DEPARTMENT OF CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

OUTCOME BASED EDUCATION (OBE) SYLLABUS

B.Sc. CHEMISTRY

2022 - 2023 BATCH

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE (AUTONOMOUS)

College with Potential for Excellence

Linguistic Minority Institution Affiliated to University of Madras

E.V.R. PERIYAR HIGH ROAD,

ARUMBAKKAM, CHENNAI – 600106, TAMILNADU.

D.G.VAISHNAV COLLEGE

VISION

To impart value-based quality academia; To empower students with wisdom and to charge them with rich Indian traditions and culture; to invoke the self, to broaden the same towards nation building, harmony and universal brotherhood

MISSION

To ensure sustained progress and development in imparting quality education, to pioneer new avenues of teaching and research and to emerge as an institution with potential for excellence

DEPARTMENT OF THE CHEMISTRY

VISION

To impart a sound **knowledge** in chemistry to the students that stresses scientific reasoning and problem-solving skills.

To equip students with the **skills** required to strengthen their social responsibility and to make them competent in this knowledge-driven society.

MISSION

M1	To educate students with state-of-the-art curriculum, improvised teaching methodologies and progressive research facilities. To expose students to a breadth of experimental techniques this will transform them into quality chemist.
M2	To produce socially responsible chemist who can contribute more to the industry and to address problems of societal importance. To make the department a thriving center of excellence in teaching, curriculum development and valuable research
M3	To outreach the under-privileged students of the city in the form of workshops, on-line courses, etc that showcase the role of chemistry as central science.

Eligibility for admission to B.Sc.

Pass in H.S.C or CBSE examination conducted by state board /central board with Mathematics, Physics, Chemistry as the main subjects.

Duration of course

B. Sc. (three years)

Eligibility for the award of degree

Passing of all the subjects (both in internal and ESE) offered by the college for the course.

PROGRAM EDUCATION OBJECTIVES (PEOs)

PEO1	To produce efficient and intellectual undergraduates with strong fundamentals in organic, inorganic, physical and analytical chemistry to pursue higher studies in the field of research, innovation and technology
PEO2	To make undergraduates, capable of attaining employment in teaching and industry.
PEO3	To enable undergraduates to develop professionally through life-long learning, higher education and other creative entrepreneurial pursuits in their areas of expertise or interest**.**

PEO TO MISSION STATEMENT MAPPING

MISSION STATEMENTS	PEO1	PEO2	PEO3
M1	2	2	2
M2	2	1	3
M3	1	2	3

CORRELATION: 3- STRONG 2- MEDIUM 1- LOW

PROGRAMME OUTCOMES

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to :

S.NO	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
1.	**Knowledge**	Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry. **(PO1)**
2.	**Critical Thinking**	Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking. **(PO2)**
3.	**Problem Solving**	Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries. **(PO3)**
4.	**Usage of modern tools**	Create data using modern chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis , FTIR, NMR, GCMS, Fluorescence, SEM,TEM and XRD) for chemical analysis **(PO4)**
5.	**Communication**	Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. **(PO5)**
6.	**Life-long Learning**	Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change. **(PO6)**
7.	**Ethical Practices and Social Responsibility**	Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences. **(PO7)**
8.	**Independent and Reflective Learning**	Develop entrepreneurial skills in interdisciplinary and multidisciplinary areas of chemical sciences and its applications and develop a zeal to pursue a career in the field of chemistry.**(PO8)**

Mapping of POs TO PEOs

PEO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
PEO 1	3	2	2	2	2	2	1
PEO 2	2	2	3	1	2	2	3
PEO 3	2	3	3	2	1	1	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

PROGRAM SPECIFIC OUTCOMES (PSO's)

At the time of graduation, our under graduates and post graduates would be able to:

PSO 1- Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

PSO2 - Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

PSO3 - Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

PSO4 – Apply the knowledge of Chemistry to appreciate, develop and test the theoretical aspects for applications in environment, materials, medicines, and technology.

PSO5 - Employ standard laboratory equipment, instrumentation and classical techniques to carry out experiments and develop skills to interpret and explain the validity of experimental data in terms of accuracy and underlying theory.

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SCHEME FOR - B.Sc. CHEMISTRY 2022– 2023 BATCH ONWARDS

SCHEME FOR I B.Sc. CHEMISTRY PROGRAM

SEM	PART	TITLE OF THE PAPER	INSTRUCTION HOURS/WEEK	DURATION OF EXAM	MAX. MARKS			CREDITS
					CIA	ESE	TOTAL	
SEMESTER-I								
I	**I**	Language Paper –I	-	3	**50**	50	**100**	**3**
	II	English Paper –I	-	3	**50**	50	**100**	**3**
	III	Core Paper – I General Chemistry-I	5	3	**50**	50	**100**	**5**
	III	***Elective I: Skill Based Course**: Food Chemistry **OR** Fundamental study on detection of adulterants and purification techniques	1	3	**50**	50	**100**	-
	III	Core Paper– II Qualitative Inorganic Mixture Analysis and Inorganic Preparations - Practical I	3	3	50	50	-	3
	III	Mathematics –I	-	3	**50**	50	**100**	**5**
	V	NME- I A Fundamental Study on Food Chemistry	2	3	**50**	50	**100**	**2**
	V	Soft skill I	-	3	**50**	50	**100**	**2**
		TOTAL	**11**					**23**
SEMESTER-II								
II	I	Language Paper –II	-	3	**50**	50	**100**	3
	II	English Paper –II	-	3	**50**	50	**100**	3
	III	Core Paper –III General Chemistry-II	5	3	**50**	50	**100**	5
	III	Core Paper– IV Volumetric Analysis and Organic preparations- Practical II	3	3	**50**	50	**100**	3
	III	***Elective I: Skill Based Course**: Food Chemistry **OR** Fundamental study on detection of adulterants and purification techniques	1	3	**50**	50	**100**	2
	III	Mathematics –II		3	**50**	50	**100**	5
	V	NME – II Chemistry in Everyday Life	2	3	**50**	50	**100**	2
	V	Soft skill II	-	3	**50**	50	**100**	2
		Value Added Course: Processing and Testing of Plastics Materials & Products						2
		TOTAL	**11**					**25**

*** Examinations will be conducted at the end of year.**

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SCHEME FOR II YEAR B.SC. PROGRAM

SEMESTER-III								
III	**I**	Language III		3	**50**	50	**100**	3
	II	English III		3	**50**	50	**100**	3
	III	**Core Paper V** General Chemistry III	5	**3**	**50**	50	**100**	**5**
	III	**Core Paper VI** Physical Chemistry - Practical III	**3**	**3**	**50**	50	**100**	**3**
	III	***Elective II: Employability Course** Dairy Chemistry OR Forensic Chemistry	**1**	**-**	-	-	**-**	**-**
	III	Allied Physics I	5	**3**	**50**	50	**100**	**4**
	III	Allied Physics Practical I	3	**3**	**50**	50	**100**	**3**
	V*	***Environmental Studies	1	-	-	-	-	-
	V	Soft Skill		**3**	**50**	50	**100**	**2**
		TOTAL	**10**					**23**
SEMESTER-IV								
IV	**I**	Language Paper IV		**3**	**50**	50	**100**	**3**
	II	English Paper IV		**3**	**50**	50	**100**	**3**
	III	**Core Paper VII** General Chemistry IV	5	**3**	**50**	50	**100**	**5**
	III	**Core Paper VIII** Analytical Chemistry- Practical IV	**3**	**3**	**50**	50	**100**	**3**
	III	Allied Physics II	5	**3**	**50**	50	**100**	**4**
	III	Allied Physics Practical II	3	**3**	**50**	50	**100**	**3**
	V	Soft skill	**-**	**3**	**50**	50	**100**	**2**
	III	***Elective II: Employability Course** Dairy Chemistry **OR** Forensic Chemistry	**1**	**3**	**50**	50	**100**	**2**
	V*	***Environmental Studies	1	**3**	**50**	50	**100**	**2**
		TOTAL	10					**27**

*** Examinations will be conducted at the end of year.**

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SCHEME OF III YEAR B.SC. PROGRAM

SEM	PART	TITLE OF THE PAPER	INSTRUCTION HOURS/WEEK	DURATION OF EXAM	MAX. MARKS			CREDITS
					C I A	ESE	TOTAL	
		SEMESTER-V						
	III	**Core Paper IX** Organic Chemistry I	5	3	50	50	100	5
	III	**Core Paper X** Inorganic Chemistry I	5	3	50	50	100	5
	III	**Core Paper XI** Physical Chemistry I	5	3	50	50	100	5
	III	**Elective Paper III** –Analytical Chemistry **OR** Pharmaceutical Chemistry	4	3	50	50	100	4
	III	**Core Paper XII** Organic Analysis and Gravimetric Estimations - **Practical V**	10	6	50	50	100	5
		Summer Internship						**2**
	IV	Value Education	1	3	50	50	100	2
		TOTAL	**30**					**28**
		SEMESTER-VI						
	III	**Core Paper XIII** Organic Chemistry II	5	3	50	50	100	5
	III	**Core Paper XIV** Inorganic Chemistry II	5	3	50	50	100	5
	III	**Core Paper XV** Physical Chemistry II	5	3	50	50	100	5
	III	**Core Paper XVI** Polymer Chemistry	4	3	50	50	100	4
	III	**Elective Paper IV:** Applied Chemistry **OR** Industrial Chemistry	4	3	50	50	100	4
	III	**Elective V: Entrepreneurship course:** Manufacturing and Marketing strategies of soaps and detergents OR Basic ideas on Cosmetology	2	3	50	50	100	2
	III	Core Paper XVII Project	5		50	50	100	3
		TOTAL CREDITS	**30**					**28**
		GRAND TOTAL	**154**					

COURSE TITLE: CORE I - GENERAL CHEMISTRY –I

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

On taking this course the student will be able to assess the ideal and non-ideal behavior of gases, to apply the concepts in first law of thermodynamics to analyse given thermochemical reactions, to analyse anions and cations in a given sample and to apply basic concepts of organic chemistry to assess the different reactions.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Compare the stability of intermediates, acidity of carboxylic acids, basicity of amines from polar effects - Assess the chemistry of alkanes - Differentiate Conformation and configuration
CO 2	Compare the stability of alkenes, assess the reactivity of alkenes, Preparation of higher alkynes
CO 3	Analyse the basic radicals in a given sample from the concepts of solubility, solubility product, and common ion effect - Estimate the amount of substance present in the whole of the given solution from the principles of volumetric analysis
CO 4	Calculate the thermal energy of gases using kinetic theory of gases and it can be compared with the results of principle of equipartition of energy - Identify the distribution of molecular velocities using Maxwell equation and - calculate the mean, root mean square and most probable velocity of gases - Assess an ideal and non-ideal behaviour of gases with the help of various equation of states -Use the basic concepts of gaseous state in thermodynamic study.
CO 5	Differentiate work and heat, isothermal and adiabatic processes, reversible and irreversible processes - Calculate enthalpy change for a given reaction from heat capacity data - Calculate work, heat, ΔU, ΔH, for reversible and irreversible processes from First law of thermodynamics.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

O/PO/PSO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	3	3	2	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	2	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 5	3	3	3	2	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No	CONTENTS OF MODULE	Hrs	COs
1	**BASIC CONCEPTS OF ORGANIC CHEMISTRY** 1.1 Hybridization and geometry- methane, ethane, ethylene, acetylene, benzene. 1.2 Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals, carbenes and nitrenes and benzyne (generation & stability). 1.3 Temporary effects – polarizability effects - electron displacement - electromeric and inductomeric effects - Permanent effects – polar effects – inductive, mesomeric effects – difference between mesomerism and resonance - Hyper conjugation, steric and field effects, ortho – effect. 1.4 Chemistry of alkanes – preparation – Wurtz reaction, Corey – House synthesis (using Gilman reagent) and its advantage over Wurtz reaction - Concept of Umpolung. 1.5 Cycloalkanes – preparation from dihaloalkanes and Dieckman method – Reactions.	**15**	**CO 1**

	1.6 Relative stabilities of cycloalkanes – Difference between Configuration and Conformation - cyclopropane to various forms of cyclohexane – Bayer's strain theory		
2	**ALKENES, DIENES AND ALKYNES** 2.1 Preparation of alkenes -E1, E2 and E1cB- reactions - illustration and mechanism with standard examples. A brief study of Reactivity of substrate, structure, nature of base, temperature, and solvent, Wittig reaction 2.2 Hofmann & Saytzeff elimination- stability of alkenes 2.3 Reactions of alkenes : Addition of HX (Markovnikoff's and anti-Markovnikoff's addition), Hydration, Ozonolysis, oxymercuration - demercuration, Hydroboration - oxidation, syn-addition (alk.KMnO4) and anti-addition (bromine) 2.4 Preparation of cycloalkenes- Cycloalkenes- reaction with NBS – Conversion of cyclohexene to benzene using NBS, Cyclohexene – correct representation -description. 2.5 Dienes – Classification – stability of 1,3-butadiene- Reaction of 1,3-butadiene with ethylene (Diels alder reaction) 2.6 Preparation of alkynes- Acetylene, higher alkynes (upto 4 carbon systems) from acetylides and alkynyl Grignard reagents. Reduction of alkynes – selectivity.	**15**	**CO 2**
	PRINCIPLES OF INORGANIC QUALITATIVE AND VOLUMETRIC ANALYSIS 3.1 Solubility and solubility products -relation between solubility and solubility product-use of solubility products in comparing relative solubilities of salts - common ion effect -their application in cation analysis- limitations of solubility product principle.		

