - Aromatic compounds – Aromaticity - Huckel's rule - Electrophilic substitution reaction in Benzene - Mechanism of nitration, halogenation, sulphonation, Friedel-craft alkylation and Friedel-craft acylation	8	CO2
III	**Co-ordination Chemistry:** Definition - classification of ligands - Werner's theory - Sidgwick's theory - Effective atomic number - Pauling's theory (VB theory) – Chelation - Chelate effect – Haemoglobin - definition and biological role – Chlorophyll - definition and biological role – EDTA - its applications.	8	CO3
IV	**Polymer Chemistry:** Natural Polymer – Types of polymer – Homopolymer – Heteropolymer – Additional and	8	CO4

	Condensation polymers – polymerization reactions - Manufacture of film sheets – Rayon and Polyacrylicfibers – PVC – Uses of polymers.		
V	**Electrochemistry:** Kohlrausch's law - measurement of conductance - determination of P^H - Conductometric titration - Hydrolysis of salts - Elementary ideas – Examples - Galvanic cell - **Galvanic cell -** EMF-Standard electrode potential - Electrochemical series - its applications - Principal of electroplating – Corrosion - Corrosion prevention.	8	CO5

Text Books:

1	*Madan.R.L. and Tuli G. D.* 2005. **Simplified course in Physical chemistry.** [Sixth Edition]. S.Chand and company Ltd., New Delhi.

Reference Books:

1	*Lee J.D*. 2008. **A New Concise Inorganic Chemistry**. [Fifth Edition]. Chapmann and Hall, London.
2	*Morrison R.T. and Boyd. R.N*. 2010. **Organic Chemistry**. [Seventh Edition]. Prentice-Hall of India (P) Ltd, New Delhi.
3	*Mukherjee. S. M. Singh .S. P. and Kapoor, R .P*. 1985. **Organic Chemistry.** [Fifth Edition]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse the bond formation in organic molecules
CO2	Learn the mechanism of the reactions
CO3	Compute the chemistry of co-ordination compounds
CO4	Predict the chemistry behind polymers
CO5	Demonstrate the working principles of cells and batteries

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	M	H	M
CO2	M	H	H	H	M
CO3	H	H	H	H	M
CO4	H	H	H	H	H
CO5	M	M	H	H	H

H-High M-Medium L-Low

18UCHBCAP101 / 18UCHMBAP101	**Allied Practical I: Volumetric and Organic analysis (For B.Sc., Biochemistry and Microbiology)**	**SEMESTER I**

COURSE OBJECTIVES:

The course aims

- To enable the students to acquire the quantitative skills in volumetric analysis.
- To know the inorganic preparation

Credits: 2 **Total Hours: 30**

EXPT NO.	**CONTENTS**	**CO**
Titrimetric Quantitative Analysis		
1	Estimation of HCl using standard oxalic acid.	CO1
2	Estimation of Ferrous sulphate using Mohr's salt.	
Organic Qualitative Analysis		
1	Monocarboxylic acid	CO2
2	Monoamide	
3	Diamide	
4	Carbohydrate	
5	Aromatic aldehyde	

Text books:

1	*Kamboj.P.C.* 2013. **University Practical Chemistry.** [First Edition (reprint)]. Vishal publications, Jalandhar, Punjab.
2	*Venkateshwara, V., Veerasamy. R. Kulandaivel. R.,* 2012. **Basic Principles of Practical Chemistry.** [Second Edition]. S. Chand & sons,New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse quantitatively by titration techniques
CO2	Analyse systematically an organic compound by laboratory techniques

18UCHBTA201	ALLIED II: CHEMISTRY (For B.Sc., Biotechnology)	SEMESTER-II

COURSE OBJECTIVES:

The course aims:

- To understand the bonding in simple organic and inorganic molecules
- To Study the chemistry of heterocyclic ring system
- To understand the basic ideas in Co-ordination Compounds
- To Study the Solution and its types
- To understand the elementary ideas in Electrochemistry

Credits: 2 **Total hours: 40**

UNIT	CONTENTS	Hrs.	CO
I	**Chemical Bonding:** Molecular Orbital Theory – Bonding - Antibonding - Non-bonding orbitals - M.O. Diagram of Hydrogen molecule - Helium molecule - Nitrogen molecule - Discussion of bond order - magnetic properties - Covalent bonds - Orbitals overlap – Hybridisation – SP – Acetylene - SP^2 – Ethylene - SP^3 - Methane.	8	CO1
II	**Heterocyclic Chemistry:** Heterocyclic compounds - Structure of five membered ring - Preparation, Properties and uses of Furan, Pyrrole, Thiophene - Structure of six membered ring - Preparation, Properties and uses of Pyridine - Condensed Heterocyclic ring - Preparation, Properties and uses of Indole and Quinoline.	8	CO2
III	**Co-ordination Chemistry:** Definition - classification of ligands - Werner's theory - Sidgwick's theory - Effective atomic number - Pauling's theory (VB theory) – Chelation - Chelate effect – Haemoglobin - definition and biological role – Chlorophyll - definition and biological role – EDTA - its applications	8	CO3
IV	**Solutions:** Types - Liquid in Liquid - Raoult's law for ideal solution - Positive and negative deviation from Raoult's law - Reason and Example – Colloids – Types - Optical property - Electrical property – Coagulation – Emulsions – Gel - Applications of colloids. **Phase rule** – Important terminologies - One component system - Water.	8	CO4
V	**Electrochemistry:** Kohlrausch's law – measurement of conductance - determination of P^H - Conductometric titration - Hydrolysis of salts - Elementary ideas – Examples - Galvanic cell - **Galvanic cell –** EMF - Standard	8	CO5

	electrode potential - Electrochemical series - its applications - Principal of electroplating – Corrosion - Corrosion prevention.		

Text books:

1	*Madan.R.L. and Tuli G. D.* 2005. **Simplified course in Physical chemistry.** [Sixth edition]. S.Chand and company Ltd., New Delhi.
2	*Puri. B. R. Sharma .L. R. and Pathania*. M. S. 2017. **Principles of Physical Chemistry.** [Forty Seventh edition]. Shoban Lal Nagin Chand and Co., New Delhi.

Reference books:

1	*Lee J. D.* 2008. **A New Concise Inorganic Chemistry.** [Fifth edition]. Chapmann and Hall, London.
2	*Morrison R.T. and Boyd .R. N.* 2010. **Organic Chemistry.** [Seventh edition]. Prentice-Hall of India (P) Ltd, New Delhi.
3	*Mukherjee. S. M. Singh .S. P. and Kapoor .R .P.* 1985. **Organic Chemistry.** [Fifth edition]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse the bond formation in organic molecules.
CO2	Learn the mechanism of the reactions.
CO3	Compute the chemistry of co-ordination compounds.
CO4	Predict the chemistry behind polymers.
CO5	Demonstrate the working principles of cells and batteries.

MAPPING:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	L	H	H
CO2	L	M	L	H	M
CO3	H	M	M	H	M
CO4	H	H	L	M	L
CO5	L	M	M	M	H

H-High M-Medium L-Low

18UCHBTAP201	**Allied Practical II: Volumetric and Organic analysis (For B.Sc., Biotechnology)**	**SEMESTER II**

COURSE OBJECTIVES:

The course aims

- To enable the students to acquire the quantitative skills in volumetric analysis.
- To know the inorganic preparation

Credits: 2 **Total Hours: 30**

EXPT NO.	**CONTENTS**	**CO**
Titrimetric Quantitative Analysis		
1	Estimation of HCl using standard oxalic acid	CO1
2	Estimation of Ferrous sulphate using Mohr's salt	
Organic Qualitative Analysis		
1	Monocarboxylic acid	CO2
2	Monoamide	
3	Diamide	
4	Carbohydrate	
5	Aromatic aldehyde	

Text books:

1	*Kamboj.P.C.* 2013. **University Practical Chemistry.** [First Edition (reprint)]. Vishal publications, Jalandhar, Punjab.
2	*Venkateshwara, V., Veerasamy. R. Kulandaivel. R.,* 2012. **Basic Principles of Practical Chemistry.** [Second Edition]. S. Chand & sons, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse quantitatively by titration techniques
CO2	Analyse systematically an organic compound by laboratory techniques

18UCHPHA401	ALLIED IV : CHEMISTRY (For B.Sc., Physics)	SEMESTER IV

COURSE OBJECTIVES:

The course aims:

- To understand the basic concepts about the bonding in chemicals
- To empathize the reaction mechanism in organic compounds
- To analyse the types of coordination compounds and its applications
- To infer basic knowledge about volumetric analysis
- To understand the basic concepts of cells and batteries