3	3.2 Separation of group II and IV groups using H_2S method-uses of NH_4Cl in III group separation. Spot test reagents. 3.3 Expression of concentration-mole, molecular weight, equivalent weight, molarity, normality, formality, *molality*, percentage, mole fraction, ppm, ppb. (simple problems based on above concepts) - primary and secondary standards. 3.4 Types of volumetric titrations: Acid base titrations (strong acid and strong base; strong acid and weak base-only). Redox titrations, precipitation titrations. 3.5 Types of indicators with examples- choice of indicators-adsorption indicators-metal ion indicators.	**15**	**CO 3**
4	**GASEOUS STATE** 4.1 Gas laws - kinetic theory of gases –collision frequency- collision diameter – mean free path – collision number – equipartition of energy – molecular basis of heat capacity 4.2 Transport properties – diffusion, elementary ideas of thermal conductivity and viscosity of gases. 4.3 Maxwell's Distribution of molecular velocities (no derivation) – Derivation of the expression for mean, root mean square and most probable velocity. 4.4 Real gases- compressibility factor- deviation from ideality- different equations of state- derivation of Van der Waal's equation of state – Andrew plot-consequences of Vander Waals equation of state—derivation – critical constants –Relationship between critical constants and Vander Waals constants-continuity of state. 4.5 Virial equation of State – Law of corresponding states – Boyle Temperature	15	**CO 4**
	THERMODYNAMICS I 5.1 Internal Energy (E) and its properties- Perpetual motion machine		

5	The first law of Thermodynamics- limitations changes in energy constant volume 5.2 Enthalpy (H) – properties -difference between internal energy and enthalpy. Practical relevance of enthalpy over internal energy. - heat capacity. Relation between Cp and Cv for ideal and real gases. Calculation of enthalpy changes from heat capacity data. 5.3 Calculation of w, q, ΔE and ΔH for expansion of ideal gases under isothermal and adiabatic conditions of reversible and irreversible processes.-related problems 5.4 Heat of reactions-heat of formation and standard states, Hess law and its relationship with first law of thermodynamics – applications- calorimetry-determination of heat of reactions 5.5 Temperature dependence of heat of reaction – Kirchhoff's equation – calculation fromheat capacity data – problems. 5.6 Bond energy and resonance energy - calculation from thermo chemical data	**15**	**CO 5**

REFERENCES TEXT BOOK:

1. Principles of Physical Chemistry, Puri, Sharma, Pathania 27th edn, Vishal Publishing Co, 2016
2. Advanced Physical Chemistry P.W. Atkins, 8th edition, Oxford Press, 2009.
3. Physical Chemistry 4th Edn, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, JohnWiley & Sons, Inc.,
4. A Text book of Physical Chemistry, A S Negi, S C Anand, New Age International Publishers, 2007.
5. Physical Chemistry,W. J. Moore- Longman Publishing Group; 5th edition (1998)
6. A text book of Physical Chemistry, Glasstone, 2nd edition, Macmillan
7. A text book of physical chemistry: KL Kapoor (Volume 2 & 3), McGraw Hill Education (for Thermodynamics)
8. Physical Chemistry, Gilbert W. Castellan, 3rd edition, Narosa (for Thermodynamics and Gaseous state)
9. Puri B.R., Sharma L.R., Kalia K.K Principles of Inorganic chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand Co 1993.

10. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)

11. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).

12. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)

13. IGNOU materials for undergraduate courses for all the topics (materials can be downloaded from the following website. (www.egyankosh.ac.in) IGNOU school of sciences-levels -bachelor degree programs - current BSC- (general): full content download (.zip/.rar) elective course in chemistry (English) view/open)

14. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984) (for Unit 4 and inorganic qualitative analysis practicals)

15. Vogels text book of quantitative chemical analysis. Fifth edition or sixth edition NPTEL video lectures.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze	-	-	5	-
Evaluate	-	-	-	-
Create	-	-	-	-

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	-
Create	-

Common question paper pattern for General Chemistry - I

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -5 (Compulsory question)** **17)** a) Unit 1 (or) b) Unit 2 **18)** a) Unit 3 (or) b) Unit 4

COURSE TITLE: CORE PAPER II
INORGANIC QUALITATIVE ANALYSIS AND PREPARATIONS- PRACTICAL I

Course Code :	**Credits 03**
L:T:P:S : 3:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

On taking this course, the student will be able to analyse acid radicals and basic radicals in a given inorganic mixture by systematic semimicro qualitative analysis

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Identify the interfering and non-interfering anions (Acid radicals) in a given inorganic mixture systematically by semimicro qualitative analysis
CO 2	Eliminate interfering radical to analyse cations (Basic radicals)
CO 3	Identify cations in a given mixture from the knowledge of solubility, solubility product and common ion effect
CO4 and CO5	Prepare the double salt and simple complexes

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	□□								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No	CONTENTS OF MODULE	COs
1	1.1 Analysis of mixture containing two cations and two anions one of which will be an interfering ion. Semimicro methods using conventional scheme may be adopted. **Reactions of the following anions to be studied.** 1.2 Carbonate, Sulphide, Sulphate, Fluoride, Chloride, Bromide, Nitrate, Oxalate, Phosphate, Borate, Iodide*, Arsenite, Arsenate*, Chromate*, Sulphite*, Thiosulphate*, Nitrite*. **1.3 Reactions of the following cations to be studied.** Lead, Silver*, Mercury*, Copper, Tin*, Antimony*, Cadmium, Bismuth, Aluminium, Chromium*, Iron, Manganese, Zinc, Cobalt, Nickel, Calcium, Strontium, Barium, Magnesium and Ammonium. *Not for Examination **INORGANIC PREPARATIONS** 1. Preparation of ferrous ammonium sulphate 2. Preparation of potassium tris oxalate chromate (III). 3. Preparation of tetrammine copper (II) sulphate 4. Preparation of hexammine nickel (II) chloride.	**CO 1** **CO 2** **CO 3** **CO4** **CO5**

NOTE: Practical Examination will be conducted at the end of II semester.

REFERENCES TEXT BOOK:

1. Vogel, Text book of Inorganic quantitative analysis.
2. Inorganic semimicro qualitative analysis, V V Ramanujam, the national publishing company, 3rd edn, 2007
3. Basic principles of practical chemistry, Venkateswaran, Veeraswamy and Kulandaivel, S. Chand & Co
4. Practical Chemistry- Volume 1, Dr. S. Sundaram, Dr.P.S. Raghavan and Dr. P. Krishnan, Viswanathan publishers.

SCHEME OF VALUATION TOTAL MARKS 50

PREPARATION **15**

RECORD **10**

ANALYSIS **25**

(Split up for analysis)

ACID RADICALS 4+4	= 8
BASIC RADICALS 4+4	= 8
GROUP IDENTIFICATION:	= 3
ELIMINATION OF INTERFERRING RADICALS	= 4
REPORT	= 2

COURSES OFFERED BY DEPARTMENT OF CHEMISTRY FOR OTHER DEPARTMENTS

NME-I

A FUNDAMENTAL STUDY ON FOOD CHEMISTRY

Course Code :		**Credits**	**02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**50**
Exam Hours : 1.30 h		**ESE Marks**	**50**

LEARNING OBJECTIVES:

This course aims to explain the scientific approach of adulterants present in food and inevitable role of food additives which are used in food products.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Solve the adulteration related issues of food items by simple qualitative chemical test.
CO2	Quote the role of additives and describe the importance of preservatives
CO3	Explain the chemistry of food colours which adds aesthetic sense to the food.
CO4	Explain the importance of food flavours and the chemical compound responsible for the same.
CO5	Quote the role of taste makers and its structural correlations.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	3	2	2	3	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1:** Sources of food, types - Food adulteration- common adulterants – contamination of wheat, rice, dhal, milk, ghee adulterants - Detection of adultered foods by simple analytical techniques.	**6**	**CO1**
2	UNIT 2: Food additives- Introduction- emulsifying agents- preservatives- leavening agents- Anti oxidants	**6**	**CO2**
3	UNIT 3: Food colours – Natural colourants – Synthetic colours – spurious colours – importance of visual appearance and flavour of food.	**6**	**CO3**
4	UNIT 4: Food flavours- the smell sensation- flavourants and its types-synthetic food flavours list with chemical compound and flavour.	**6**	**CO4**
5	UNIT 5: Taste Makers- the sensation of taste- taste factors – perception of sweet taste- artificial sweetners- saccharin-(SAR elementary idea only) cyclamate and aspartame.	**6**	**CO5**

References:

1. N.Shakuntala Manay, M.Shadaksharaswamy., Foods facts and Principles, New Age International (P) Limited, Publishers
2. Swaminathan.M.,Food Sciences and Experimental foods, Ganesh and Company.
3. Srilakshmi.B., Food Science (4^{th} edition)., New Age International Pvt Ltd.,
4. G.D.Gem Mathew., Module1-Chemistry in everyday life.,
5. Manahan S.E general applied chemistry., PWS Publishers.
6. Seager S.L and Slabaugh M.R., Organic and biochemistry for today.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**50**
Remember	20	20		15
Understand	20	20		15
Apply	10	10		8
Analyze				7
Evaluate			5	5
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	25
Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

SKILL BASED ELECTIVE I

FOOD CHEMISTRY

Course Code :		**Credits**	**02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**50**
Exam Hours : 1.5		**ESE Marks**	**50**

LEARNING OBJECTIVES:

This course aims to explain about food which occupies the hierarchal needs of human being. The scientific approach of adulterants added to food incidentally and intentionally and the inevitable role of food additives and food laws and standards governing food products are explained in detail.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Introduce the Facts and Principles of food.
CO2	Solve the adulteration related issues of food items by simple qualitative chemical test.
CO3	Quote the role of additives like artificial sweetener, food colourants and flavouring agents and preservatives in food products.
CO4	Explain the laws related to food and related Products.
CO5	Explain the voluntary standards and certification system in food

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	3	3	3	3
CO2	3	3	3	2	2	3	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1:** Introduction to food- food as a source of nutrients- food is more than nutrients- population and food production- food and the future.	**6**	**1**
2	**UNIT 2 :** Food adulteration- common adulterants – Intentional adulterants- contamination of wheat, rice, dhal, milk, ghee, sugar, asafoetida, soft drinks, edible oils, coal tar dyes in food stuffs adulterants - Detection of adultered foods by simple analytical techniques- Incidental adulterants.	**6**	**2**
3	**UNIT 3:** Food additives- artificial sweetners- saccharin- cyclamate and aspartame. Food flavours- Food colours- emulsifying agents- preservatives- leavening agents. Baking powder- yeast- taste makers- MSG, vinegar.	**6**	**3**
4	**UNIT 4:** Food laws- Prevention of food adulteration (PFA) Act, 1954 – Essential Commodities Act, 1955, Fruit Product Order (FPO), 1955 –Solvent extracted oil, De- oiled Meal and Edible Flour (Control) Order, 1967- Milk and Milk products Order, 1992- Meat Food Products Order, 1992 – Vegetable oil Products (Regulation) Order, 1998 – Food Safety and Standards Act, 2006	**6**	**4**
5	**UNIT 5:** Voluntary standards and certification system- ISI Mark of the Bureau of Indian Standards- The AGMARK standard- International Food standards- Codex Alimentarius- Hazard Analysis Critical control Points (HACCP).	**6**	**5**

REFERENCES TEXT BOOK:

1. N.Shakuntala Manay, M.Shadaksharaswamy., Foods facts and Principles, New Age International (P) Limited, Publishers
2. Swaminathan.M.,Food Sciences and Experimental foods, Ganesh and Company.
3. Srilakshmi.B., Food Science (4^{th} edition)., New Age International Pvt Ltd.,
4. G.D.Gem Mathew., Module1-Chemistry in everyday life.,
5. Manahan S.E general applied chemistry., PWS Publishers.
6. Seager S.L and Slabaugh M.R., Organic and biochemistry for today.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	25
Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

SKILL BASED ELECTIVE I

FUNDAMENTAL STUDY ON DETECTION OF ADULTERANTS & PURIFICATION TECHNIQUES

Course Code :		**Credits**	**02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**50**
Exam Hours : 03		**ESE Marks**	**50**

LEARNING OBJECTIVES:

This course aims to explain the industry oriented skills targeting food industry, water analysis and electroplating and general purification techniques and.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Introduce the students to popularly used of food additives.
CO2	Solve the adulteration related issues of food items by simple qualitative chemical test.
CO3	Enumerate the fundamental studies on water analysis.
CO4	Explain the basic separation and purification techniques.
CO5	Explain the importance of electrolysis and its application in the form of electroplating.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1 : FOOD ADDITIVES IN FOOD** Food additives – Introduction – food colours – natural colourants, synthetic colours and spurious colours – flavours – flavourants types – emulsifying agents – preservatives- organic and inorganic compounds- leavening agents- baking powder and yeast- flavour enhancers – Mono sodium glutamate (MSG) – Vinegar – Antioxidants- Government Regulations- importance of food additives	**6**	**CO1**
2	**UNIT 2 : DETECTION OF ADULTERANTS** Experiments 1. Detection of starch in milk. 2. Detection of neutralizers in milk. 3. Detection of mashed potato in ghee. 4. Detection of hidden insect infestation (Ergot) in food grains. 5. Detection of chalk powder in wheat powder. 6. Detection of washing soda in sugar. 7. Detection of sugar solution in honey. 8. Detection of coal tar dyes (Malachite green) in Green vegetables/peas 9. Detection of chalk powder in asafoetida. 10. Detection of mineral acid (other than phosphoric acid) in soft drinks. 11. Detection of coal tar dyes (metanil yellow) in food stuffs 12. Detection of Sodium bicarbonate in Jaggery. 13.Detection of prohibited colours in edible oil. 14.Detection of metanil yellow in turmeric powder. 15.Detection of Rhodamine B in processed foods(sweets/ syrup).	**6**	**CO2**
3	**UNIT 3 : WATER ANALYSIS** Boiler feed water- requirements- disadvantages of using hard water in boilers - Hardness of water: temporary and permanent hardness. - softening of hard water - Internal conditioning (phosphate, calgon and carbonate conditioning methods) – External conditioning- demineralization process – desalination- reverse osmosis	**6**	**CO3**

	- Purification of water for domestic use: use of chlorine, Ozone and UV light –Significance of BOD and COD		
4	**UNIT 4 : BASIC SEPARATION AND PURIFICATION TECHNIQUES** Exposure to the Hands-on training about Principle and application of Distillation Techniques-Exposure to the principle and properties of Recrystallization Techniques-Practical Knowledge on the Techniques in Filteration of precipitates -Basic Knowledge on Sublimation Techniques-Solvent Extraction Techniques of using two immiscible liquids - Thin layer chromatography analysis of various coloured Stic pens.	**6**	**CO4**
5	**UNIT 5 : ELECTROPLATING USING ELECTROLYSIS** Basics of electrolysis- Faraday's laws of electrolysis and electroplating - Electroplating of zinc - Electroplating of Nickel - Separation of metals from a coin.	**6**	**CO5**

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	25
Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

Common question paper pattern for
Fundamental Study on Detection of Adulterants & Purification Techniques

Section A **(10 x 2 = 20 marks)** **Answer all the questions**	**Section B** **(5 x 7 = 35 marks)** **Answer all the questions**	**Section C** **(3 x 15 = 45 marks)** **Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	16) Unit – 1 (Compulsory question) 17) a) Unit 2 (or) b) Unit 3 18) a) Unit 4 (or) b) Unit 5

COURSE TITLE: CORE PAPER III - GENERAL CHEMISTRY – II

Course Code :		**Credits**	**05**
L:T:P:S	**: 5:0:0:0**	**CIA Marks**	**50**
Exam Hours : 03		**ESE Marks**	**50**

LEARNING OBJECTIVES:

On taking this course the student will be able to interpret the different properties of solids, to analyse thermo chemical reactions, to assess the nature of chemical bonding, to analyse properties of s- block elements, and to assess the reactions involved in aromatic and halogen compounds.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Compare the stability of intermediates from the concept of aromaticity - Assess the mechanism of electrophilic substitution reaction in polynuclear hydrocarbons and it's reactivity towards the same reaction.
CO 2	Explain the reactivity of carbonyl compounds, preparation, oxidation and reduction of aldehydes and ketones.
CO 3	Calculate lattice energy from Born-Haber cycle and assess the factors affecting lattice energy - Determine the hybridisation and shapes of simple inorganic molecules from VSEPR and VB theory - Sketch the Molecular orbital diagram for homo and hetero diatomic molecules.
CO 4	Analyse physical and chemical properties and applications of alkali and alkaline earth metals - Compare stabilities of carbonates of alkaline earth metals - Compare the solubility of sulphates of alkaline earth metals - Restate the special position of hydrogen in the periodic table
CO 5	Explain the II law of Thermodynamics, necessity for the II law, different statements of II law, Carnot cycle, concept of entropy, including Clausius inequality, Gibb's free energy, Helmholtz free energy, Gibb's-Helmholtz equations and its applications.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

O/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	3	3	2	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	2	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 5	3	3	3	2	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No	CONTENTS OF MODULE	Hrs	COs
1	**BENZENOID AROMATIC COMPOUNDS AND HALOGEN DERIVATIVES.** 1.1 Aromaticity – Huckel's rule – Examples aromatic, non-aromatic and antiaromatic compounds - Non benzenoid aromatic compounds. 1.2 Aromatic electrophilic substitution – mechanisms – nitration – sulphonation – halogenations – Friedel-Crafts alkylation and acylation - orientation and reactivity in mono – and di – substituted benzenes – o/p ratio 1.3 Polynuclear hydrocarbons – Orientation and reactivity of naphthalene, Anthracene and phenanthrene - Haworth synthesis of naphthalene – chemical properties of naphthalene, Anthracene and phenanthrene, Importance of 9- and 10- positions. Anthracene – Diels-Alder reaction and reaction with Benzyne 1.4 Preparation of Halogen derivatives from alcohols using HX, PX_3, PX_5 and $SOCl_2$, Basicity Vs nucleophilicity. SN1, SN2 and SNi reactions – illustration & mechanism with examples – Effect of substrate, base, temperature, solvent and nucleophiles in SN1 & SN2 reactions- 1.5 Reactions of halogen derivatives-hydrolysis, nitrile &isonitrile formation, thiocyanide and isothiocyanide. Williamson's ether synthesis- Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides 1.6 Preparation of chloro and bromo halides by Sandmeyer & Gattermann reactions, preparation of fluoro halides by Schiemann reaction(with mechanisms.)	**15**	**CO1**
	AROMATIC NUCLEOPHILIC SUBSTITUTION AND CARBONYL COMPOUNDS		

2	2.1. Aromatic nucleophilic substitution – SNAr and Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3)–Addition - elimination and Elimination – addition mechanism. 22 Carbonyl compounds –polarization and reactivity of carbonyl groups- acidity of alpha hydrogen- Nucleophilic addition – addition elimination mechanism. 23 Aldehydes and ketones - Preparation –from carboxylic acid and MnO, from salts of carboxylic acids, By reaction of acid halides with Lithium dimethyl cuprate, dialkyl cadmium reagents, by ketonic hydrolysis of acetoacetic ester(AAE) with dil acids, from nitriles , Benzaldehyde by Etard reaction. 24 Oxidation of aldehydes and ketones - Tollen's, Fehling's and Benedict reagents. MPV reductions. Clemmensen reduction and Wolff Kishner reduction -Reaction of acetone with Mg-Hg, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation.	**15**	**CO2**
3	**CHEMICAL BONDING** 3.1 Ionic bond – conditions for the formation of ionic bond- characteristic of ionic compounds- 3.2 Covalent bond – bond polarity- characteristics of covalent compounds- polarizing power and polarisability- Fajan's rule- deviation from the octet rule-incomplete octet-expansion of the octet (hyper valence). 3.3 VSEPR theory for $BeCl_2$, BF_3, SO_2, SO_3, PCl_5, SF_6, NH_3 and H_2O molecules. 3.4 Coordinate valency - General characteristics of compounds containing coordinate compounds. 3.5 VB theory – assumptions-limitations-principles of hybridization – shapes of simple inorganic molecules – BeF_2, BCl_3, NH_3, PCl_5, SF_6, H_2O, IF_5 and IF_7.	**15**	**CO3**

	3.6 MO theory –conditions for the combination of atomic orbitals - LCAO-energy levels of MOs-rules for the filling of electrons in MOs- MO energy level diagrams of homo diatomic molecules- H_2, He_2, C_2, N_2, O_2, hetero diatomic molecules –HF, NO and CO. Concept of sp mixing. 3.7 Comparison of VB and MO theories, Hydrogen bonding – types, nature of hydrogen bond-effects of hydrogen on properties of substances. (H_2O and H_2S; HCl and HF)		
4	**CHEMISTRY OF s-BLOCK ELEMENTS** 4.1 General characteristics of IA and II A group elements-electronic configuration – atomic and ionic radii- ionization potential-metallic character- electro negativity-polarising power- hydration ion and hydration energy-flame coloration- diagonal relationship- action with water, halogens and ammonia-formation of hydrides, oxides and complex compounds. 4.2 Extraction- sodium by Down's process-magnesium by electrolysis of fused magnesium chloride. Physical and Chemical Properties, and uses of Li, Na, K, Be, Mg and Ca. 4.3 Chemical Properties and uses of plaster of paris, bleaching powder and sodium bi-carbonate. Comparison of stability of II group carbonates and solubility of sulphates. 4.4 Position of hydrogen in the periodic table- resemblance with alkali metals -special position of hydrogen.	15	**CO4**
5	**THERMODYNAMICS II** 5.1 Second Law of Thermodynamics: Need of the law , Kelvin Planck and Clausius statements of second law. Carnot's cycle and efficiency of Carnot engine, Carnot's theorem, Thermodynamic scale of temperature. 5.2 Concept of Entropy: qualitative relationship between entropy change and unavailable heat or degraded energy - entropy	**15**	**CO5**

		change, randomness, disorderness and irreversibility. Clausius inequality-proof, Entropy criterion for spontaneous and equilibrium processes in isolated systems, Entropy as a function of P, V and T, Entropy changes during phase changes , Entropy of mixing and entropy change of chemical reactions.		
	5.3	Free energy: Gibb's free energy (G) and Helmholtz free energy (A), practical relevance of ΔG and ΔA, Free energy criterion for spontaneous and equilibrium process. Variation of A and G with P, V and T, Gibb's Helmholtz equation and its applications, Thermodynamic equation of state-coefficient of thermal expansion (α) and coefficient of compressibility(β), derivation of thermodynamic parameters from α and β, Maxwell's relations.		
	5.4	Systems of variable composition: Partial molar quantities, Chemical potential, Variation of chemical potential with T, P and Gibb's - Duhem equation.		

REFERENCES:

1. Principles of Physical Chemistry, Puri, Sharma Pathania 7th edn, Vishal Publishing Co, 2016
2. Physical Chemistry: Robert G. Mortimer 3rd edition, Elsevier Academic Press, 2008.
3. Advanced Physical Chemistry P.W. Atkins Oxford Press. 1990
4. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, John Wiley & Sons, Inc.,
5. A Text book of Physical Chemistry, A S Negi, S C Anand, , New Age International Publishers, 2007.
6. Physical Chemistry, W. J. Moore- Longman Publishing Group; 5th edition (1998)
7. A text book of Physical Chemistry, Glasstone, 2nd edition, Macmillan
8. A text book of physical chemistry: KL Kapoor (Volume 2 & 3) McGraw Hill Education
9. Physical Chemistry, Gilbert W. Castellan, 3rd edition ,Narosa
10. Puri B.R., Sharma L.R., Kalia K.K Principles of Inorganic chemistry, (23 rd edition), New Delhi, Shoban Lal Nagin Chand * Co 1993.

11. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn& Bacon Ltd., Newyork (2006)

12. Pillai C. N., Textbook of Organic chemistry for undergraduates, University press (2008).

13. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12thedition, Sultan Chand and Co., NewDelhi (1997)

14. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).Bruice Paula Yurkani.,Organic Chemistry, 8th Edition ,Pearson (2008)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Common question paper pattern for General Chemistry - II

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

CORE PAPER VI VOLUMETRIC ANALYSIS AND ORGANIC PREPARATIONS-PRACTICAL II

Course Code :	**Credits 03**
L:T:P:S : 0:0:3:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

LEARNING OBJECTIVE:

To impart basic knowledge in estimation of acid- base, various metal ions by volumetric analysis, preparation of simple inorganic compounds.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Estimate the amount of acid-bases involved in the titrations Explain the volumetric laws and concept of normality, molarity, molality, and equivalent mass Assess the choice of indicators according to the pH involved in the titrations.
CO2	Differentiate the chemical substances as, oxidizing and reducing agents. Using redox titrations.
CO3	Estimate the amount of hardness of water using complexometric titrations and amount of chloride ion by Mohr's method
CO4	Estimate the amount of ferrous ion using dichrometry
CO5	They can prepare simple organic compounds by using Functional Group Inter conversion

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO3	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**1**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**
CO 6	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE		COs
1	**Acidimetry and Alkalimetry** 1. Estimation of sodium hydroxide using standard Sodium carbonate. 2. Estimation of borax using standard Sodium carbonate. 3. Estimation of mixture of Sodium hydroxide and Sodium carbonate using standard Sodium carbonate*****. 4. Estimation of Oxalic acid using standard Potassium hydrogen phthalate.		**CO1**
2	**Permanganometry** 5. Estimation of Ferrous ammonium sulphate using standard Oxalic acid. 6. Estimation of Calcium using standard oxalic acid solution. **Iodometry** 7. Estimation of Cu (II) sulphate using standard Potassium dichromate. 8. Estimation of Potassium dichromate using standard Cu (II) sulphate		**CO2**
3	**Argentometry** 9. Estimation of Chloride by Mohr's method. **Argentometry** 10. Estimation of Chloride by Mohr's method. **Complexometry** 11. Estimation of Magnesium sulphate using EDTA as link and Zinc sulphate as standard 12. Estimation of total hardness of water*.		**CO3**
4	**Dichrometry** 12. Estimation of Ferrous ion using standard Oxalic acid **Precipitation Titrations** 13. Estimation of Zinc using standard Potassium ferrocyanide. 14. Estimation of Barium by back titration method*****.		**CO4**
5	**Preparation of organic compounds involving the following chemical conversions,** 1. Oxidation (benzaldehyde to benzoic acid), 2. Esterification (2-napthol to 2-napthyl benzoate), 3. Hydrolysis (methyl salicylate to salicyclic acid), 4. Nitration (phenol to 2,4,6-tribromo phenol), 5. Bromination (aniline to tribromo aniline), 6. Diazodization (preparation of methyl orange), 7. Osazone Formation (preparation of glucosazone).		**CO5**

REFERENCE BOOKS:

1. Vogels Text Book of Inorganic Quantative Analysis.
2. Basic Principles of Practical Chemistry by Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A. R. 1993, Sultan Chand & Sons.
3. Practical Chemistry for UG by Sundaram, Krishnan and Raghavan.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

SCHEME OF VALUATION TOTAL MARKS 50

Organic Preparation 15 (Quality 05+ Quantity 10)
Record 10

Volumetric Analysis	25
(Split Up For Volumetric Analysis)	
Less Than 2%	25
2-3%	20
3-4 %	20
3-4 %	10
More Than 4%	05

NME-II CHEMISTRY IN EVERYDAY LIFE

Course Code :		**Credits**	**02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**50**
Exam Hours : 1.30 h		**ESE Marks**	**50**

LEARNING OBJECTIVES:

This course aims to explain the biggest role of chemistry (a branch of Science) employed in different spheres of human life such as the air we breathe, the water we use, the various cosmetic products used every day, building materials we use for construction purposes, common pharmaceutical drugs we intake, fuel studies, colour compositions of dyes and pigments and chemical fertilizers we depend on for good yield in food production.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Recall the product used in daily life with a correlation to the polymer studies.
CO2	Summarize the chemical composition of colour pigments and dyes used in fabrics.
CO3	Assess the chemical formulations of cosmetic products used in industries and their hazards.
CO4	Analysis and purification of water treatment
CO5	Demonstrate the chemistry behind the cleansing action of soaps and detergents.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	3	3	3	3	3	2	3	3	3
CO2	3	3	3	2	2	3	3	3	3	2	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1** Polymers- introduction- classification- uses of polymers – polyethylene- low density polyethylene (LDPE)- high density polyethylene (HDPE)- polypropylene- poly vinyl chloride(PVC)- polyethylene terephthalate (PET)- biodegradability of polymers- environmental hazards of polymers- recycling of plastics – recycling codes- polymers and the future.	**6**	**CO1**
2	**Unit 2** Dyeing chemistry –**Dyes:** definition – Otto-Witt theory of colour and constitution –classification of dyes with examples and applications.	**6**	**CO2**
3	**Unit 3** Cosmetics – creams and lotions, lip stick, nail polish, perfumes, after shave lotions- deodorants - general formulation – toxicology of cosmetics	**6**	**CO3**
4	**Unit 4** Water analysis and treatment - Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light	**6**	**CO4**
5	**Unit 5**	**6**	**CO5**
	Soaps – introduction- Cleansing action of soaps- types - detergents – introduction- types of detergents - common detergents additives – enzymes used in commercial detergents- Environmental Hazards.		