Credits: 2 **Total Hours : 30**

UNIT	CONTENTS	Hrs	CO
I	**Chemical Bonding:** Types of bonding – Examples - Ionic bond - Covalent bond - Co-ordinate bond – Hybridization - Elementary ideas – Examples - Hydrogen bond – Types – Examples - Consequences of Hydrogen bonding - Molecular orbital theory - Types of Molecular orbitals - Basic ideas - M.O.diagram of Hydrogen molecule - Helium molecule.	6	CO1
II	**Reaction and Mechanism:** Aliphatic nucleophilic substitution reaction - Mechanism of SN^1 and SN^2 reaction – Aromatic compounds – Aromaticity - Huckel's rule - Electrophilic substitution reaction in Benzene - Mechanism of nitration, halogenation, sulphonation, Friedel-craft alkylation and Friedel-craft acylation.	6	CO2
III	**Co-ordination Chemistry:** Definition – classification of ligands - Werner's theory - Sidgwick's theory - Effective atomic number - Pauling's theory (VB theory) – Chelation - Chelate effect – Hemoglobin - definition and biological role – Chlorophyll - definition and biological role – EDTA - its applications.	6	CO3
IV	**Volumetric Analysis:** Important terminologies - Basic requirements of a titration reaction - Expressing concentration of solution - Primary standard - Acid base titration - Their indicators - **Statistical Evaluation** – Error - Types of error - Methods of minimizing error - Normal error curve – Accuracy – Precision - Significant figure.	6	CO4

V	**Electrochemistry:** Kohlrausch's law - measurment of conductance - determination of Ph - Conductometric titration - Hydrolysis of salts - Elementary ideas – Examples - Galvanic cell - **Galvanic cell –** EMF - Standard electrode potential - Electrochemical series - its applications - Principal of electroplating – Corrosion - Corrosion prevention.	6	CO5

Text Books:

1	Madan. R.L. 2010. Chemistry for degree students S.Chand and company Ltd New Delhi.
2	Puri. B.R. Sharma. L.R. and Pathania. M.S. 1998 **Principles of Physical Chemistry**, Thirty seventh editions, Shoban Lal Nagin Chand and Co. Jalandar.

Reference Books:

1	Lee J.D. 1996 **A New Concise Inorganic Chemistry**, Fifth Edition, Chapmann and Hall, London
2	Morrison R.T. and Boyd.R.N.1992 **Organic Chemistry**, Sixth Edition, Prentice-Hall of India (P) Ltd, New Delhi.
3	Mukherjee. S.M. Singh.S.P. and Kapoor. R.P. 1985 **Organic Chemistry**, First Edition, New Age International (P) Ltd, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO 1	Acquire knowledge about the theories and types of chemical bonding.
CO2	Evaluate the basic principles of reaction mechanism in organic compounds.
CO3	Recall inorganic concepts of ligands and the theory behind the applications.
CO4	Revise the basic concepts of quantum chemistry and utilize the principles of quantum chemistry.
CO5	Formulate the laboratory techniques and prepare solutions for practicals.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	L
CO2	L	H	M	M	M
CO3	M	L	H	H	L
CO4	L	L	L	L	L
CO5	M	H	H	H	H

H-High M-Medium L-Low

18UCHPHAP401	**Allied Practical IV: Chemistry (For B.Sc., Physics)**	**SEMESTER IV**

COURSE OBJECTIVES:

The course aims

- To enable the students to acquire the quantitative skills in volumetric analysis.

Credits: 2 **Total Hours: 30**

EXPT NO.	**CONTENTS**	**CO**
Titrimetric Quantitative Analysis		
1	Estimation of Sodium Hydroxide using standard sodium carbonate.	CO1
2	Estimation of HCl using standard oxalic acid.	
3	Estimation of Borax using standard sodium carbonate.	
4	Estimation of Ferrous sulphate using Mohr's salt.	
5	Estimation of Oxalic acid using standard oxalic acid	
6	Estimation of Potassium permanganate using standard oxalic acid.	
7	Estimation of Ferrous ion using Diphenylamine as internal indicator.	
8	Estimation of copper sulphate using standard potassium dichromate.	CO1
9	Estimation of hardness of water using standard sodium carbonate.	
10	Estimation of calcium using EDTA method.	

Text books

1	*Kamboj. P.C.* 2013. **University Practical Chemistry.** [First Edition (reprint)]. Vishal publications, Jalandhar, Punjab.
2	*Venkateshwara, V., Veerasamy. R. Kulandaivel. R.,* 2012. **Basic Principles of Practical Chemistry.** [Second Edition]. S. Chand & sons, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Analyse quantitatively by titration techniques

18UCHM501	CORE VII: INORGANIC CHEMISTRY I	SEMESTER V

COURSE OBJECTIVES:

The course aims

- To rephrase the preparation and properties of halogen family and noble gases
- To illustrate the characteristics of d-block elements
- To predict the fundamental properties of lanthanides and actinides
- To critique the chemistry of radioactive elements
- To appraise the methodologies in metallurgy

Credits: 4 Total Hours: 50

Unit	Content	Hrs	CO
I	**Halogen family**: General characteristics of halogen family- Comparative study of elements and their compounds – Oxides - Oxyacids and Hydracids. Preparation, properties and structure of interhalogen compounds. **Noble gases**: Position in the periodic table - reasons for inertness-uses. Compounds of xenon - preparation, properties and structure of XeF_2, XeF_4, XeF_6 and XeO_3. Polyacids of Mo and W. Interstitial compounds and clathrates – water and quinol clathrates.	10	CO1
II	**Transition metals (d–block elements):** First, second and third row of transition series – General characteristics – Metallic character, atomic and ionic radii - oxidation states, colour, complex formation, catalytic and magnetic properties – Non-stoichiometric compounds – Magnetic properties – Types: para, dia, ferri, ferro, antiferro. Curie and Neel temperature. Determination of magnetic moment by Gouy balance method.	10	CO2

III	**Inner transition metals (f–blockelements): Lanthanides:** Properties of lanthanides. Electronic configuration - oxidation states - ionic radii, lanthanide contraction and its consequences. Colour and magnetic properties. Extraction of mixture of lanthanides from monazite sand and separation of lanthanides. Uses of lanthanides. **Actinides**: Sources of actinides - preparation of transuranic elements – Electronic configuration – oxidation states – ionic radii - Colour of ions – comparison with lanthanides. Extraction of thorium from monazite sand. Production and uses of plutonium.	10	CO3
IV	**Nuclear chemistry:** Natural radioactivity - types and properties of radioactive rays. Modes of radioactive decay. Rate of radioactive disintegration – half-life period – average life period. Group displacement law – Isomers, Isotopes, Isobars and isotones. Uses of isotopes as tracers in medical, agriculture, analytical and industrial field. C^{14} dating and rockdating. Artificial radioactivity. Nuclear reactions – Nuclear fission – mechanism of fission – liquid drop model – Atom bomb. Nuclear fusion - hydrogen bomb –stellar energy. Q-value of nuclear reactions. Nuclear stability - N/P ratio - mass defect – binding energy.	10	CO4
V	**Metallurgy:** Occurrence of metals – various steps involved in metallurgical processes – concentration of ore – calcinations – Roasting – smelting – Electrometallurgy – the Ellingham diagram – Hydrometallurgy – Zone Refining.	10	CO5

Text books:

1. *Puri P.R., Sharma L. R.*and *Pathania M.S.* 2010. **Principles of Inorganic Chemistry**, Vishal Publishing Co, Jalandhar.
2. *Madan R.D., Tuli G.D.* and *Malick S.* 1988. **Selected Topics in Inorganic Chemistry**, S. Chand & Co., New Delhi.

Reference books:

1. *Soni P.L.*1999. **Text Book of Inorganic Chemistry**, S. Chand & Co., New Delhi.
2. *Lee J.D.* 1991. **Concise Inorganic Chemistry**, [Fourth Edition], ELBS, London.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Quote the fundamentals about halogens and noble gases
CO2	Interpret the properties of d-block elements
CO3	Relate the attribution of lanthanides and actinides
CO4	Compute exemplar radioactive nuclear reactions
CO5	Generalize the methodologies adopted in metallurgy

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	L	M	H
CO2	H	M	M	L	L
CO3	M	M	L	H	L
CO4	M	H	H	L	M
CO5	H	L	M	M	M

H-High M-Medium L-Low

18UCHM502	CORE VIII: ORGANIC CHEMISTRY I	SEMESTER V

COURSE OBJECTIVES:

The course aims

- To assess the chemistry of carbohydrates.
- To illustrate the elucidation and properties of saccharides.
- To critique the stereochemistry and conformational analysis of various saccharides.
- To integrate the chemistry, preparation and properties of various heterocyclic compounds