REFERENCE TEXT BOOKS

1. R.Norrish.,Chemical process industries (4^{th} edition).
2. Snyder C.H., The extraordinary chemistry of ordinary things; John Wiley &Sons, Newyork.
3. Selinger B.K., Chemistry in the market place; Sydney 1998.
4. G.D.Gem Mathew., Chemistry in Everyday life.
5. Manahan S.E general applied chemistry., PWS Publishers.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE (AUTONOMOUS)
College with Potential for Excellence
Linguistic Minority Institution Affiliated to University of Madras
Arumbakkam, Chennai – 600106
SCHEME FOR II YEAR B.SC. PROGRAM

SEMESTER-III								
III	**I**	Language III		3	**50**	50	**100**	3
	II	English III		3	**50**	50	**100**	3
	III	**Core Paper V** General Chemistry III	5	**3**	**50**	50	**100**	**5**
	III	**Core Paper VI** Physical Chemistry - Practical III	**3**	**3**	**50**	50	**100**	**3**
	III	***Elective II: Employability Course** Dairy Chemistry OR Forensic Chemistry	**1**	**-**	-	-	**-**	**-**
	III	Allied Physics I	5	**3**	**50**	50	**100**	**4**
	III	Allied Physics Practical I	3	**3**	**50**	50	**100**	**3**
	V*	***Environmental Studies	1	-	-	-	-	-
	V	Soft Skill		**3**	**50**	50	**100**	**2**
		TOTAL	**10**					**23**
SEMESTER-IV								
IV	**I**	Language Paper IV		**3**	**50**	50	**100**	**3**
	II	English Paper IV		**3**	**50**	50	**100**	**3**
	III	**Core Paper VII** General Chemistry IV	5	**3**	**50**	50	**100**	**5**
	III	**Core Paper VIII** Analytical Chemistry- Practical IV	**3**	**3**	**50**	50	**100**	**3**
	III	Allied Physics II	5	**3**	**50**	50	**100**	**4**
	III	Allied Physics Practical II	3	**3**	**50**	50	**100**	**3**
	V	Soft skill	**-**	**3**	**50**	50	**100**	**2**
	III	***Elective II: Employability Course** Dairy Chemistry **OR** Forensic Chemistry	**1**	**3**	**50**	50	**100**	**2**
	V*	***Environmental Studies	1	**3**	**50**	50	**100**	**2**
		TOTAL	10					**27**

*** Examinations will be conducted at the end of year.**

COURSE TITLE: CORE V - GENERAL CHEMISTRY –III

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

On taking this course the student will be able to assess the hydroxy derivatives, to apply the concepts in p-block elements and to apply basic concepts of phase equilibria and quantum mechanics.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	Explain the methods of preparation and properties of aliphatic alcohols, phenols and polyhydric phenols. Explain the classification, preparation and properties of alkyl and aryl ethers. Discuss the preparation, properties of epoxides and importance of crown ethers
CO 2	Explain the general periodic trend, preparation and properties of electron deficient boron compounds, difference between carbon and silicon from the rest of the family..
CO 3	Explain types of oxides and oxyacids, their structure and reactivity of nitrogen, oxygen. Discuss the periodic properties and reactivity of halogen family. Explain the properties of interhalogen compounds and pseudo halogens. Explain the periodic position of noble gases, structure and properties of Xenon compounds
CO 4	To deduce the phase rule and interpret the same for various binary and ternary mixture
CO 5	Apply Schrodinger wave equation to quantum mechanical systems such as 1D, 2D, 3D and rigid rotor to deduce the expression for the energy which he can use in molecular spectroscopy. Can set up Schrodinger equation for hydrogen atom and identify the radial and angular probability distribution functions to visualize and grasp the concept of various orbitals and their shapes

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

O/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	3	3	2	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	2	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 5	3	3	3	2	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1 Hydroxy Derivatives ,Thiols And Ethers** 1.1. Alcohols-Classification, Basicity & Acidity -Preparation of alcohols Hydrogenolysis with copper chromite, Bouveault - Blanc reduction, reduction with Na/EtOH , H_2/Ni.Preparation of 1^o, 2^o and 3^o alcohols- using Grignard reagent - Ester Hydrolysis (common mechanism). Preparation from aldehydes, ketones,Carboxylic acid and esters using LAH and $NaBH_4$ 1.2. Reaction of alcohols – Esterification - Mechanism of acid and base catalyzed ester formation, Oxidation of aliphatic alcohols - use of dichromate- acidic & alkaline $KMnO_4$, hot Con.HNO_3, H_2CrO_4 , CrO_3 – Pyridine complex (PCC) - Lucas test -Oppenauer oxidation 1.3. Preparation of Phenols - From aryl diazonium salts, Grignard reagents , cumene - Acidity of phenol – ReimerTiemann Reaction, Gattermann-Koch Reaction, Schotten – Baumann Reaction. 1.4. Polyhydric phenols – Classification - Preparation of Catechol from salicylaldehyde- Resorcinol from benzene-m-disulphonic acid, p-quinol from Aniline, pyrogallol from Gallic acid. 1.5. Alkyl and Aryl ethers - Classification - preparation of dimethyl ether from CH_3I, Williamson ether synthesis and Tebbe synthesis, preparation of anisole using diazomethane. Preparation of acyclic and cyclic ethers by acid catalyzed dehydration of alcohols. 1.6. Preparation of epoxides - using m-CPBA - Cleavage of epoxides to 1, 2 – diol. Conversion of epoxide to alcohol using RMgX (Regioselectivity) and LAH- Crown ethers - 18 – crown 6-Importance.	**15**	**CO1**
	Unit 2 - p-Block Elements 1 2.1. General periodic trend-electronic configuration-oxidation state- atomic and ionic radii-ionisation energy-metallic character- inert pair effect- lewis acid character and nature of oxides.		

2	2.2. Boron family: periodic discussion-similarity and dissimilarity of boron with aluminium - diagonal relationship of boron with silicon. Electron deficient boron compounds- preparation, properties, structure and uses of Diborane, Borazole and Boron nitride. 2.3. Carbon family: periodic discussion- similarity-electronic configuration-valency- oxidation state-formation of complexes- allotropy (diamond and graphite only) -gradation in properties-electropositive character, nature of oxides, nature of hydrides, nature of halides. 2.4. Difference of carbon and silicon from the rest of the family – catenation.	**15**	**CO2**
3	**Unit 3: p-Block Elements 2** 3.1. Nitrogen family: Periodic trend-Similarity- electronic configuration, valency, oxidation states, allotropy, characteristics of oxides, oxyacids, hydrides, and halides 3.2. Unique feature of nitrogen from the rest of the family-valency-oxidation state- Preparation, properties, structures and uses of hydrazine, hydroxylamine and hydrazoic acid. Structure, properties and uses of PCl_3, PCl_5, P_4O_6, P_4O_{10}, H_3PO_2, H_3PO_3 and H_3PO_4. Application of the covalency maxima to halides of N and P- Maximum covalency rule-concept of overlapping of atomic orbitals. 3.3. Oxygen family: Periodic discussion-Similarity- electronic configuration, valency, oxidation states, allotropy, atomicity, catenation, characteristics of oxides, oxyacids, hydrides, and halides–(dihalides, tetrahalides, hexahalides, dimeric monohalides) Abnormal behaviour of oxygen. Oxides of sulphur – structure aspects of sulphur dioxide and sulphur trioxide. Peracids of sulphur- Caro's acid and Marshall's acid- preparation, properties structure and uses. 3.4 . Halogen family: Periodic discussion-Similarity- electronic configuration- electronegativity, electron affinity, oxidiation states and oxidizing power - atomicity, metallic and non- metallic character-combination with hydrogen-combination with metals and non-metals-action with water-action with alkalies - oxyacids. Peculiarities of fluorine, basic nature of iodine. 3.5. Interhalogen compounds: AX type- ClF, BrF; AX_3 type- ClF_3, BrF_3, ICl_3; AX_5 type- ClF_5, BrF_5, IF_5; AX_7 type- IF_7 -properties and structure.	**15**	**CO3**

	3.6. Pseudo halogen compounds: Preparation and properties of cyanogen and thiocyanogen. Comparison of halogens with pseudo halogens. 3.7. Noble gases: Position in the periodic table- hybridisation, geometry and structure of xenon compounds- XeF_2, XeF_4, XeO_2F_2, XeO_2, XeF_6 and $XeOF_4$.		
4	**Unit 4: Phase Study** 4.1 Definition of terms in the phase rule –phase, components and degrees of freedom with examples. 4.2 Equilibrium- physical equilibrium of one component system – Clapeyron equation and Clausius – Clapeyron equation for various phase equilibria. 4.3 Derivation of phase rule- Phase diagram and Application of phase rule to one component system- water and CO2 – super cooling, sublimation. 4.4Reduced phase rule for condensed systems- Phase diagram of two component systems – solid liquid equilibria, simple eutectic (Pb-Ag & Bi-Cd), desilverisation of lead –Compound formation with congruent melting point. (Mg-Zn) and incongruent melting point (NaK). Freezing mixtures – $FeCl_3$-H_2O and $CuSO_4$-H_2O systems.	15	**CO4**
5	**Unit 5: QUANTUM MECHANICS FOR BEGINNERS** 5.1 Postulates of quantum mechanics –equation- normalized, orthogonal and orthonormal Functions- quantum mechanical operations. 5.2 Particles in a box with infinite potential barrier (1D, 2D, 3D) 5.3. Rigid rotor in 3D (no derivation). 5.4 1D- Simple harmonic oscillator (no derivation) 5.5 Hydrogen atom (no derivation), radial and angular probability distribution. 5.6 Concept of orbitals.	**15**	**CO5**

REFERENCES TEXT BOOK:

1. Principles of Physical Chemistry, Puri, Sharma, Pathania 27th edn, Vishal Publishing Co, 2016
2. Advanced Physical Chemistry P.W. Atkins, 8th edition, Oxford Press, 2009.

3. Physical Chemistry 4th Edn, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, JohnWiley & Sons, Inc.,
4. A Text book of Physical Chemistry, A S Negi, S C Anand, New Age International Publishers, 2007.
5. Physical Chemistry,W. J. Moore- Longman Publishing Group; 5th edition (1998)
6. A text book of Physical Chemistry, Glasstone, 2nd edition, Macmillan
7. A text book of physical chemistry: KL Kapoor (Volume 2 & 3), McGraw Hill Education (for Thermodynamics)
8. Physical Chemistry, Gilbert W. Castellan, 3rd edition, Narosa (for Thermodynamics and Gaseous state)
9. Puri B.R., Sharma L.R., Kalia K.K Principles of Inorganic chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand Co 1993.
10. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
11. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).
12. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)
13. IGNOU materials for undergraduate courses for all the topics (materials can be downloaded from the following website. (www.egyankosh.ac.in) IGNOU school of sciences-levels -bachelor degree programs - current BSC- (general): full content download (.zip/.rar) elective course in chemistry (English) view/open)
14. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984) (for Unit 4 and inorganic qualitative analysis practicals)
15. Vogels text book of quantitative chemical analysis. Fifth edition or sixth edition
16. NPTEL video lectures.

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: CORE PAPER VI PHYSICAL CHEMISTRY-PRACTICAL III

Course Code :	**Credits 03**
L:T:P:S : 3:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	derive kinetic equations and investigate the reaction rate
CO2	construct phase diagram & determine the eutectic composition and temperature
CO3	compute the colligative properties such as depression of freezing point & cryoscopic constant
CO4	predict the transition temperature of hydrated salts
CO5	apply Nernst distribution law and calculate equilibrium constant
CO6	determine the miscibility temperature of phenol–water system and study the effect of impurity to CST

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**
CO6	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	LIST OF EXPERIMENTS	Hrs	COs
1	1. *Determination of Critical Solution Temperature 2. Effect of Impurity on Critical Solution Temperature 3. Determination of Transition Temperature 4. Determination of K_f and molecular weight by Rast Method 5. Kinetics of Acid Catalysed Hydrolysis of Ester (First order kinetics) 6. Kinetics of Iodination of Acetone (Zero order kinetics) 7. Kinetics of Persulphate-Iodide Reaction (Second order kinetics) 8. Determination of Partition Coefficient of Iodine between CCl_4 and water. 9. *Determination of Equilibrium constant of $KI + I_2 = KI_3$ 10. *Phase Diagram (Simple Eutectic System) 11. *Determination of Viscosity 12. * Determination of Association factor of Benzoic acid * Not to be given for examination	**9**	**CO1, CO2, CO3, CO4, CO5 & CO6**

TEXT & REFERENCE BOOKS:

1. Venkateswaran, V. Veeraswamy,R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997)
2. Daniels et al., Experimental Physical Chemistry, VII Edn, New York, McGraw Hill, (1970)
3. Findley, A., Practical Physical Chemistry, VII Edn., London, Longman (1959)
4. Ahluwalia, V.K., Dingra, S and Gulati, A. College Practical Chemistry, Orient Longman Pvt. Ltd., Hyderabad (2005)
5. Sharma, K. K. and Sharma, D.S. Introduction to Practical Chemistry, Vikas Publishing House, New Delhi, (2005)

COURSE TITLE: ALLIED PAPER CHEMISTRY – I (For Mathematics & Physics)

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES: To impart basic knowledge in nuclear chemistry, industrial chemistry, thermodynamics, chemical kinetics photochemistry and fundamental organic chemistry

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1.	Upon completion of this unit, the students would understand the fundamentals of preparation to colouration of dyes. [K1]
CO 2	Student should have learnt the fundamentals knowledge involved in the theory of dyeing[K2]
CO 3.	Students gain knowledge on how do used machines for preparation and dyeing processes. [K3]
CO 4.	Students learn about the printing of various classes of dyes and pigments-printing of natural and synthetic materials with direct reactive disperse and other dyes. [K4]
CO 5.	Student should have learnt Basics idea and how to finishing of textile materials in various method [K4]

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE	Hrs	COs
1	**UNIT-I NUCLEARCHEMISTRY** 1.1 Fundamental particles of Atom-Definition and classification alpha, Beta, Gama particles;Isotopes, isobars, and isotones Definition and examples. 1.2 Comparison of chemical and nuclear reactions: Nuclear reactions Writing equation for nuclear reactions-Nuclear Fission-NuclearFusion; Natural radioactivity- Radioactive series including Neptunium series-group displacement law (Soddy Fajan's Law) 1.3 Nuclear stability-Nuclear binding energy, *n/p* ratio, simple calculations. 1.4 Application of radio isotopes –as traces in medicine-agriculture industry- mutation of crops - pest control-radiocarbon dating.	**15**	**CO1**
2	**UNIT-II INDUSTRIALCHEMISTRY** 2.1 Fuels-classification-Preparation and uses of water gas, producer gas, liquefied petroleum gas, gobar gas, compressed natural gas, Rocket fuels (elementary ideas only) 2.2 Fertilizers – Classification – urea, superphosphate, Triple super phosphate, Potassium nitrate - manufacture and uses 2.3 Silicones – Preparation, properties and applications. 2.4 Hardness of water: temporary and permanent hardness, disadvantages of hard water – softening of hard water – Zeolite (permutit) process – demineralization process and reverse osmosis 2.5 Purification of water for domestic use: use of chlorine, Ozone and UV light –Significance of BOD and COD (Basic ideas only)	**15**	**CO2**
3	**FUNDAMENTAL OF ORGANIC CHEMISTRY** 3.1 Hybridization in Methane, Ethane, Ethylene, Acetylene, Benzene. 3.2 Classification of reagents – Electrophiles, Nucleophiles and Free radical 3.3 Classification of reactions: Addition, Substitution, Elimination, condensation, and Polymerization. Oxidation Reduction - Elementary ideas only 3.4 Polar Effects: Inductive effect, Inductometric effect, Resonance effect, Mesomeric effect- Hyper-conjugation, applications. 3.5 Electrophillic substitution mechanism in benzene, Nitration, Sulphonation, and Halogenation, Friedel crafts alkylation and acylation.	**15**	**CO3**
4	**THERMODYNAMICS** 4.1 Definition of certain terms – system, surroundings-difference between heat and work, boundary -Thermodynamic state, thermodynamic equilibrium, processes, Reversible and Irreversible process- Heat and work	**15**	**CO4**

	4.2 Internal energy- First law of thermodynamics-Limitations of I Law, Need for II Law – Different Statements of II Law 4.3Carnot cycle – Efficiency of heat engine – Carnot theorem. 4.4 Entropy – Definition - Unit and change of entropy for phase transformation. 4.5 Free energy - Nature of process in terms of Free energy and entropy – Statement of Third Law (Planck's statement only)		
5	**CHEMICAL KINETICS AND PHOTOCHEMISTRY** 5.1 Rate of chemical reaction–Differential rate expression- Order and Molecularity of reaction – integrated rate expression for first and zero order reactions-Half life period. 5.2 Effect of temperature on rate of a reaction – Activation energy Arrhenius equation 5.3 Catalyst-types-positive catalyst-negative catalyst-auto catalyst induced catalyst-promoters-inhibitors - Homogeneous and Heterogeneous catalysis (Definition & examples only) – Enzyme catalysis-Michealis Menton Equation. 5.4 Photochemistry: Statement of Grotthus – Draper Law, Stark – Einstein's Law, Beer-Lambert's law, Quantum yield. Hydrogen chlorine reaction & Hydrogen bromine reaction (No derivation is required) 5.5 Definition with examples of Photosensitization- Photosynthesis Phosphorescence-Fluorescence-Chemiluminescence Bioluminescence	**15**	**CO5**

TEXT &REFERENCE BOOKS

REFERENCE BOOKS:

1. Dr. Veeriyan V., Text Book of Ancillary Chemistry, Highmount publishing house, Chennai – 14 Edition 2006.
2. Vaithyanathan S. and others, Textbook of Ancillary Chemsitry, Priya Publications, Karur – 2- Edition –2006.
3. Soni P.L. and others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006.

4. Soni P.L. and others, Textbook of Inorganic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006
5. Puri B.R. Sharma and pathania, Text book of physical chemistry, Vishal Publishing Co., New Delhi, Edition – 2006.
6. Dara S.S., Textbook of Environmental Chemistry and pollutuion Control – S.Chand and Co., NewDelhi, Edition 2006.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Common question paper pattern for Allied Chemistry I

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: ALLIED PAPER CHEMISTRY – I (For Botany Major)

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVE:

To impart basic knowledge in nuclear chemistry, industrial chemistry, thermodynamics, Botany and environment and fundamental organic chemistry.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Discuss the applications of nuclear energy for useful purposes and radio isotopes in medical and industrial field and also explain the radio activity, predict the products in nuclear reactions
CO2	Predict the geometry of organic compounds by using concept of hybridization and analyze the various types of organic reactions like addition, substitution, elimination…etc. and Assess the mechanism of reactions like nitration, halogenation, and alkylation.
CO3	Calculate the efficiency of heat engine and Predict the spontaneity of various thermodynamic processes using the concepts such as entropy, Gibbs free energy and enthalpy.
CO4	Outline the different types of fuels and its applications and convert hard water into soft water from the concepts of zeolite, reverse osmosis and demineralization processes.
CO5	Demonstrate the usage of various types of preservatives to preserve the specimens and explain the environmental pollutions like water pollution, soil pollution, air pollution and its adverse effects.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	2	2	3	3	2	3	3	3	3	2
CO2	3	3	3	3	2	2	2	2	3	3	3	3	2
CO3	3	3	3	2	2	2	2	2	3	2	3	3	3
CO4	3	2	2	1	2	3	2	2	3	3	3	3	3
CO5	3	3	2	3	3	2	3	2	3	2	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Nuclear Chemistry** 1.1 Fundamental particles of Atom-Definition and classification; Isotopes, isobars, isotones, nuclear isomers–Definition and examples. 1.2 Comparison of chemical and nuclear reactions: Nuclear reactions-Writing equation for nuclear reactions-Nuclear Fission-Nuclear Fusion; Natural radioactivity- Radioactive series including Neptunium series- group displacement law (Soddy Fajan's Law) 1.3 Nuclear stability-Nuclear binding energy, *n/p* ratio, simple calculations. 1.4 Application of radio isotopes –as traces in medicine-agriculture-industry- mutation of crops - pest control-carbon dating. III Stage nuclear developments in India	**15**	**CO1**
2	**Industrial Chemistry** 2.1 Fuels – classification – Preparation and uses of water gas, producer gas, liquefied petroleum gas, gobar gas, compressed natural gas, Rocket fuels (elementary ideas only) 2.2 Fertilizers – Classification – urea, superphosphate, Triple super phosphate, Potassium nitrate - manufacture and uses 2.3 Silicones – Preparation, properties and applications. 2.4 Hardness of water: temporary and permanent hardness, disadvantages of hard water – softening of hard water – Zeolite (permutit) process – demineralization process and reverse osmosis 2.5 Purification of water for domestic use: use of chlorine, Ozone and UV light –Significance of BOD and COD (Basic ideas only).	**15**	**CO2**
3	**Fundamental of Organic Chemistry** 3.1 Hybridization in methane, Ethane, Ethylene, acetylene, benzene. 3.2 Classification of reagents – Electrophiles, Nucleophiles and Free radical 3.3 Classification of reactions: Addition, Substitution, Elimination, Condensation, and Polymerization. Oxidation Reduction - Elementary ideas only.	**15**	**CO3**

	3.4 Polar Effects: Inductive effect, Inductometric effect, Resonance effect, Mesomeric effect- Hyper-conjugation, steric effect- applications. 3.5 Electrophillic substitution mechanism in benzene-alkylation, acylation, Nitration, Sulphonation and Halogenation		
4	**Unit 4 Thermodynamics** 4.1 Definition of certain terms – system, surroundings-difference between heat and work, boundary -Thermodynamic state, thermodynamic equilibrium, processes, Reversible and Irreversible process- Heat and work 4.2 Internal energy- First law of thermodynamics-Limitations of I Law, Need for II Law – Different Statements of II Law 4.3 Carnot cycle – Efficiency of heat engine – Carnot theorem. 4.4 Entropy – Definition - Unit and change of entropy for phase transformation. 4.5 Free energy - Nature of process in terms of Free energy and entropy – Statement of Third Law (Planck's statement only)	**15**	**CO4**
5	**Unit 5 Chemistry In Botany And Environment (15 Hours)** 5.1 Phytochemicals- Elementary study. 5.2 Preservation of biological specimens – Role of Mercuric chloride – Uses of Formalin, transeau solution, alcohol and FAA in preserving specimens. 5.3 Role of Crystal violet and Iodine in the preparation of Gram stains. Classification of soil based on pH. Chemical treatment of soil for cultivation. Role of natural manures. 5.4 Chemical fumigants, preservatives, insecticides and plant growth regulators – Elementary study. 5.5 Types of pollutions: Water pollution, air pollution, soil pollution sources, preventive measures-adverse effects-greenhouse effect-eutrophication- acid rain- chloro fluoro carbon emission-global warming. Treatment of nuclear wastes-its adverse effects. Concept of Carbon sink and Carbon neutrality – Photosynthesis - Basic ideas.	**15**	**CO5**

REFERENCE BOOKS:

1. Dr. Veeriyan V., Text Book of Ancillary Chemistry, Highmount publishing house, Chennai – 14 Edition 2006.
2. Vaithyanathan S. and others, Textbook of Ancillary Chemsitry, Priya Publications, Karur – 2- Edition –2006.
3. Soni P.L. and others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006.
4. Soni P.L. and others, Textbook of Inorganic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006
5. Puri B.R. Sharma and pathania, Text book of physical chemistry, Vishal Publishing Co., New Delhi, Edition – 2006.
6. Dara S.S., Textbook of Environmental Chemistry and pollutuion Control – S.Chand and Co., NewDelhi, Edition 2006.

This assessment pattern is for theory papers of UG and PG

programme ASSESSMENT PATTERN

IE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Common question paper pattern

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: ALLIED CHEMISTRY PRACTICALS-I (SEMESTER-III)
VOLUMETRIC ANALYSIS AND INORGANIC PREPARATIONS
(PHYSICS, MATHEMATICS AND BOTANY)

Course Code :	**Credits 03**
L:T:P:S : 0:0:3:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

LEARNING OBJECTIVE:

To enable the students to estimate the given substance volumetrically and analyze the organic compounds qualitatively.

COURSE OUTCOMES: At the end of the Course, the Student will be able to:

CO1, CO2 & CO3	Define the various terms and outline the principles of volumetric analysis (K1, K4) and Perform the volumetric analysis and estimate the quantity present (K2)
CO4	Perform the preparation of inorganic and coordination compounds
CO5	Demonstrate the formation of coordination compounds from their metal salts.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	2	1	2	2	3	1	3	3	3	2	3
CO2	3	3	2	2	3	2	3	2	3	3	2	2	3
CO3	3	3	2	2	3	2	3	2	3	3	2	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Volumetric Analysis** 1. Estimation of Sodium hydroxide using standard sodium carbonate 2. Estimation of Hydrochloric acid using Oxalic acid. 3. Estimation of Borax using standard sodium carbonate 4. Estimation of Ferrous sulphate using Ferrous ammonium sulphate. 5. Estimation of Oxalic acid using standard Mohr's salt. 6. Estimation of Ferrous ion using diphenylamine as internal indicator. 7. Estimation of temporary and permanent hardness of Water* 8. Estimation of zinc using standard magnesium sulphate * Not given for exam		**CO1, CO2 and CO3**
2	**Preparation of Inorganic and coordination compounds** 1. Preparation of ferrous ammonium sulphate 2. Preparation of tetrammine copper (II) sulphate		**CO4**
3	**Demonstration of some coordination compound formation * (not for exam)** 1. $[Fe(SCN)(H_2O)_5]^{2+}$ 2. $[CoCl_4]^{2-}$ 3. $Cu_2[Fe(CN)_6]$ 4. $[Ni(DMG)_2]$		**CO5**

For practical examination procedure for experiments will be provided for the students at the time of examination. The purpose of giving procedure is to emphasize analytical approach during practical.

REFERENCE BOOKS:

1. N. S. Gnanapragasam, G. Ramamurthy Organic Chemistry Lab Manual , S. Viswanathan Printers & Publishers Pvt. Ltd. Reprint 1996
2. A. I. Vogel, A Text Book of Quantitative Inorganic Analysis, Longman Publishers 6th Edn.,2009

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	**MODEL**	**ESE**
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

ELECTIVE II: EMPLOYABILITY COURSE

DAIRY CHEMISTRY

Course Code :		**Credits**	**02**
L:T:P:S	**: 2:0:0:0**	**CIA Marks**	**50**
Exam Hours : 03		**ESE Marks**	**50**

Learning Outcome:

At the end of the course, the student will be able to understand the composition of milk, physicochemical properties of milk, and will be enabled to test the presence the adulterants in milk, analyze the role of preservatives and neutralizers.