Credits: 5 Total Hours: 50

Unit	Content	Hours	CO
I	**Carbohydrates:** Classification – monosaccharides - Epimers and anomers – glucose – chemical properties of open chain glucose - Structural elucidation - synthesis by interconversions and chain lengthening including epimerization - Haworth & Fischer Projection (pyranose form) - mutarotation. Fructose - chemical properties of open chain glucose – Structural elucidation – synthesis by inter conversions (pyranose and furanose form) – Haworth & Fischer Projection - mutarotation.	10	CO1
II	**Disaccharides**: Sucrose – Elucidation – Preparation – Chemical properties. Maltose - structural elucidation – preparation - chemical properties - mutarotation. Lactose - structural elucidation – preparation - chemical properties. **Polysaccharides:** Starch – preparation and properties. Cellulose – preparation – structure - derivatives.	10	CO2

III	**Stereochemistry:** Geometrical isomerism - cis-trans, syn-anti and E and Z notations - geometrical isomerism in maleic and fumaric acid. Methods of distinguishing geometrical isomers using melting points, dipole moment, dehydration, cyclisation. Optical isomerism - Projection formulae. Fischer, Flying Wedge, Sawhorse and Newmann projection formulae – Optical activity – optical isomerism in lactic acid and tartaric acid D,L notations. R,S notation of optical isomers with one and two asymmetric carbon atoms. Racemisation and Resolution of Optical Isomers. Biphehyl, allenes and spiranes.	10	CO3
IV	**Conformational analysis:** Conformers, configuration, dihedral angle, torsional strain, conformational analysis of ethane and n-butane – stability with energy diagram. Conformers of cyclohexane – axial and equatorial bonds – stability with energy diagram – ring flipping – conformers of mono and dimethyl cyclohexane- 1,3 and 1,5 – diaxial interactions in substituted cyclohexane - conformation and stereochemistry of cis-trans decalins.	10	CO4
V	**Heterocycles:** Introduction **–** Molecular orbital picture of pyrrole, furan, thiophene and pyridine – preparation, properties and structure of pyrrole, furan, thiophene and pyridine – condensed heterocycles – Synthesis of Indole and Quinoline – Eelectrophilic and Nucleophilic substitution reactions of Indole, Quinoline and Isoquinolone.	10	CO5

Text books:

1. *Bahl A.* and *Bahl B.S.*2014. **Advanced Organic Chemistry**, S.Chand & Co. Ltd., NewDelhi.
2. *Kalsi P.S.* 2005. **Stereochemisry, Conformationsand Mechanism**, New age International Publishers Ltd., [Sixth Edition], NewDelhi.
3. *Pine S. H.* 1986. **Organic Chemistry**, McGraw – Hill International Book Company [Fourth edition], New Delhi.

Reference books:

1. *Finar I. L.*1996. **Organic Chemistry**, Vol 1 &2, Addison Wesley Longman Ltd. [Sixth edition], England.
2. *Morrison R.T*and *Boyd R.N.* 2011. **Organic Chemistry**, Allyn& Bacon Ltd., [Seventh edition], NewYork.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Ascertain the properties and projections of carbohydrates
CO2	Elucidate the structure and predict the properties of various saccharides
CO3	Integrate the diverse range of Stereochemical properties
CO4	Paraphrase the various methods for conformational analysis
CO5	Infer the chemistry behind heterocyclic compounds

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	L	M	H
CO2	L	H	M	H	M
CO3	M	H	L	M	L
CO4	H	L	H	M	L
CO5	L	M	H	L	H

H-High M-Medium L-Low

18UCHM503	**CORE IX: PHYSICAL CHEMISTRY I**	**SEMESTER V**

COURSE OBJECTIVES:

The course aims

- To declaim the fundamentals of colloids
- To cognize the phase rule and its associated systems
- To discriminate the laws and systems related to solutions
- To recall the basics of kinetics
- To rephrase the various catalytic reactions

Credits: 4 Total Hours: 40

Unit	**Content**	**Hours**	**CO**
I	**Colloids:** Types – Sols - Preparation, Purification, properties - Kinetic, optical and electrical, stability of colloids, Gold number, associated colloids. Emulsions – Types of emulsions, preparation, properties and applications. **Gels:** Types of gels, preparation, properties and applications. Donnan – Membrane equilibrium - Osmosis, Reverse Osmosis, Dialysis and desalination. Electrical double layer theory and Zeta potential	8	CO1
II	**Phase Rule**: Definition of phase, components and degrees of freedom – derivation of Gibbs phase rule. One component system: water and sulphur system – Reduced phase rule. Two component systems: Simple eutectic system: Pb-Ag system, KI-water system. Freezing mixture Thermal analysis and cooling curves - compound formation with congruent melting point – Zn-Mg system, $FeCl_3$ -H_2O system Compound formation with incongruent melting point: Na-K system.	8	CO2

III	**Ideal binary liquid mixtures:** Liquid-liquid mixture (Benzene and Toluene) - Raoult's law and Henry's law - activity and activity coefficients - Fractional distillation of binary miscible liquid - Non-ideal systems – Azeotropes - HCl and water system – Ethanol and water system. Partially miscible binary liquid systems: Phenol and water – Triethylamine – Nernst distribution law – Principle and applications steam distillation. **Dilute solutions and colligative properties**: Determination of molecular weight – lowering of vapour pressure – Elevation of boiling point – Depression of freezing point - Thermodynamic derivation – Abnormal molecular mass - Van'tHoff factor - Degree of dissociation and degree of association of solutes.	8	CO3
IV	**Chemical kinetics:** Definition – Order – rate – rate constant - half- life period. Derivations of Zero, First, Second and Third order reactions - Determination of order of the reactions - Integration, graphical, half-life - Steady state approximation- Chain reactions and explosion reaction. Effect of temperature on reaction rate - temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates: Bimolecular collision theory - Transition state theory - Lindemann's unimolecular theory.	8	CO4
V	**Catalysis:** Homogeneous and Heterogeneous catalysis – Acid – base catalysis, enzyme catalysis – Michaelis – Menten equation – Adsorption – Distinction between physical and chemical adsorption – Factors influencing adsorption - adsorption isotherm – Freundlich adsorption isotherm. Langmuir isotherm – theory and derivation – Postulates of B.E.T isotherm - Equation (no derivation) – determination of surface area.	8	CO5

Text books:

1. *Puri P.R., Sharma L. R.*and *Pathania M.S.* 2010. **Principles of Physical Chemistry**, Vishal Publishing Co, Jalandhar.
2. *Gurdeep Raj*.1978**. Advanced Physical Chemistry**, Krishna Prakashan Media (P) Ltd., Meerut.

Reference books:

1. *SoniP.L.,Dharmarha* and *Dash,* 2001.**Text Book of Physical Chemistry**,Sultan Chand & Co.Ltd., NewDelhi.
2. *Bahl B.S.,Tuli G.D*. and *Arun Bahl*, 1983. **Essentials of Physical Chemistry**,S. Chand & Co., New Delhi.
3. *Atkins P.W.* 1994. Physical Chemistry, [Fifth edition], Oxford UniversityPress,UK.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Compute the chemistry of colloids.
CO2	Interpret phase rule in various systems.
CO3	Paraphrase the chemistry of solutions
CO4	Recognize the basics of kinetic laws
CO5	Appraise the derivations of catalytic theories

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	M	L
CO2	L	M	H	L	M
CO3	H	L	M	H	H
CO4	H	M	M	L	H
CO5	L	M	L	H	L

H-High M-Medium L-Low

18UCHM504	**CORE X: ANALYTICAL CHEMISTRY**	**SEMESTER V**

COURSE OBJECTIVES:

The course aims

- To compute the basic principles in laboratory handling
- To discriminate the errors in experiments
- To illustrate the principles in gravimetric estimations
- To interpret the fundamentals in chromatographic techniques
- To examine the electroanalytical techniques

Credits: 4 Total Hours: 40

Unit	**Content**	**Hrs**	**CO**
I	**Safe Handling of Chemicals and waste management:** Quantitative analytical methods – Chemicals - apparatus - unit operation – selecting - handling reagents and chemicals – cleaning – marking of laboratory ware – measuring mass and volume – calibrating volumetric glassware - Safety Measures; Handling reagents and solutions – Corrosive – Explosive – Toxic - Carcinogenic – inflammable chemicals - Disposal of wastes – waste chemicals - fumes.	8	CO1
II	**Importance of analytical methods in Qualitative and Quantitative analysis:** Molality **–** Molarity – Normality **-** parts per million - parts per billion - Chemical and instrumental methods – advantages - limitations of chemical methods – instrumental methods -methods of analysis - steps in analysis. Errors and treatment of Analytical Chemistry – Errors – Determinate – Indeterminate – Accuracy and precision. Distribution of random errors - Average derivation - standard derivation - variance limit - confidence limit - Significant figures - computation rules.	8	CO2