COURSE OUTCOMES:

At the end of the Course, the Student will be able to:

CO1	Demonstrate the various composition of different types of Milk
CO2	Asses the important constituents of Milk
CO3	Interpret the structure of Milk
CO4	Evaluate the Physico -Chemical properties of Milk
CO5	Analyze the chemistry of Milk with respect to its constituents and adulterants.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO										**PSO**				
CO/PO/PSO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	2	2	3	3	3	3	3	3	3	2	2
CO5	3	3	3	3	2	2	3	3	3	3	3	3	3	2	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1:** Composition of milk: Definition of milk, Composition of cow milk, buffalo milk, sheep milk, goat milk and human milk. Differences between the composition of cow and buffalo milks.	6	CO1
2	**Unit 2:** Constituents of milk: Minor and major constituents. Colostrum: Significance, Composition, difference between normal milk and colostrum.	6	CO2
3	**Unit 3:** Structure of Milk: Structural elements of milk: fat globules, casein micelles, globular proteins, lipoprotein particles and their properties and grading of milk	6	CO3
4	**Unit 4**: Physico-chemical properties of milk – Colour, Flavour, Density, Specific gravity, freezing point, Boiling point, Surface tension, Viscosity, Specific heat, Refractive index, Electrical conductivity, Germicidal property, pH and acidity.	6	CO4
5	**Unit 5**: (i) Chemistry of major constituents of milk (ii) Nutritive value of milk (iii) Platform tests; Tests for detection of adulteration of milk; Preservatives and Neutralizers. (iv) FSSAI specifications for milk. (6).	6	CO5

Common question paper pattern

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -3 (Compulsory question)** **17)** a) Unit 1 (or) b) Unit 2 **18)** a) Unit 4 (or) b) Unit 5

REFERENCE TEXT BOOKS:

1. Dairy Chemistry and Animal Nutrition – M.M. Roy
2. Textbook of Practical Dairy Chemistry – N.K. Roy.
3. Fundamentals of Dairy Chemistry – Webb Johnson and Alfred.
4. Dairy Chemistry and Physics – Pieter Walstra and Robert Jenner.
5. Fundamentals of Dairy Chemistry – Noble P. Wong.
6. A textbook of Dairy Chemistry – Ling, E.R.

ELECTIVE II: EMPLOYABILITY COURSE
FORENSIC CHEMISTRY

Course Code :	**Credits**	**02**
L:T:P:S: 2:0:0:0	**CIA Marks**	**50**
Exam Hours : 03	**ESE Marks**	**50**

Learning Outcome:

At the end of the course, the student will be able to forensic chemistry understand the, and will be enabled to test the presence the adulterants in milk, analyze the role of preservatives and neutralizers.

COURSE OUTCOMES:

To deliver knowledge on chemistry involved in the forensic science.

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit – I: Poisons** Poisons – types and classification – diagnosis of poisons in the living and the dead – clinical symptoms – post-mortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods – use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.	6	CO1
2	**Unit – 2: Crime Detection** Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs – possible explosives (gelatin sticks and RDX) – metal detector devices and other security measures of VVIP – composition of bullets and detecting powder burns.	6	CO2
3	**Unit – 3: Forgery and Counterfeiting** Documents – different type of forged signatures – simulated and traced forgeries – inherent signs of forgery methods – writing deliberately modified – uses of ultraviolet rays – comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using	6	CO3

	AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels – authenticity of diamond.		
4	**Unit – 4: Tracks and Traces** Tracks and traces – small tracks and police dogs – foot prints – costing of foot prints – residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture – tool marks – paints – fibers – Analysis of biological substances – blood, semen, saliva, urine and hair – Cranial analysis (head and teeth) DNA finger printing for tissue identification in dismembered bodies – detecting steroid consumption in athletes and race horses.	**6**	**CO4**
5	**Unit – 5: Medical Aspects** Aids – Causes and prevention – misuse of scheduled drugs – burns and their treatment by plastic surgery, Metabolite analysis using mass spectrum – Gas chromatography – Arson – natural fires and arson – burning characteristics and chemistry of combustible materials – nature of combustion, Ballistics – classification – internal and terminal ballistics – small arms – laboratory examination of barrel washing and detection of powder residue by chemical tests.	**6**	**CO5**

REFERENCE TEXT BOOKS:

1. T.H. James, Forensic Sciences, Stanley Thornes Ltd, 1987.
2. Richard Saferstin and Criminalistics – An introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition, 2003.

COURSE TITLE: CORE VII - GENERAL CHEMISTRY – IV

Course Code :		**Credits**	**05**
L:T:P:S	**: 5:0:0:0**	**CIA Marks**	**50**
Exam Hours : 03		**ESE Marks**	**50**

LEARNING OBJECTIVES:

On taking this course the student will be able to assess the nature of carboxylic acids, to analyze properties of amines, nitro and heterocyclic compounds, to interpret the different properties of solids and solutions and to analyze the isomerism of co-ordination complexes.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1	To discuss the preparation and properties of carboxylic acids.
CO 2	To discuss the amines, nitro and heterocyclic compounds.
CO 3	To distinguish the optical and geometrical isomerism of co-ordination complexes.
CO 4	Calculate packing fraction, radius ratio, density of crystals – Determine interplanar distance in crystals from X-ray diffraction data - Explain the conductance of insulators, semiconductors, superconductors.
CO 5	Explain the different laws for ideal solution (Raoult's law & Henry's law), discuss about non ideal solution, azeotropes, partially miscible liquid systems. Discuss the various colligative properties and methods of determining them. Discuss about partially miscible liquid systems (phenol-water, water-triethylamine, water-nicotine) and partition coefficient

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

O/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO 1	3	3	3	2	3	3	2	3	3	3	3	3	2
CO 2	3	3	3	2	3	3	3	2	3	3	3	3	3
CO 3	3	3	3	2	3	3	2	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	2
CO 5	3	3	3	2	3	3	3	2	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1: Carboxylic Acids** 1.1. Preparation of monocarboxylic acids- by oxidation of alkenes with $KMnO_4$, by oxidation of alkyl benzenes, Arndt-Eistert synthesis, conversion of acid to acid chlorides, alcohols, Anhydrides, Esters and Amides. 1.2 Reactions of carboxylic acids – Esterification by diazomethane, Hell Volhard Zelinski reactions. 1.3 Active methylene compounds – Preparation and Synthetic applications of diazomethane . AAE and cyanoacetic ester. 1.4 Unsaturated acids: Preparation of Acrylic acid from propanoic acid, crotonic acid from β- lectrop butyric acid , Cinnamic acid from malonic ester and cyanoacetic ester. 1.5 Reformatsky reaction – action of heat on α, β, γ & δ lectrop acids. 1.6 Dicarboxylic acids – Nomenclature – General preparation of dicarboxylic acids –Succinic and Glutaric acids - Preparation of adipic acid from cyclohexanone- preparation of phthalic acid from naphthalene.	**15**	**CO1**
2	**Unit 2 : Organic Nitrogen compounds and Heterocyclic compounds** 2.1 Amines –Classification – Preparation of amines from acids (Schmidt reaction)-from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction –Reactions of amine – Distinction between primary, secondary and tertiary amines –Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. 2.2 Nitro compounds – Preparation – Difference between alkyl nitrites and nitro alkanes, distinction between primary, secondary and tertiary nitro compounds. Reduction of nitrobenzene in acidic and alkaline medium. 2.3 Five membered Heterocyclic compounds – Furan, Pyrrole, and thiophene – Hybridization, Basicity/Acidity, Orientation and aromaticity,	**15**	**CO2**

	Preparation, Reactivity towards electrophilic and nucleophillic substitution reactions – Diels alder reaction with furan. 2.4 Six-membered heterocycles – Pyridine-Aromatic character, structure, Hybridization, basicity/acidity. Orientation and reactivity- Preparation – electrophilic and nucleophilic substitution reactions. Chichibabin reaction, Zeigler alkylation.		
3	**Unit – 3 - METALLURGY AND INTRODUCTION TO COORDINATION CHEMISTRY** 3.1. Metallurgy: Definition-Classification of ores- metallurgical processes-: concentration of the ore-hand picking, gravity separation, magnetic separation- Electrostatic separation, froth floatation-Chemical separation; calcinations, roasting; Ellingham diagram-reduction to free metal-smelting- reduction by controlled heating in air (auto reduction)-reduction by aluminium. Electrometallurgy-Amalgamation method, hydrometallurgy. Fluxes- acidic and basic. 3.2 Refining of metals- Zone refining, electrolytic refining, vapour phase, *van Arkel* process, vacuum arc furnace refining. Extraction of titanium from Rutile and platinum from Sperrylite (Ni ore). Alloys and uses of Ti and Zr. 3.3. Types of ligands- IUPAC Nomenclature- Structural Isomerism-ionization, hydrate, linkage, ligand and coordination isomerism. 3.4 Stereoisomerism-geometrical and optical isomerism of four and six coordinated complexes. Geometrical Isomerism: four coordinated complexes- $[MA_2B_2]^{n\pm}$, $[MA_2BC]^{n\pm}$, $[MABCD]^{n\pm}$, $[M(AB)_2]^{n\pm}$. Six coordinated complexes-$[MA_4B_2]^{n\pm}$, $[MA_4BC]^{n\pm}$, $[MA_3B_3]^{n\pm}$, $[MABCDXY]^{n\pm}$, $[M(AA)_2\ (B)_2]^{n\pm}$, $[M(AA)_2\ BC]^{n\pm}$, $[M(AB)_3]^{n\pm}$. (where (AA) is symmetrical bidentate ligand and (AB) is unsymmetrical bidentate ligand) 3.5. Optical Isomerism: four coordinated complexes- $[M(AB)_2]^{n\pm}$. Six coordinated complexes- $[M(AA)_3]^{n\pm}$, $[M(AA)_2\ X_2]^{n\pm}$, $[M(AA)_2\ XY]^{n\pm}$, $[M(AA)\ X_2\ Y_2]^{n\pm}$.	**15**	**CO3**
4	**Unit – 4- Solid State Chemistry**		

	4.1. Crystalline solids, space lattice, Unit cell, seven crystal system, Bravais lattices, close packing of crystals. 4.2. Packing fraction, radius ratio calculation, stability of ionic crystals, density of crystals, Miller indices, interplanar spacing- X-ray diffraction, Laue method and Debye-Scherrer (powder) method intensities and structural determination of sodium chloride. 4.3. Bragg's equation, application of Bragg's equation to cubic crystal systems (simple cubic, BCC and FCC).	15	**CO4**
5	**Unit – 5- Solutions** 5.1. Ideal solutions: Solutions of gases in liquids-Henry's law, solutions of liquids in liquids- Binary liquid mixtures-Ideal solutions, Raoult's law, Vapour pressure Vs composition curves. 5.2. Non ideal solutions: Deviations from ideal behaviour- non ideal solution- temperature Vs vapour pressure curves- azeotropic mixture - azeotropic distillation. 5.3. Dilute solutions: colligative properties- thermodynamic derivation of lowering of vapour pressure, elevation of boiling point and depression of freezing point- osmotic pressure – abnormal colligative properties- calculation of molecular weight –vant Hoff factor. Critical solution temperature-phenol-water system, Nicotine – Water system – triethylamine -water system. Effect of impurity on CST. 5.4 Partially miscible liquids-upper critical solution temperature (UCST) and lower critical solution temperature (LCST)- Immiscible liquids-Nernst distribution law – Thermodynamic derivation and applications.	**15**	**CO5**

REFERENCES:

1. Principles of Physical Chemistry, Puri, Sharma Pathania 7thedn, Vishal Publishing Co, 2016
2. Physical Chemistry: Robert G. Mortimer 3rdedition, Elsevier Academic Press, 2008.
3. Advanced Physical Chemistry P.W. Atkins Oxford Press. 1990
4. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi, John Wiley & Sons, Inc.,

5. A Text book of Physical Chemistry, A S Negi, S C Anand, , New Age International Publishers, 2007.
6. Physical Chemistry, W. J. Moore- Longman Publishing Group; 5th edition (1998)
7. A text book of Physical Chemistry, Glasstone, 2nd edition, Macmillan
8. A text book of physical chemistry: KL Kapoor (Volume 2 & 3) McGraw Hill Education
9. Physical Chemistry, Gilbert W. Castellan, 3rdedition ,Narosa
10. Puri B.R., Sharma L.R., Kalia K.K Principles of Inorganic chemistry, (23 rd edition), New Delhi, Shoban Lal Nagin Chand * Co 1993.
11. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn& Bacon Ltd., Newyork (2006)
12. Pillai C. N., Textbook of Organic chemistry for undergraduates, University press (2008).
13. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12thedition, Sultan Chand and Co., NewDelhi (1997)
14. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).
15. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -5 (Compulsory question)** **17)** a) Unit 1 (or) b) Unit 2 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: CORE PAPER VIII ANALYTICAL CHEMISTRY PRACTICAL IV

Course Code :	**Credits 03**
L:T:P:S : 3:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning objective:

The objective of the course is to equip the students to measure conductance, apply the concept of potential difference to carry out titrations and to calculate thermodynamic parameters, measure absorption using colorimeter and verify and apply the Lambert-Beer law.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Determine the cell constant and explain the effects of dilution on equivalent and molar conductance.
CO2	Carry out conductometric titrations to determine the concentration of unknown acids
CO3	Learnt to use the potentiometer and carryout potentiometric titrations for acid base and redox reactions.
CO4	They learnt to use colorimeter and measure absorption to find the unknown concentrations of the given solutions.
CO5	Identify the number of components in a mixture using TLC and column chromatography.
CO6	Use polarimeter to measure specific rotation of an optically active compound such as sucrose and calculate the concentration.
CO7	Determine the thermodynamic parameters of a reaction in the Daniel cell using potentiometer.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO6	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO7	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S No	CONTENTS OF MODULE		COs
1	**Conductometry** a) Determination of Cell constant b) Determination of Specific conductance, Molar conductance, equivalent conductance and Verification of Onsager equation		**CO1**
2	**Conductometry** Determination of strength of given strong acid using strong base		**CO2**
3	**Potentiometric titrations** Determination of strength of a strong acid using strong base.(HCl Vs. NaOH)		**CO3**
4	**Potentiometric titrations** Redox titrations. ($K_2Cr_2O_7$ Vs $FeSO_4$)		**CO3**
5 6	**III Colorimetry** Estimation of Iron Estimation of Copper		**CO4**
7	**Chromatographic techniques*:** Thin layer chromatography: Determination of R_f value of Ni and Co, Cu ions		**CO5**
8	**Chromatographic techniques*:** Column chromatography: Separation of mixture of organic compounds into single components (Demonstration only)		**CO5**
9	Estimation of Glucose by Polarimetric method		**CO6**
10	Determination of Thermodynamic properties for the cell reaction in a Daniel Cell by potentiometer		**CO7**

REFERENCE BOOKS:

1. Venkateswaran, V. Veeraswamy,R.Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997).

1. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984)

2. Practical physical chemistry, Alexander Findley.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

COURSE TITLE: ALLIED PAPER CHEMISTRY – II (For Mathematics & Physics)

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objective:

To impart basic knowledge in Co-ordination chemistry, Bimolecular, Phase study, electrochemistry and analytical Chemistry

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Deduce the basic principles and reaction involving coordination compounds and illustrate the biological role of coordination complexes
CO2	Infer the structure and functions of simple and essential biomolecules.
CO3	Evaluate the phase rule and reduced phase rule to simple binary systems.
CO4	Implement electrochemical series and types of cells to devise electroplating process and conductometric titrations
CO5	Describe the principles of volumetric analysis and summarize chromatographic separations and purification techniques.

MAPPING OF COURSE OUTCOMES TO PROGRAMME OUTCOMES

	PO								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE	HR	CO
1	**CO-ORDINATION CHEMISTRY** 1.1 Introduction-some basic definitions: central metal ion, ligand, oxidation state of central metal ion, coordination sphere, Coordination number-classification of ligands- Chelation (EDTA and its applications) 1.2 Theories of Bonding: Postulates of Werner's theory, Sidgwick theory (Effective Atomic Number –EAN rule), Pauling's Valence Bond Theory– geometry, hybridization and magnetic property of [Ni (CO)4], [Ni(CN)4]2-, [Co(CN)6]3- - Merits and demerits of Werner and Pauling's Valence Bond Theory. 1.3 Applications of co-ordination of compounds: Qualitative analysis - separation of copper and cadmium ions using KCN, identification of metal ions like Cu and Fe- quantitative analysis, estimation of Nickel using DMG and estimation of aluminium using oxine. 1.4 Bio-inorganic complexes: Hemoglobin and chlorophyll-central metal ion, oxidation state, ligand, coordination sites, Biological role (elementary idea only). Blue baby syndrome- (elementary idea)	15	CO
2	**BIOMOLECULES** 2.1 Classification, preparation and reactions of glucose and fructose. Discussion of open and ring structure of glucose, mutarotation. Interconversion of glucose to fructose and vice versa 2.2 Preparation and properties of sucrose-Properties of starch. 2.3 Cellulose and derivatives of cellulose. RNA and DNA (elementary idea only).	15	CO2

	2.4 Amino acids: Classification, preparation, and properties of glycine and alanine (Gabriel Phthalimide synthesis and Strecker's synthesis only) – preparation of dipeptide using Bergman method. Proteins and enzymes (elementary idea)		
3	**PHASE STUDY** 3.1 Phase rule: Definition of terms-Phase, Component, Degrees of freedom 3.2 Application of phase rule to water and CO2 system 3.3 Reduced phase rule and its application to Pb-Ag system. 3.4 Freezing mixtures –NaCl-water system 3.5 Freezing mixtures and soldering	15	CO3
4	**ELECTROCHEMISTRY** 4.1 Galvanic cells – *emf* – standard electrode potential – reference electrodes. Difference between electrolytic cell and galvanic cell. 4.2 Electrochemical series and its applications –Determination of pH using hydrogen electrode. Different type of cells, primary cell, Secondary cell-Lead acid battery merits and demerits Nickel-cadmium battery-fuel cells (H2-O2 fuel cells and its advantages-advantage over heat engine) 4.3 Corrosion and its prevention- Electroplating process: Nickel and Chrome plating 4.4 Conductometric titrations- Buffer solution – Henderson's equation. Application of pH and buffer in biological processes.	15	CO4
5	**ANALYTICAL CHEMISTRY** 5.1 Concentration terms: Molarity, Normality, molality, formality and mole fraction (elementary problems), Principle of volumetric analysis. 5.2 Separation techniques: extraction, solvent extraction, distillation, fractional distillation	15	CO5

	5.3 Purification techniques: factors affecting purity of a compound –crystallization-fractional crystallization-sublimation. 5.4 Chromatographic separations – Principles and application of column, paper, thin layer and ion-exchange chromatography.		

REFERENCES TEXT BOOK:

1. Dr. Veeriyan V., Text Book of Ancillary chemistry , Highmount publishing house, Chennai – 14 Edition 2006
2. Vaithyanathan S. and others, Textbook of Ancillary Chemsitry, Priya Publications, Karur – 2- Edition –2006.
3. Soni P.L. and others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006.
4. Soni P.L. and others, Textbook of Inorganic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006
5. Puri B.R. Sharma and pathania, Text book of physical chemistry, Vishal Publishing Co., New Delhi, Edition – 2006.
6. Dara S.S., Textbook of Environmental Chemistry and pollutuion Control – S.Chand and Co., NewDelhi, Edition 2006.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

End Semester examination question paper pattern (Max. marks: 100)

Common question paper pattern for Allied Chemistry II

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: ALLIED CHEMISTRY – II (For Botany)

Course Code :	**Credits 05**
L:T:P:S : 4:0:0:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

Learning objective*: *To impart basic knowledge in nuclear chemistry, industrial chemistry, thermodynamics, Botany and environment and fundamental organic chemistry.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Predict the geometry of coordination compounds using the concept of hybridization and estimate the metal ions like nickel, aluminum etc., present in the given sample gravimetrically by converting them into coordination compounds
CO2	Explain various types of sugars and amino acids and the inter conversions, preparation and properties of sugars.
CO3	Analyse the adulterants in various food samples like sugar, salt , turmeric power, honey etc., and the need for Choice of proper balanced diet from calorific values of different food
CO4	Demonstrate the usage of herbs like thulasi, kezhaneli, neem as a remedies for common diseases and Explain the importance of chemistry in sidda, Ayurveda and homeopathy medicines
CO5	Explain the various volumetric solutions and estimate the amount of solute present in the given solution by volumetric principles –separate the organic compounds by using chromatographic techniques like column, paper, thin layer chromatography.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**
2CO5	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	Cos
1	**Co-Ordination Chemistry** 1.1 Definition of terms-classification of Ligands-Nomenclature (Elementary treatment only)-chelation –examples. 1.2 Werner's theory – Effective Atomic Number – 1.3 Pauling's theory – geometry and hybridization of [Ni $(CO)_4$], $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$Merits and demerits of Werner and Pauling's Theory – Biological role of haemoglobin and chlorophyll,(Elementary idea only)– 1.4 Estimation of Nickel using DMG and estimation of Aluminium using Oxine	**15**	**CO1**
2	**Biomolecules** 2.1 Classification, preparation and reactions of glucose and fructose Discussion of open and ring structure of glucose, mutarotation. Interconversion of glucose to fructose and vice versa – 2.2 Preparation and properties of sucrose. Properties of starch. Cellulose and derivatives of cellulose ,chitin .(Properties – Hydrolysis , Methylation , and acetylation) 2.3 Amino acids: Classification, Isoelectric point –Zwitter ion –primary and secondary structure of aminoacids-hydrolysis. 2.4 Preparation, and properties of glycine and alanine (Strecker's and Gabriel pthalimide synthesis)– preparation of dipeptide using Bergman method.	**15**	**CO2**
3	**Food Chemistry** 3.1 Calorific value of food –examples –Balanced diet –sources-oils and fats-definition- Iodine value of oil 3.2 Adulteration - Common adulterants in food –examples-Test for detection of some common adulterants(sugar , salt, coffee, milk , tea, chilli powder, turmeric powder, honey, pepper, edible oil) 3.3 Food colours , food flavours –Types –health effects. 3.4 Preservatives and its types –adverse health effects due to preservatives	**15**	**CO3**
4	**Medicinal Chemistry** 4.1 Medicinal herbs –types –importance	**15**	**CO4**

	4.2	Occurance - Medicinal properties and some chemical components of thulasi, Kezhanelli , neem , aloe vera and Turmeric-significance.		
	4.3	Natural remedies for common disease –common cold –allergies-dengue-digestion problems – (preparation and administration of natural recipes)		
	4.4	Importance of chemistry in siddha, Ayurveda and homeopathy medicines-advantages and disadvantages.		
5	**Analytical Chemistry**		**15**	**CO5**
	5.1	Principle of volumetric analysis – volumetric law – molarity , normality (elementary problems)		
	5.2	Separation techniques – extraction –solvent extraction -distillation –fractional distillation–		
	5.3	Purification techniques – factors affecting purity of a compound – crystallization-fractional crystallization-sublimation.		
	5.4	Chromatographic separations – Principles and application of column, paper, and thin layer chromatography.		

REFERENCE BOOKS:

1. Dr. Veeriyan V., Text Book of Ancillary Chemistry, Highmount publishing house, Chennai – 14 Edition 2006.
2. Vaithyanathan S. and others, Textbook of Ancillary Chemistry, Priya Publications, Karur – 2- Edition –2006.
3. Soni P.L. and others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006.
4. Soni P.L. and others, Textbook of Inorganic chemistry, Sultan Chand and Company, New Delhi, Edition – 2006
5. Puri B.R. Sharma and pathania, Text book of physical chemistry, Vishal Publishing Co., New Delhi, Edition – 2006.
6. Dara S.S., Textbook of Environmental Chemistry and pollution Control – S.Chand and Co., NewDelhi, Edition 2006.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Common question paper pattern

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: ALLIED CHEMISTRY PRACTICALS-II (SEMESTER-IV)

ORGANIC ANALYSIS AND DETECTION OF ADULTERANTS IN FOOD MATERIALS (PHYSICS, MATHEMATICS AND BOTANY)

Course Code :	**Credits 03**
L:T:P:S : 0:0:3:0	**CIA Marks : 40**
Exam Hours : 03	**ESE Marks : 60**

LEARNING OBJECTIVE:

To enable the students to estimate the given substance volumetrically and analyze the organic compounds qualitatively.

COURSE OUTCOMES: At the end of the Course, the Student will be able to:

CO1, CO2 & CO3	Identify and analyze organic compounds (K2)
CO4 & CO5	Identify the presence of adulterants in food materials

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	2	1	2	2	3	1	3	3	3	2	3
CO2	3	3	2	2	3	2	3	2	3	3	2	2	3
CO3	3	3	2	2	3	2	3	2	3	3	2	2	3
CO4	3	3	2	2	3	2	3	2	3	3	2	2	3
CO5	3	3	2	2	3	2	3	2	3	3	2	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No.	CONTENTS OF MODULE	Hrs	COs
1	**Organic analysis** Analysis of aldehyde (aromatic), Carbohydrate (reducing sugars only), Carboxylic acid (both saturated and unsaturated), Phenol, Aromatic Amine, Aliphatic Diamide. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests.		**CO1, CO2 & CO3**
2	Detection of adulterants in food materials: (*Not for Exam) 1. Detection of starch in milk 2. Detection of neutralizers in milk 3. Detection of mashed potato in ghee 4. Detection of hidden insect infestation (Ergot) in food grain 5. Detection of chalk powder in wheat powder 6. Detection of sugar solution in honey 7. Detection of coal tar dyes in green vegetables/ peas 8. Detection of chalk powder in asafetida 9. Detection of mineral acids (except phosphoric acid) in soft drinks 10. Detection of coal tar dyes in food 11. Detection of sodium carbonate in Jaggery		**CO4 & CO5**

For practical examination procedure for experiments will be provided for the students at the time of examination. The purpose of giving procedure is to emphasize analytical approach during practical.

REFERENCE BOOKS:

1. N. S. Gnanapragasam, G. Ramamurthy Organic Chemistry Lab Manual, S. Viswanathan Printers & Publishers Pvt. Ltd. Reprint 1996
2. A. I. Vogel, A Text Book of Qualitative organic Analysis, Longman Publishers 6th Edn.,2009
3. Laboratory manual prepared by the Department staff. (for detection of adulterants in food materials)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

LAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE (AUTONOMOUS)
College with Potential for Excellence
Linguistic Minority Institution Affiliated to University of Madras
Arumbakkam, Chennai – 600106

SCHEME OF III YEAR B.SC. PROGRAM

SEM	PART	TITLE OF THE PAPER	INSTRUCTION HOURS/WEEK	DURATION OF EXAM	MAX. MARKS			CREDITS
					C I A	ESE	TOTAL	
SEMESTER-V								
	III	**Core Paper IX** Organic Chemistry I	5	3	50	50	100	5
	III	**Core Paper X** Inorganic Chemistry I	5	3	50	50	100	5
	III	**Core Paper XI** Physical Chemistry I	5	3	50	50	100	5
	III	**Elective Paper III** –Analytical Chemistry **OR** Pharmaceutical Chemistry	4	3	50	50	100	4
	III	**Core Paper XII** Organic Analysis and Gravimetric Estimations - **Practical V**	10	6	50	50	100	5
		Summer Internship						**2**
	IV	Value Education	1	3	50	50	100	2
		TOTAL	**30**					**28**
SEMESTER-VI								
	III	**Core Paper XIII** Organic Chemistry II	5	3	50	50	100	5
	III	**Core Paper XIV** Inorganic Chemistry II	5	3	50	50	100	5
	III	**Core Paper XV** Physical Chemistry II	5	3	50	50	100	5
	III	**Core Paper XVI** Polymer Chemistry	4	3	50	50	100	4
	III	**Elective Paper IV:** Applied Chemistry **OR** Industrial Chemistry	4	3	50	50	100	4
	III	**Elective V: Entrepreneurship course:** Manufacturing and Marketing strategies of soaps and detergents OR Basic ideas on Cosmetology	2	3	50	50	100	2
	III	Core Paper XVII Project	5		50	50	100	3
		TOTAL CREDITS	**30**					**28**
		GRAND TOTAL	**154**					

COURSE TITLE: CORE IX - ORGANIC CHEMISTRY I

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

This course will expose students, the principles involved in the spectroscopic techniques and the analysis of simple organic molecules using UV, IR, NMR Spectroscopy and Mass spectrometry as tools. The details of stereochemistry involving organic molecules will be discussed. In addition, molecular rearrangements will be introduced in detail.