III	**Gravimetric methods of analysis**: Crucibles – types – care – uses - Principles of gravimetric analysis - characteristics of precipitating agents - choice of precipitants - conditions of precipitation - specific and conditions of precipitation - specific and selective precipitants – DMG – cupferron – salicylaldehyde – ethylende diamine - use of sequestering agents – coprecipitation – postprecipitation – peptisation – differences – Drying and ignition of precipitates - reduction of error – precipitation from homogeneous solutions - calculations in gravimetric methods - use of gravimetric factor - Application of Gravimetric methods.	8	CO3
IV	**Chromatographic methods:** Column Chromatography – principle - types of adsorbents - preparation of the column - applications – TLC – principle - choice of adsorbent and solvent - preparation of chromate plates – R*f* values – factors affecting the R*f* values - Significance of R*f* values – Paper Chromatography – principle - solvents used - development of Chromatogram - Applications. Ion-exchange Chromatography – principle - applications.	8	CO4
V	**Electro analytical method:** Polarography – principle - Dropping mercury electrode (DME) – advantages – disadvantages – migration– residual - limiting –diffusion currents - use of supporting electrolyte - Ilkovic equation (Derivation not require) – significance - experimental assembly - current voltage curve - oxygen wave – influence of temperature on diffusion layer – Half wave potential (E1/2) – polarography as an analytical tool in quantitative and qualitative analysis.	8	CO5

Text books:
1. *Skoog*, *West, Holler* and *Crouch*. 2004. **Fundamentals of Analytical Chemistry**, [Eighth edition) Brooks/Cole Publishing, CA. 2. *Khopker S.M.* 1998. **Basic concepts of Analytical Chemistry**, [Second edition], New Age Int. Pvt.Ltd, New Delhi. **3.** *Gopalan R, Rengarajan K* and *Subramanian P.S.* 2004. **Elements of Analytical Chemistry,** [Third Edition] Sultan Chand & Sons, New Delhi.

Reference books:
1. *De, A. K.* 1994. **Environmental Chemistry**, [Third edition], Wiley Eastern, New Delhi. **2.** *Willard H. H., Merritt L.L.* and *Dean J.A.* 1968. **Instrumental Methods of Analysis**, [Sixth edition], CBS Publishers and Distributors, Shahdara, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Conclude the principles of laboratory handling techniques
CO2	Interpret the errors in the problems of chemical methods
CO3	Ascertain the analytical methods of gravimetry
CO4	Signify the principles and procedure of chromatographic methods
CO5	Recognize the electroanalytical techniques for qualitative and quantitative analysis

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	M	L
CO2	M	L	M	H	H
CO3	L	M	H	L	M
CO4	L	H	M	M	L
CO5	M	H	H	L	M

H-High M-Medium L-Low

18UCHEL501	**ELECTIVE I: SPECTROSCOPY I**	**SEMESTER V**

COURSE OBJECTIVES:

The course aims

- To dictate the rudimentary facts of the spectroscopic techniques
- To assess the principles and theories of IR spectroscopy
- To cater the cardinal rationale of NMR
- To compare IR with Raman spectroscopy
- To rationalize the concepts of Mass spectroscopy

Credits: 4 Total Hours: 40

Unit	Content	Hours	CO
I	**Introduction:** Electromagnetic radiation – units - Electromagnetic spectrum and absorption of radiations - Quantization of different forms of energies in molecules (translational, rotational and electronic) - Born Oppenheimer approximation. **Ultra violet and Visible spectroscopy:** Introduction – Beer-Lambert's law – Instrumentation – Types of electronic transition - Transition probability – Chromophore Auxochrome concept – Bathochromic, Hypsochromic, Hyperchromic, Hypochromic shift - Factors influencing λ_{max} and σ_{max} values - Applications of UV spectroscopy with examples.	10	CO1
II	**Infra–red spectroscopy:** Introduction – Principle - Theory of molecular vibrations - Expression for vibrational frequency (derivation not needed) - selection rules. Factors influencing vibrational frequencies – Instrumentation – Finger print region.	10	CO2
III	**Raman spectroscopy:** Introduction - Theory of Raman spectra (Stoke's and antistoke'sline) – Instrumentation - Conditions for Raman spectroscopy – Beer Lambert law of absorption in Raman scattering – Mutual Exclusion Principle of CO_2 and NO_2 - Difference between IR and Raman spectra – Applications of Raman spectroscopy.	10	CO3

IV	**Nuclear Magnetic Resonance Spectroscopy:** Introduction – basic principles – Relaxation process – Chemical shift - Number and position of signals – Instrumentation – Shielding & Deshielding effects – Factors influencing chemical shift – Spin-Spin coupling – coupling constant – TMS as NMR standard – Applications of NMR	10	CO4
V	**Mass spectroscopy:** Basic principles - Instrumentation – molecular ion peak, base peak, meta stable peak, isotopic peak their uses, determination of molecular formula. Fragmentation – Nitrogen rule – McLafferty rearrangements. Interpret Mass spectra of Isopentane, 2,2-dimethylpropane, 2,2,5,5-tetramethylheaxane, n-propylcyclohexane, 2-butanol. (Self Study)	-	CO5

Text books:

1. *Sharma Y.R.* 2013. **Elementary Organic spectroscopy, [Fifth revised Edition],** S.Chand & Co. Ltd., New Delhi.
2. *Sindhu P.S.* 1985. **Fundamentals of molecular Spectroscopy**, New Age Int. Pvt. Ltd. New Delhi.
3. *Colin N Banwell 2015,* **Fundamentals of molecular Spectroscopy,** McGraw Hill Education.

Reference books:

1. *Parikh V.M.* 2002. **Absorbtion Spectroscopy of Organic molecules**, Mehta publishers, Pune.
2. *Williams D.W.* and *Flemming I*. 1987. **Spectroscopic methods in Organic chemistry**, McGraw-Hill, U.K.
3. *KalsiP.S.*2007. **Spectroscopy of Organic compounds**, New Age Int. Pvt. Ltd. New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Reword the basics of spectroscopic techniques
CO2	Acknowledge the theory behind IR spectroscopy
CO3	Perceive the chemistry of NMR
CO4	Discern IR techniques with Raman spectroscopy
CO5	Agnize the concepts of Mass spectroscopy

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	L
CO2	L	M	L	M	H
CO3	M	M	H	H	L
CO4	M	L	M	H	M
CO5	M	M	L	L	H

H-High M-Medium L-Low

18UCHEL502	**ELECTIVE I: BIO-INORGANIC CHEMISTRY**	**SEMESTER V**

COURSE OBJECTIVES:

The course aims

- To nurture the importance of metals in biological systems
- To render the role of metals and its complexes in the synthesis of drugs
- To impart the functions and properties of various metals
- To bestow the work of topical agents
- To forge the wreak of radioactivity inchemotherapy

Credits: 4 Total Hours: 40

Unit	Contents	Hours	CO
I	**Metal ions in biological systems:** Essential and trace metals - alkaline and alkaline earth metals in biological systems, role of iron in living systems, biologically important complexes of Iron (transport proteins) - haemoglobin, myoglobin - Structure of haemoglobin and myoglobin. Bohrs effect – Nitrogen fixation, in vitro nitrogen fixation and in vivo nitrogen fixation.	10	CO1
II	**Co-ordination Compounds and Complexation**: Platinum complexes as anticancer drugs – cis-platin and trans-platin - Complexes of gold for Rheumatoid arthritis. Lithium complexes for mental health. Role of copper, zinc, mercury, arsenic and antimony in drugs. Biological functions and toxicity of chromium, manganese, cobalt, nickel and iodine.	10	CO2
III	**Role of Medicinal Inorganic Compounds:** Medicinal inorganic complexes -Alum, Phosphoric acid, Ferric ammonium citrate. Preparation, Properties and uses. Biological role of inorganic compounds-Sodium, Potassium, Calcium and Iodine. Na-K pump. Metal deficiency and diseases, Metal excess and toxicity.	10	CO3
IV	**Topical Agents:** Protectives - Calamine, Talc, Zinc Oxide, Zinc Stearate, Titanium dioxide. Astringents - Zinc sulphate, Alum. Anti-infectives: Boric acid, Hydrogen peroxide, Iodine.Dental Products: Anti-caries Agents –Role of Fluorides as anti-caries agents, NaF.	10	CO4

V	**Inorganic Radio-Pharmaceuticals**: Radioactivity, Units of radioactivity, radiation dosimetry, Hazards and precautions in handling of radiopharmaceuticals and storage. Chemotherapy: Radio diagnostic agents - MRI scanning - Chelating Agents (with special reference to EDTA) and therapy based on in vivo chelation of radio nucleotides - Dosage and toxicity. (Self Study)	-	CO5

Text Books:

1. *Bertini, H. B. Gray, S. J. Lippard and J. S. Valentine*, **Bioinorganic Chemistry**; University Science Books.
2. *Dr Asim K Dass*, **Bioinorganic Chemistry 2007**, Books and Allied (P) Limited.
3. *Keith F. Purcell and John C. Kotz*, **Inorganic Chemistry**, 3rd Edition

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recite the role of metal ions in biological systems
CO2	Quote the pharmaceutical behavior of metal complexes
CO3	Persuade the biological role of inorganic complexes
CO4	Hark the functions of various topical agents
CO5	Illustrate the chemistry of radio-pharmaceuticals

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	L	H
CO2	L	H	L	H	M
CO3	M	H	H	L	H
CO4	H	L	H	M	L
CO5	M	L	M	H	L

H-High M-Medium L-Low

18UCHMP501	**CORE PRACTICAL V: GRAVIMETRIC ESTIMATION AND ORGANIC PREPARATION**	**SEMESTER V**

COURSE OBJECTIVES:

The course aims

- To cater the laboratory proficiency for the estimation of chemical compounds by gravimetric techniques
- To train the students in conventional method of preparing inorganic complexes

Credit: 3 Total hours: 50

Expt.	**Content**	**Hours**	**CO**
Gravimetric Estimations			
1.	Estimation of Barium as Barium sulphate	5	CO2
2.	Estimation of Barium as Barium chromate	5	CO2
3.	Estimation of Lead as Lead chromate	5	CO2
4.	Estimation of Nickel as Nickel-DMG complex	5	CO2
5.	Estimation of Calcium as Calcium oxalate monohydrate	5	CO2
6.	Estimation of Iron as Iron (III) oxide	5	CO2
Organic Preparations			
1.	Oxidation of Benzaldehyde toBenzoic acid	5	CO1
2.	Hydrolysisof Methyl salicylate orethyl benzoate	5	CO1
3.	Nitration (p-nitroacetanilide and m-dinitrobenzene)	5	CO1
4.	Bromination (p-bromoacetanilide and tribromophenol)	5	CO1
5.	Benzoylation (β-naphthyl benzene)	5	CO1

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Indulge in systematic estimation by laboratory methods of synthesizing an organic compound/
CO2	Embark on the sequential estimation of inorganic metals

18UCHSB501	**SBC III: POLYMER CHEMISTRY**	**SEMESTER V**

COURSE OBJECTIVES:
The course aims

- To restate the basics of polymers and its properties
- To illustrate the reactions of polymers
- To predict the molecular weight of polymers by various methods
- To infer the usage of commercial polymers and in the field ofbiology

Credits: 2 Total Hours: 25

Unit	Contents	Hours	CO
I	**Polymers:** Basic Concept - classification of polymers on the basis of source, utility and effect of temperature – distinction among plastics (thermosetting and thermoplastic), elastomers, and fibers, Homo and heteropolymers, copolymers, properties of polymer.	5	CO1
II	**Molecular Weight of polymer:** Number average –weight average – sedimentation and viscosity - average molecular weights – Molecular weights and degree of polymerization. Reactions – Hydrolysis –Hydrogenation – addition - substitution, cross linking - vulcanization and cyclisation.	5	CO2
III	**Polymerization techniques:** Bulk, solution, suspension & emulsion polymerization – melt polycondensation. Polymer processing - Calendaring, die-casting, rotational casting.	5	CO3
IV	**Chemistryof commercial polymers:** General methods of preparation - properties and uses of the following - Teflon, polyethylene, polystyrene, polymethylacrylate, poly amides, polycarbonates and PVC.	5	CO4
V	**Advances in polymers:** Bio-Polymers,biomaterials, polymers in medical field, High temperature and fire resistant polymers – Silicones – Rubber - Grease.	5	CO5

Text Books:

1. *Gowariker V. R., Viswanathan N. V.*and *Jayadev Sreedhar.*1986. **Polymer Science**, Halsted Press (John Wiley & Sons), New York.

Reference Books:

1. *Sharma. B.K.* 1989. **Polymer Chemistry**, Goel Publishing House, Meerut.
2. *Arora M.G.* and *Vadar M.S.* 1989. **Polymer Chemistry,** Anmol Publications PrivateLtd, New Delhi.
3. *Stevens M.P.*1990. **Polymer Chemistry**: **An Introduction**, Oxford University Press, New York.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Revise the fundamentals of polymers and its properties
CO2	Evaluate the molecular weight of polymers by various methods
CO3	Paraphrase the various polymerization techniques
CO4	Compile the synthesizing techniques involved in preparation
CO5	Compute the role of polymers in biology

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	M	M	H
CO2	M	H	L	M	L
CO3	L	M	H	H	M
CO4	M	L	H	H	M
CO5	H	L	M	L	H

H-High M-Medium L-Low

18ULS501	CAREER COMPETENCY SKILLS III	SEMESTER – V

Course Objectives:

The course aims

- To impart knowledge on the logical reasoning.
- To enhance employability skills and to develop career competency.

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Verbal Reasoning: Number Series Completion- Alpha Series Completion- Blood Relation- Distance and Direction- Analogy- Inequality- Classification.	3	CO 1
II	Non-Verbal Reasoning: Series Completion - Analogy and Classification - Completion of Incompletion Pattern.	3	CO 2
III	Non-Verbal Reasoning: Mirror Image and Water Image – Statement and Arguments - Cubes and Dices.	3	CO 3
IV	Reasoning: Puzzle Arrangement - Syllogism - Input and Output.	3	CO 4
V	Verbal Reasoning: Linear Arrangement - Circular Arrangement – Matrix Arrangement.	3	CO 5

Text Book

1	Test of Reasoning – RS Aggarwal, S Chand and Company Limited, 2017 Edition, New Delhi.

Reference Book

1	Verbal & Non-Verbal Reasoning For Competitive Exams -Gajendra Kumar, Abhishek Banerjee, Disha publication, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course , the students will be able to :

CO1	Understand the core concepts of Verbal Reasoning
CO2	Formulate Non Verbal Reasoning with shortcuts
CO3	Find Mirror Image, Cubes and Dices
CO4	Obtain the knowledge on shortcuts to solve Puzzles.
CO5	Solve Linear Arrangement and Matrices with shortcuts.

18UCHM601	CORE XI: INORGANIC CHEMISTRY II	SEMESTER VI

COURSE OBJECTIVES:

The course aims

- To ascertain the hypothesis and rules of the coordination chemistry
- To recite the different types of splitting occupied in inorganic complexes
- To critique the factors behind the role of elements in biological systems
- To discriminate the chemistry of organometallic compounds
- To appraise the fundamental concepts in solid state

Credits: 5 Total Hours: 50

Unit	Content	Hrs	CO
I	**Coordination compounds I:** Double salt - Coordination compounds – central metal ion – ligands – types of ligands – coordination number, oxidation number and coordination sphere and chelation - Nomenclature of coordination compounds. Structural and stereoisomerism - Werner'stheory of complexes. EAN rule - VB theory – applications and limitations –Factors affecting stability of complexes.	10	CO1
II	**Coordination compounds II:** Crystal Field theory – Crystal field splitting in octahedral,tetrahedral and square planar complexes – factors influencing the magnitude of crystal field splitting – CFSE calculations – magnetic properties and Colour. Labile and inert complexes – stepwise and overall stability constants –Reaction mechanism – substitution reactions in octahedral complexes.	10	CO2
III	**Bio-inorganic Chemistry:** Role of Sodium, Potassium, Calcium, Iodine, Copper and Zinc. Introduction to prophyrin ring systems. Structure and functions of haemoglobin and Chlorophyll. Chemistry of Vitamin B_{12}**.** Metalloenzymes – Carboxypeptidase and Carbonic anhydrase.	10	CO3
IV	**Organometallic compounds:** Definition, nomenclature and classification of organometallic compounds – preparation – properties and uses of organo Li, Al, Hg and Sn compounds. Synthesis and structure of Zeises salt – Sandwich compounds – preparation, properties and structure and uses of Ferrocene – Wilkinson's catalyst – Ziegleer-Natta catalyst.	10	CO4

V	**Solid state Chemistry:** Symmetry elements in crystal systems – Bravais lattices – Unit cell – law of rational indices (Weiss indices) – Miller indices - Unit cell dimension - number of atoms per unit cell – X-ray diffraction by crystals – derivation of Bragg's equation – Experimental methods of X-ray study – Rotating crystal method – X-ray pattern by powder method – crystal structure of KCl, NaCl and CsCl – Properties of metals, Band theory, conductors, semiconductors and insulators.	10	CO5

Text books:

1. *Puri B.R., Sharma L.R.* and *Kalia K.K.* 2010. **Principles of Inorganic Chemistry**, [Twenty third edition], Shoban Lal, Nagin Chand & Co., New Delhi.
2. *Madan R.D., Tuli G.D.* and *Malick S.* 1988. **Selected Topics in Inorganic Chemistry**, S.Chand & Co., New Delhi.

Reference books:

1. *Lee J.D.* 2006. **Concise Inorganic Chemistry**, Blackwell Science, UK.
2. *Bassett J., et al.* 1985. **Vogel's Text book of Quantitative Inorganic Analysis**, [Fourth edition], ELBS Longman.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Ascertain the formation and stability of common inorganic complexes
CO2	Conceptualize the calculations involved in splitting theory
CO3	Generalize the role of elements in biological system
CO4	Relate the classification and properties of various complexes
CO5	Interpret the lattices and indices of various unit cells

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	M	H	L
CO2	L	M	L	M	M
CO3	H	L	H	H	H
CO4	M	L	M	M	H
CO5	M	H	L	L	M

H-High M-Medium L-Low

18UCHM602	**CORE XII: ORGANIC CHEMISTRY II**	**SEMESTER VI**

COURSE OBJECTIVES:

The course aims

- To rephrase the fundamentals in organic photochemistry
- To compute the classifications and structure of proteins
- To elucidate the occurrence and isolation of nucleiccomponents
- To device the mechanism of various organic reactions
- To deduce the reactivity of various organometallic compounds and catalysts

Credits: 5 Total Hours: 60

Unit	**Contents**	**Hours**	**CO**
I	**Organic photochemistry:** Basic Concepts of Photochemistry – Beer Lambert law – Grotthus Drapper law – Stark Einstein law – Jablonski diagram - Photochemical reactions – Norrish type-I, Norrish type-II, Paterno Buchi reaction, Photooxidation - Photoreduction, Oxetane formation. Photochemistry of Alkenes and dienes–cis-trans isomerisation, dimerisation, cycloaddition of olefins with various substrates, Photo rearrangements – Di-pi-methane rearrangement, Fries rearrangement, Claisen rearrangement, Cope and oxycope rearrangement.	12	CO1
II	**Amino acids:** Classification of amino acids - preparation and properties of glycine and alanine –with special reference to Gabriel phthalamide synthesis - Zwitterion, isoelectric point. Polypeptides and proteins: Classification of proteins based on physio-chemical and physiological functions. Peptides synthesis – Bergman synthesis and Curtius synthesis. Primary structure of proteins – Secondary structure of protein with helical and sheet structures – Denaturation of proteins.	12	CO2
III	**Nucleic acids:** Nucleosides, nucleotides, degradation of nucleotide chain – structure and function of nucleic acids – RNA and DNA. **Alkaloids:** Classification – Occurrence and Isolation –Structural elucidation of Nicotine and Papaverine. Terpenoids - Isoprene rule – Structural elucidation of geraniol and citral.	12	CO3

IV	**Molecular rearrangements:** Pinacol - pinacolone rearrangement, Benzilic acid rearrangement, , Beckmann rearrangement, Hoffmann rearrangement, Curtius rearrangement, Baeyer-Villiger and Fries rearrangements.	12	CO4
V	**Organometallic compounds:** Formation and reactions of organo magnesium, organo zinc compounds, Organo lithium compounds. Reduction: Mechanism of reduction with sodium borohydride, lithium aluminium hydride.	12	CO5

Text Books:

1. *Bahl B.S.*and *Arun Bahl*. 1997. **Advanced Organic Chemistry**, [Twetfh Edition], Sultan Chand and Co., New Delhi.
2. *Agarwal O.P.* 1997. **Organic Chemistry of Natural Products,** Vol I & II, Goel Publishing House, New Delhi.
3. *Jagdamba singh* and *Jaya singh*. 2012. **Photochemistry & Pericyclic reactions**, [Third edition), New Age International Limited, New Delhi.

Reference Books:

1. *Finar I. L.* 1996. **Organic Chemistry,** Vol 1 & 2, [Sixth edition], Addison Wesley Longman Ltd., England.
2. *Morrison R.T*. and *Boyd R.N.* 1996. **Organic Chemistry**, [Sixth edition] Allyn& Bacon Ltd, New York.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Deduce the formation and rearrangements in photochemical reactions
CO2	Discriminate the assortment in proteins and their analysis
CO3	Attribute the occurrence and isolation of nucleic acids
CO4	Extrapolate the driving hale behind organic mechanisms
CO5	Infer the mechanism of various reduction reactions

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	L	H
CO2	L	H	L	M	M
CO3	L	M	H	H	M
CO4	H	L	M	M	L
CO5	M	L	H	M	H

H-High M-Medium L-Low

18UCHM603	**CORE XIII: PHYSICAL CHEMISTRY II**	**SEMESTER VI**

COURSE OBJECTIVES:

The course aims

- To inculcate the laws and limitations to be practiced in Electrochemistry
- To ascertain the basic electrochemical parameters by derivations
- To compute different types of cells and titrimetric techniques
- To integrate the properties by symmetry elements and operations
- To illustrate the fundamental laws and processes in photochemistry

Credits: 4 Total Hours: 50

Unit	**Contents**	**Hours**	**CO**
I	**Electrochemistry I:** Ohm's law - Electrolytic conductance –conduction in metals and electrolytes. Specific conductance, equivalent conductance and molar conductance – Relation between equivalent and specific conductance. Variation of equivalent conductance with dilution. Debye-Huckel theory of strong electrolytes - Onsager equation (No derivation) significance and limitations. Kohlraush's law and its applications. Migration of ions - ionic mobility and its determination. Transport number –determination by Hittorf and moving boundary methods.	10	CO1
II	**Electrochemistry II:** Determination of degree of dissociation of weak electrolytes, ionic product of water, solubility of sparingly soluble salts. **Conductometric titrations:** Strong acid – strong base, weak acid – strong base, Strong acid – weak base, mixture of strong acid and weak acid - strongbase. Oswald's dilution law: dissociation constant of weak acid & weak base. pH and pOH. Buffer solution and buffer action – Henderson equation for pH of buffer solution – Hydrolysis of Salts.	10	CO2

III	**Electrochemical cells**: Electrolytic cell – Reversible and irreversible cells – Conventional representation of electrochemical cells – EMF and its measurements – Gibbs Hemholtz equation and EMF – Electrode reaction – Nernst equation of electrode reaction – Derivation of cell EMF –single electrode potential – standard hydrogen electrode – reference electrodes – Standard electrode potential - sign conventions – Electrochemical series and its significance – concentration cell with and without transport number – Liquid Junction Potential – Application of EMF measurements – valency of ions, solubility product, activity coefficient, Potentiometric titration – Determination of pH using hydrogen, Quinhydrone and glass electrodes – Determination of pKa of acids by potentiometry.	10	CO3
IV	**Group theory:** Symmetry elements and operations - centre of symmetry – rotation axis of symmetry – plane of symmetry – improper rotation axis – point groups – point groups of simple molecules –properties of group – Abelian group – cyclic group – point groups of water, ammonia, methane, benzene and SF_6.	10	CO4
V	**Photochemistry and Radiation Chemistry:** Photochemical reaction – Laws of photochemistry - Grothus-Drapper law – Stark Einstein law – Jablonski diagram – quantum yield – primary and secondary process – Decomposition of HI and HBr - kinetics of hydrogen chloride reaction – Photochemical equilibrium – Photosensitisation – fluorescence, phosphorescence, non-radioactive process -Chemiluminescence.	10	CO5

Text Books:

1. *Puri B.R., Sharma L.R.* and *Pathania M.S.*1993. **Principles of Physical Chemistry**, [Twenty third edition], Shoban Lal, Nagin Chand & Co.,New Delhi.
2. *Atkins P.W.* 1994. **Physical Chemistry**, [Fifth edition], Oxford University Press, UK.
3. *Raman K. V*. 1990. **Group Theory and its applications to Chemistry**, Tata McGraw- Hill Education Private Ltd, New Delhi.

Reference Books:
1. *Soni P.L.,Dharmarha* and *Dash*. 2001. **Text Book of Physical Chemistry**,Sultan Chand & Company Ltd., New Delhi. 2. *Glasstone S.* 1969. **An Introduction to Electrochemistry**, Affiliated East West Press, NewDelhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Apply the laws of electrochemistry in practicals
CO2	Cite the acid base concepts using various theories
CO3	Assess the conventional methods of emf and potential measurements
CO4	Categorize the elements according to group theory
CO5	Agnize the laws and reactions in photochemistry

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	L
CO2	H	M	H	H	M
CO3	L	H	L	L	H
CO4	M	L	M	L	L
CO5	H	M	H	M	M

H-High M-Medium L-Low

18UCHEL601	ELECTIVE II: GREEN CHEMISTRY AND NANOCHEMISTRY	SEMESTER VI

COURSE OBJECTIVES:

The course aims

- To instill the tools of green chemistry
- To impregnate the types of solvents and its properties
- To feed the basics of microwave assisted organic synthesis
- To inculcate the fundamentals of nano chemistry
- To enrich the analyzing and characterization techniques

Credits: 4 Total Hours: 50

Unit	Contents	Hours	CO
I	**Green Chemistry:** Introduction – Need for green chemistry – principles of green chemistry – atom economy – Prevention or minimization of hazardous products, choice of solvents –green oxidant – hydrogen peroxide. **Tools of green chemistry:** Alternative starting materials, reagents, catalysts, solvents and processes with suitable examples.	12	CO1
II	**Green solvents:** Definition – Water as solvent - advantages of using water as solvent – physical properties of water – specific reactions in aqueous phase - Diels-Alder reaction – Hetero Diels –Alder reaction – Claisen rearrangement – Michael reaction – Pinacol coupling. **Super critical carbon dioxide (SCC):** Introduction - properties of super critical carbon dioxide –Use of SCC for extracting natural products – Use of SCC for dry cleaning.	13	CO2
III	**Microwave assisted organic synthesis** (MAOS): Apparatus required – examples of MAOS – Suzukireaction – Heckreaction – Mannich reaction – Epoxide ring opening reaction - Diels-Alder cycloadditions - oxidation of Toluene - advantages and disadvantages of MAOS. **Organic reactions by sonication method:** Apparatus required– examples of Sonochemical reactions (Heck,	12	CO3

	Hunds diecker and Wittig reactions).		
IV	**Basics of Nanochemistry:** Introduction – definition – length scales – importance of nanoscale and its technology – self-assembly of materials – self-assembly of molecules – porous solids, nanowires, nanomachines and quantum dots. Nanoparticles – definition – Techniques to synthesize nano particles – topdown and bottom up approaches – common growth methods – applications of nanomaterials.	13	CO4
V	**Nanomaterials and their Characterization:** Preparation, properties and applications of carbon nanotubes, nanorods, nanofibre and nanoclay – toxic effects of nanomaterials. Characterisation techniques – scanning electron microscopy (SEM) – Transmission electron microscopy (TEM) – atomic force microscopy (AFM) – scanning tunneling electron microscope (STEM) (basic principles & block diagram). (Self Study)	-	CO5

Text Books:

1. *Sanghi R. S*. and *Srinivastava M. M*.2003**. Green Chemistry: Environmental Friendly Alternative**s, Narosa Publishing House, New Delhi.
2. *Ahluwalia V. K*.and *Narosa*. 2011. **Green Chemistry**, New Delhi.
3. *Shanmugam S*. 2010. **Nanotechnology**, MJP Publishers, Chennai.

Reference Books:

1. *SalomonP.* A 2008. **Handbook on Nanochemistry**, Dominant Publishers and Distributers, New Delhi.
2. *Balaji S*. 2010. **Nanobiotechnology**, MJP Publishers, Chennai.
3. *Pradeep T*. 2007. **Nano: The Essentials,** Tata Mc-Graw Hill, New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Quote the principles and processes of green chemistry
CO2	Restate the green solvents used in various organic reactions
CO3	Paraphrase the microwave assisted synthesis of organic compounds
CO4	Recite the fundamentals of Nano chemistry and types of nanomaterials
CO5	Evaluate the characterization techniques used for the analysis

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	H	M	L
CO2	L	M	M	H	H
CO3	L	H	L	M	H
CO4	H	L	H	M	L
CO5	M	H	M	L	H

H-High M-Medium L-Low

18UCHEL602	ELECTIVE II: SPECTROSCOPY II	SEMESTER VI

COURSE OBJECTIVES:

The course aims

- To illustrate the principles and concepts of ESR spectroscopy
- To paraphrase the concepts and applications of Mossbauer spectroscopy
- To prognosticate the chemicals compounds using AAS techniques
- To interpret the compounds using flame photometry techniques
- To recognize the utilization of fluorescence and phosphorescence techniques

Credits: 4 Total Hours: 50

Unit	Content	Hours	CO
I	**ESR Spectroscopy:** Introduction – Zeeman splitting – hyperfine splitting – g value – Mc Connel's equation – Krammer's degeneracy – spin orbital coupling – dipole-dipole interaction. Isotropic, rhombic and axial spectra of Copper II system	12	CO1
II	**Mossbauer Spectroscopy:** Introduction – Principle – basic concepts – Doppler shift – Resonance conditions - Recoil effect – Isomer shift – electric quadrupole splitting – magnetic dipole splitting – applications	13	CO2
III	**Atomic Absorption Spectroscopy:** Introduction – Principle – Grotrian Diagrams – Detection of non-metals by AAS – Difference between AAS & Flame emission spectroscopy – Instrumentation – Applications – Advantages and disadvantages.	12	CO3
IV	**Flame photometry:** Introduction – General principles – Instrumentation – Effect of Solvent – Factors affecting the intensity – Multielement analysis - Interferences - Applications – Limitations.	13	CO4
V	**Fluorimetry and Phosphorimetry:** Introduction – Comparison of Absorption and Fluorescence methods – Singlet and Triplet states - Excited state processes in molecules – Instrumentation – Application – Determination of Vitamins – Application of Phosphorimetry – Comparison of Fluorimetry and Phosphorimetry. (Self Study)	-	CO5

Text books:
1. *Gurdeep R. Chatwal, Sham K. Anand*, 2017, **Spectroscopy (Atomic and Molecular), Fifth Edition,** Himalaya Publishing House. **2.** *Colin N. Banwell, Elaine M. Mc Cash*, 2016, **Fundamentals of Molecular Spectroscopy [Fourth Edition],** McGraw Hill Education

Reference books:
1. *Parikh V.M.* 2002. **Absorbtion spectroscopy of organic molecules**, Mehta publishers, Pune. 2. *Williams D.W.* and *Flemming I*. 1987. **Spectroscopic methods in Organic chemistry**, McGraw-Hill, U.K. 3. *KalsiP.S.*2007. **Spectroscopy of Organic compounds**, New Age Int. Pvt. Ltd. New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Utilize the ESR techniques to interpret the spectrum of unknown compounds
CO2	Recall the working principles of Mossbauer spectroscopy
CO3	Detect the metals and non-metals using AAS technique
CO4	Analyse the multiple types of elements by flame photometry
CO5	Determine the compounds like vitamins by the concepts of Fluorimetry and phosphorimetry

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	H	M	L
CO2	L	M	M	H	H
CO3	L	H	L	M	H
CO4	H	L	H	M	L
CO5	M	H	M	L	H

H-High M-Medium L-Low

18UCHSB601	**SBC IV: AGRICULTURAL CHEMISTRY**	**SEMESTER VI**

COURSE OBJECTIVES:
The course aims

- To inculcate the knowledge about fertilizers
- To feed the chemistry behind manures
- To illustrate the types of pesticides and insecticides widely used
- To pronounce the classification and properties of soil
- To compute the classification, properties and parameters of soil

Credits: 2 Total Hours: 30

Unit	**Contents**	**Hours**	**CO**
I	**Fertilizers**: Effect of Nitrogen, potassium and phosphorous on plant growth – commercial method of preparation of urea, triple super phosphate. Complex fertilizers and mixed fertilizers –their manufacture and composition. Secondary nutrients –micronutrients – their function in plants.	6	CO1
II	**Manures**: Bulky organic manures – Farm yard manure – handling and storage - oil cakes - blood meal – fish manures.	6	CO2
III	**Pesticides and Insectides:** Pesticides – classification of Insecticides, fungicides, herbicides as organic and inorganic – general methods of application and toxicity. Safety measures when using pesticides. Insecticides: Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC.	6	CO3
IV	**Fungicides and Herbicides:** Fungicide – Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides – Acaricides – Rodenticides. Attractants – Repellants. Preservation of seeds.	6	CO4
V	**Soils:** Classification and properties of soils – soil water, soil temperature, soil minerals, soil acidity and soil testing.	6	CO5

Text Books:
1. *Brady N.C.* 1988. **The Nature and properties of soils,** Eruasia Publishing House (P) Ltd, New Delhi. 2. *Jones.V.S.* 2004. **Fertilizers and soil** fertility, Prentice Hall of India, New Delhi.
Reference Books:
1. *Fracer D.E.H.* 1992.Chemistry of Pesticides–D.Van strand Co., NewYork.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Describe the preparation methodologies of various fertilizers
CO2	Assess the handling and storage of manures
CO3	Reproduce the general methods and applications of various pesticides
CO4	Ascertain the preservation techniques using fungicides and herbicides
CO5	Illustrate the classification and properties of soil

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	M	M	H
CO2	M	H	L	M	L
CO3	L	M	H	H	M
CO4	M	L	H	H	M
CO5	H	L	M	L	H

H-High M-Medium L-Low

18ULS601	CAREER COMPETENCY SKILLS-IV	SEMESTER – VI

Course Objectives: The course aims

- To understand the basic needs of Communication
- To utilize the communication skills for achieving at the time of Interview

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar- English usage- Reading and Writing (Level-2) Direct and Indirect Speech	3	CO1
II	Spotting Errors – Parts of speech and Punctuation	3	CO2
III	Role Play – Just a Minute (JAM) -Group Discussion	3	CO3
IV	Interview Presentation (Self-Introduction)-Critical thinking, problem solving.	3	CO4
V	Dress Code and Body Language-Leadership	3	CO5

Text Books

1	*Basic English Grammar for English-Book 1, Learners, Anne Seaton, Y.H. Mew, Saddle point Publishers(E-Copy)*
2	*Basic English Syntax with Exercises, Mark Newson(E-Copy)*

Reference Book

1	*Objective General English, S. Chand, Dr. R.S. Agarwal*

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Recall the basic grammar in language
CO2	Concentrate on sentence correction
CO3	Recognize the differences among facts, opinions and judgments
CO4	Develop their personal skills through interview
CO5	Appropriately apply their learning and leadership style and strength

18UCHAL501	ADVANCED LEARNERS COURSE: CHEMISTRY FOR ENVIRONMENT	SEMESTER V

Course Objectives:

The Course aims

- To inculcate the contribution of Chemistry in the environment
- To recognize the effects the ozone depletion
- To evocate the role chemical compounds in various environmental crisis
- To address the controlling methods of pollution
- To wreak the various safe disposal methods of pollutants

Unit	Contents	CO
I	**Environmental Chemistry:** Introduction – Long Distance Movement of Pollutants – Air Pollutants – Carbon monoxide – Carbondioxide – Chlorine – Oxides of Nitrogen (NO, NO_2) – Nitric acid rain – Sulphur oxides, sulphuric acid rain – Hydrogen sulphide	CO 1
II	**Ozone Depletion:** Depletion of Ozone layer – Effect of oxides of Nitrogen on Ozone layer – Fluorocarbons and their effect. **Particulates:** Solid and Liquid aerosols – Sources of Particulates – Toxic effect of Particulates – Effect on Humans – Effect on visibility – Effect on materials.	CO 2
III	**Smog:** Classical Smog – Photochemical Smog – Mechanism of the formation of photochemical smog **-** Monitoring of Air pollutants – CO, Oxides of Nitrogen, Sulphur dioxide, Hydrogen sulphide, Hydrocarbons, Particulate matter.	CO 3
IV	**Control of Air Pollutants:** CO pollution – CO_2 pollution **-** NO_x pollution – SO_2 pollution – Control of Pollution caused by Particulates.	CO 4
V	**Soil Pollution:** Introduction – Causes of Soil Pollution – Indiscriminate use of fertilizers, pesticides, animal excreta,, urban solid waste. Disposal of urban solid waste – Dumping: Urban waste – Industrial waste – radioactive waste.	CO 5

Text Book:

1. *Puri Sharma Kalia* **Principles of Inorganic Chemistry** 2017 VishalPublications
2. *K Bagavathi Sundari* **Applied Chemistry** MJP Publishers
3. *B K Sharma* **Industrial Chemistry** 2000 GOEL Publishing House

COURSE OUTCOMES:

After the completion of the course, the students will be able to

CO 1	Understand the causes of pollution
CO 2	Comprehend the effects of ozone depletion
CO 3	Infer the reduction of problem causing chemical compounds
CO 4	Empathize and practice the subdue of pollution
CO 5	Commit the safe and proper disposal methods employed for urban wastes

Mapping:

PSO / CO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	L	M	H
CO 2	L	H	M	H	M
CO 3	M	H	L	M	L
CO 4	H	L	H	M	L
CO 5	L	M	H	L	H

18UCHAL502	ADVANCED LEARNERS COURSE: QUANTUM AND SOLID STATE CHEMISTRY	SEMESTER V

Course Objectives:

- To learn the quantum theory, operators and postulates of quantum mechanics.
- To know about the Huckel theory and its application.
- To gain the basics in solid state chemistry
- To emphasize the significance of crystallographic properties and description of crystal structure.
- To acquire awareness about the defects in crystal structure and its effect in electrical properties.

Unit	Content	CO
I	**Quantum Chemistry**: Plancks' quantum theory - Compton effect - wave particle duality - uncertainty principle – operators; linear - Hermitian and Hamiltonian operators. Eigen functions and Eigen values. Postulates of quantum mechanics-physical interpretation of wave function - orthogonality and normalization theorems.	CO1
II	**Born–Oppenheimer approximations:** LCAO - MO and VB treatments of H_2 molecule. MO theory of simple heterodiatomic molecules like HF, LiH, CO and NO. Huckel theory: application to ethylene - butadiene and benzene. Calculation of electron density and bond order	CO2
III	**Lattice energy**: Lattice energy and its determination using Born-Haber cycle - factors affecting crystal lattice energy, properties of ionic crystals (high melting point, hardness, electrical conductivity in molten condition and in solution) – ion. Radius ratio rule – Born Meyer equation.	CO3
IV	**Solid State**: Types of solids - symmetry of crystals - Miller Indices, unit cell, space lattice, Bragg's equation, classification of crystals on the basis of bonds, ionic crystals, molecular crystals, covalent crystals and metallic crystals. Structure of CsCl and NaCl, concept of liquid crystals.	CO4

V	Band theories - non - stoichiometry - point defects in solids - Schottky and Frenkel defects - linear defects - dislocations - effects due to dislocations - electrical properties of solids - insulators - intrinsic semiconductors - impurity semiconductors (n and p- type).	CO5

Text books:

1. *Prasad. R. K*, 2014. **Quantum Chemistry**, [Fourth Revised Edition]. New Age International.
2. *Moore. W.J*. 1998. **Physical Chemistry**, [Fifth Edition].
3. *Chandra. K*. 2017.**Introductory Quantum Chemistry**, [Fourth Edition].
4. *Malik, Tuli, Madan*. 2006. **Selected Topics In Inorganic Chemistry**, Chand.S & Co., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the students will be able to

CO1	Understand the concept of quantum theory, picture out the postulates of quantum mechanics
CO2	Comprehend Born –Oppenheimer, approximations and Huckel theory
CO3	Get detailed knowledge about the lattice energy, Born-Haber cycle and the properties of ionic crystals
CO4	Learn how to solve the problems in solid state chemistry
CO5	Understand the band theory, point defects and electrical properties of Solids

Mapping:

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	L
CO2	H	M	H	H	M
CO3	L	H	L	L	H
CO4	M	L	M	L	L
CO5	H	M	H	M	M

H-High M-Medium L-Low

GUIDELINES

1. Submission of record note books and project dissertation:

Candidates appearing for Practical Examinations and Project Viva-voce shall submit Bonafide Record Note Books/ Record or Thesis prescribed for Practical/ Project Viva-voce Examinations, otherwise the candidates will not be permitted to appear for the Practical/ Project Viva-voce Examinations.

2. Passing Minimum and Internal Mark Distribution (Theory, Practical andProject)

(i) Theory

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Theory paper with a passing minimum of 30 marks in External out of 75.

Internal Marks Distribution [CA- Total Marks: 25]

Attendance	: 5 Marks
Assignment	: 5 Marks
Seminar	: 5 Marks
Internal Examinations	: 10 Marks
Total	**: 25 Marks**

(ii) Practical

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Practical paper with a passing minimum of 40 marks in External out of 60.

Internal Marks Distribution [CA- Total Marks: 40]

Experiment	: 10 Marks
Attendance	: 5 Marks
Record	: 5 Marks
Internal Examinations (2)	: 20 Marks
Total	**: 40 Marks**

External Marks- 60

Marks distribution given under each practical varies depending upon the experiments

(iii) PROJECT WORK /DISSERTATION (18UCHPR601)

- The project work shall be carried out by students in group in the VIsemester and has to complete the work at the end Semester.
- Upon completion of the project work/dissertation, the candidate willbe required to appear for a Viva-Voce conducted by an ExternalExaminer.
- The Student has to attend 3 reviews before completing his/her Project.
- A candidate failing to secure the prescribed passing minimum in the dissertation shall be required to re-submit the dissertation with the necessary modifications.

Mark Distribution Pattern

Comprehensive Examination (CE)	60
Marks Continuous Assessment (CA) Marks	40
Total	**: 100 Marks**

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Project with a passing minimum of 24 marks in External out of 60.

Internal Mark Distribution **[CA - Total Marks: 50 Marks]**

1. Research work done	: 20 Marks
2. Attendance	: 05 Marks
3. Observation Note	: 05 Marks
4. Reviews (3 reviews)	: 10 Marks
Total	**: 40 Marks**

CORE PRACTICAL V: GRAVIMETRIC ESTIMATION AND ORGANIC PREPARATION (18UCHMP501)

Marks Distribution: 60 Marks

Procedure	:	10 marks
Gravimetric Estimations		20 marks
Organic Preparation	:	20 marks
Crystallization	:	10 marks
Total marks	**:**	**60 marks**

KEY FOR EVALUATION

0-2% - 20 marks

2-3% - 18 marks

3-4% - 16 marks

4-5% - 12 marks

>5% - 10 marks

Question Paper Pattern and Mark

Distribution Theory Question Paper

Pattern and Mark Distribution (For 75

marks)

1. **PART – A (5 x 5 = 25 Marks)**
   Answer ALL questions
   One question from each UNIT with Internal Choice

2. **PART – B (5 x 10 = 50 Marks)**
   Answer ALL questions
   One question from each UNIT with Internal Choice