COURSE OUTCOMES: At the end of the Course, the Student will be able to:

CO1	Understand the three-dimensional representations, elements of symmetry, optical isomerism, enantiomers and diastereomers and the importance of ORD, CD techniques.
CO2	Predict the cis –trans isomers and learn the concepts of chiral axis, chiral plane and its application in biphenyls, allenes, alkylidene cycloalkanes and adamants. To develop knowledge in asymmetric synthesis and methods of resolution and racemisation.
CO3	To develop knowledge in the principle and instrumentation of UV -Visible and Infrared spectroscopy and the fundamental laws governing the spectroscopic techniques.
CO4	Learn the concept of NMR spectroscopic technique in details and its importance in the prediction of simple organic compounds.
CO5	Analyse the mechanism of different molecular rearrangements. To know the application of mass spectrometry in understanding the structure of organic molecules.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	2	2	2	3	1	3	3	3	2	3	2
CO4	3	3	3	3	3	3	2	3	2	3	3	3	2	3	2
CO5	3	3	3	3	2	3	2	3	2	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Stereochemistry – I** 1.1 Isomerism, stereoisomerism-Classification– Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. Conformation-definition, difference between configuration and conformation- Symmetry, asymmetry, dissymmetry, Elements of symmetry, chiral centre, stereogenic centre , chiral axis, chiral plane. 1.2 Optical isomers- Enantiomers, Diastereomers and Meso compounds. Relative and absolute configuration - Threo and erythro isomers; D and L; CIP Rules: R / S (upto 3 chiral carbon atoms). 1.3 Optical isomerism - Optical activity and chirality– Plane and circularly polarized light Criteria for optical activity – Necessary and sufficient conditions. Diastereomers – distinguishing between enantiomers and diastereomers. 1.4 Optical isomerism in compounds with chiral axis and chiral plane - allenes, spiranes Alkylidene cycloalkanes - Adamantanes and biphenyl- criteria for exhibiting chirality in each case-atropisomerism 1.5 Definition of ORD and CD	**15**	**CO1**
2	**Unit 2: Stereochemistry II** 2.1 Geometrical isomerism: Explanation and examples with respect to carbon-carbon, carbon-hetero atom, hetero atom-hetero atom, acyclic, conjugated and cyclic compounds. Designation as Cis-Trans and E- Z notation. 2.2 Configuration of geometrical isomers – Identification of geometrical isomers using physical and chemical methods.	**15**	**CO2**

	2.3 Conformational analysis - acyclic systems-substituted ethane, n-propane, n-butane- and cyclic systems-mono- and di-substituted cyclohexanes-Stability and optical activity of mono and di- substituted methyl cyclohexanes. 2.4 Asymmetric synthesis – partial asymmetric synthesis-Methods-with optically active Reagents, with optically active substrates-Absolute asymmetric synthesis with circularly polarized light. (Elementary idea only) 2.5 Methods of Resolution and Racemisation-Walden inversion – Evidences.		
3	**Unit 3: UV – VIS and IR spectroscopy** 3.1 UV- Visible spectroscopy – Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, Beer-Lambert's law- calculations involving Beer-Lambert's law 3.2 Basic principles of instrumentation for single and double beam instrument – block diagrams - description of components- Types of source, monochromator and detector- Choice of solvent. 3.3 Electronic transitions, λmax & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward Hoffmann rules for calculating λ max of conjugated dienes and α,β – unsaturated enones. (acyclic systems only) 3.4 IR spectrometry - Basic principles of instrumentation for single and double beam instrument , Block Diagram, Types of	**15**	**CO3**

	source, monochromator & detector, sampling techniques (basic idea). 3.5 Infrared radiation and types of molecular vibrations (normal modes of vibration), functional group and fingerprint region. Application of IR spectra in determining functional groups.		
4	**Unit 4 : Nuclear Magnetic Resonance spectroscopy (NMR)** 4.1 Principle- NMR active nuclei and percentage of abundance. 4.2 Energy levels and Basic NMR equation. 4.3 Instrumentation – block diagram, NMR solvents – Use of TMS as reference 4.4 Chemical shift – Shielding and deshielding, up field and down field-Calculation of δ, spin – spin coupling, coupling constant, Pascal's triangle – significance. 4.5 Analysis of spectrum of ethanol, acetone, acetaldehyde, ethylene, acetylene, benzene.	**15**	**CO4**
5	**Unit 5: Mass Spectrometry and Molecular Rearrangements** 5.1 Mass spectrometry-Instrumentation- nitrogen rule- odd and even electron rule- fundamentals- molecular ion peak, base peak, isotopic peak and meta stable ions- Mass fragmentation of functional groups- aliphatic alkanes, alcohol, phenol, carbonyl compounds- carboxylic acid, esters - Mclafferty rearrangement- amines, nitro compounds – Mass spectrometry of organic compounds such as benzyl alcohol, 2-methyl pentane, benzaldehyde, ethyl amine, pyrrolidine. 5.2 Molecular rearrangements- Classification – General mechanistic treatment of nucleophilic, Electrophilic and free radical rearrangement.	**15**	**CO5**

	5.3 Mechanism of the following rearrangements - Pinacol-pinacolone (only open chain compounds), dienone-phenol rearrangement. Wagner –Meerwein, Hofmann, Curtius, Lossen and Schmidt rearrangements – Beckmann and Benzidine rearrangements.		

REFERENCES & TEXT BOOKS

1. Finar I.L., Organic Chemistry, Vol. 1 & 2, 6th edition, Addison Wesley Longman Ltd., England (1996)
2. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
3. Bahl B.S., Arun Bahl., Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., New Delhi (1997)
4. Pine S.H., Organic Chemistry, 4th edition, Mc-Graw-Hill International Book Company, New Delhi (1986)
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8. Nasipuri., Stereochemistry of Organic Compounds, 2nd Edition, Wiley Eastern Ltd, New Delhi (1994)
9. Kalsi.P.S., Stereochemistry, Conformation Analysis and Mechanism, 2nd Edition,
10. Wiley Eastern Limited, Chennai (1993)
11. Kalsi.P.S., Stereochemistry and Mechanism Through Solved Problems, 3rd Edition, Newage International publishers (1999)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	**Weightage %**
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Common question paper pattern for Organic Chemistry - I

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -3 (Compulsory question)** **17)** a) Unit 1 (or) b) Unit 2 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: CORE X - INROGANIC CHEMISTRY I

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning Objective*: This course provides an ideal platform to explain the periodic properties of inner transition elements, theories of co-ordination compounds, concepts of bonding in organometallic chemistry, bio inorganic Chemistry and introduction to solid state chemistry.*

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1.	**To assess the** concept of electronic arrangement, various oxidations states and their exclusive magnetic properties of lanthanides and actinides [K2]
CO 2	**To predict** the shape, geometry, hybridisation, magnetic properties and stability of various six and four membered complexes of 3d series transition metals using VBT and CFT. [K2]
CO 3.	**To discuss the** about the origin and concept of toxicity from metals and Chemical speciation in the environment, chelating agents medicine. [K3]
CO 4.	**To acquire** knowledge on the various donor systems donating sigma and pi bonds involved in the structure, bonding and properties pertaining to utility nature of organometallic compounds comprising of Pb, Zn, Li Cu and B. [K3]
CO 5.	**To distinguish** the structure of solids as hcp/ccp based on the arrangement of atoms in the crystal lattice and establish the nature of the crystal lattice as FCC or BCC. [K2].

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	2	3	2	2	2	3	3	3	3	3	2
CO2	3	3	2	3	2	3	2	2	2	3	3	3	3	3	2
CO3	3	3	3	3	2	3	2	3	2	3	3	3	2	3	2
CO4	3	3	3	2	2	3	2	2	2	3	3	3	2	3	2
CO5	3	3	3	3	2	3	3	3	2	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**Unit 1: Chemistry of Inner Transition Elements** **Position in the periodic table.** **1.1 Lanthanoids:** General characteristics - Electronic configuration, oxidation states, oxidation potential, color, magnetic properties (concept of spin-orbit coupling, 'g' value, special mention about magnetic moment values of Sm(II) and Eu (II) ions), basic character, solubility of compounds, double salts, chemical reactivity, formation of complex compounds, spectral properties, ionization potential and formation of organometallic compounds. Lanthanide contraction- its consequences. **1.2 Separation of Lanthanoids:** Ion-exchange chromatography, valency method, solvent extraction, EDTA method. **1.3 Actinoids:** General characteristics - Electronic configuration, oxidation states, atomic radii, ionic radii, actinide contraction, formation of complex compounds, magnetic properties, spectral properties, chemical reactivity. Similarities and differences between lanthanides and actinides. **1.4** Extraction and uses of thorium and uranium-Extraction of thorium from monazite and uranium from pitch blende.	**15**	**CO 1**
2	**Unit 2: Coordination Chemistry-I** 2.1 Theories of coordination compounds- Werner's theory, Effective Atomic Number rule-Concept of electroneutrality, Kepert model, V.B theory- hybridization, geometry and magnetic properties of $[Ni(CN)_4]^{2-}$, $[Zn(NH_3)_4]^{2+}$,$[NiCl_4]^{2-}$, $[Fe(CN)_6]^{4-}$,$[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$, $[Fe(CN)_6]^{3-}$, $[Co(NH_3)_6]^{3+}$. Limitations of V.B theory. 2.2 Crystal field theory- splitting of metal d orbitals in octahedral and tetrahedral complexes-low spin and high spin complexes. Crystal Field Stabilization Energy (CFSE)-factors affecting Dq. Spectrochemical series. Jahn-Teller distortion-theorem-(example Cu^{2+} complex only). Explanation of magnetic properties, enthalpy of hydration, ionic radii and colour using CFT- Comparison of Valence Bond and Crystal field theories. Limitations of Crystal Field theory.	**15**	**CO 2**
3	**Unit 3: Bio Inorganic Chemistry**	**15**	**CO 3**

	3.1 Metal Ion Toxicity: Chemical speciation of some metals in environment -Chemical speciation of Pb, Hg, As, Cd, Se, Cu and Cr. Natural detoxification of metal ions 3.2 Chelating agents used as metal ion detoxification Requirements of a chelating antidote in metal ion detoxification-BAL (British Anti Lewisite), EDTA, Unithiol (2,3-dimercapto-1-propane sulfonic acid), dmsa (meso-2,3-dimercapto succinic acid), D-pencillamine (DPA), desferrioxamine (DFO), *puchel*. Limitations of chelation therapy in metal ion detoxification. Cyanide toxicity and detoxification. 3.3 Anti-cancer activity of Pt complexes: Different types of active Pt complexes; Toxic effects of anti-cancer Pt complexes; mechanism of anti-cancer activity of cis-platin; non activity of trans-platin.		
4	**Unit 4: Organometallic compounds-I** 4.1 Introduction to organometallic chemistry: Definition and Classification with appropriate examples based on nature of metal carbon bond (ionic, sigma-bonded covalent organo-metallic compounds, pi-bonded covalent organo-metallic compounds, electron deficient with bridged multi-centered bonds). 4.2 The eighteen-electron rule: Basis of eighteen electron rule, counting electrons in complexes, limitations of eighteen electron rule. 4.3 Transition metal alkyls: Stability of transition metal alkyls: Beta-elimination, fluoride elimination, reductive elimination; Reactions: Decomposition reactions, intra-molecular reductive elimination, M-C cleavage reactions. 4.4 Structure and bonding: Structure, bonding, properties and uses of organo Magnesium, Zinc, Lithium, Copper and Boron Compounds.	**15**	**CO 4**
5	**Unit 5: Introduction to solid state chemistry** 5.1 Structures of ionic solids-sodium chloride, cesium chloride, fluorite, anti-fluorite nickel arsenide, cadmium iodide, pervoskite and zinc blende. 5.2 Structural faults in crystals. Stoichiometry defects-Schotty defects and Frenkel defects-variation of properties of crystals due to Schotty	**15**	**CO 5**

	defects and Frenkel defects-thermodynamic aspect of stoichiometric defects. Non-stoichiometric defects-metal excess defects-metal deficiency defects-impurity defects-thermal defects. Extrinsic and intrinsic semiconductors. 5.3 Solid solutions: Interstitial and substitutional solid solutions; Hume-Rothery empirical Rules		

REFERENCE BOOKS

1. Puri B.R., Sharma, L.R., Kalia, K., Principles of Inorganic Chemistry 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Lee J. D., Concise Inorganic Chemistry, UK, Blackwell science (2006)
3. Madan, R.D., Tuli,G.D Malik.W.U Principles of Inorganic Chemistry, S.Chand, 1999.
4. Miessler, G. L. and Tarr, D. A. Inorganic Chemistry III Edition, 2004.
5. Soni P. L. Text Book of Inorganic Chemistry, S. Chand & Co., New Delhi, 2006.
6. Cotton, F. A and Wilkinson, Advanced Inorganic Chemistry. Wiley Eastern Limited, 1988.
7. B.K. Sharma, Industrial Chemistry, Geol Publications. 2002
8. R.Sarkar, General and Inorganic Chemistry Part I. Books and Allied (P) Ltd. 2006
9. R. Sarkar, General and Inorganic Chemistry Part II Books and Allied (P) Ltd. 2006.
10. Arun Bahl, Bahl, B.S. A Text Book of Organic Chemistry. S. Chand and Company Ltd. 16th Edn. 2001.
12. Morrison, R.T and Boyd. B.N. Organic Chemistry. (6th Edn.) Allyn and Bacon Ltd. 1976.
13. Shriver and Atkins. Inorganic Chemistry IV Edn. International student edn. 2006.
14. Advanced Inorganic Chemistry Vol I and II by S. P. Banerjee. Books and Allied (P) Ltd. 2003.
15. Solid state chemistry and its applications by A. R. West. 2011. Wiley student edition.
16. Organometallic Chemistry: A Unified Approach : A Unified Approach 2nd Edition R. C. Mehrotra and Singh.2014
17. Asim K. Das Fundamental concepts of Inorganic Chemistry. 2008. Vol. 1-7. II Edition. (CBS Publications)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

End Semester examination question paper pattern (Max. marks: 100)

Common question paper

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -2 (Compulsory question)** **17)** a) Unit 1 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: CORE PAPER XI - PHYSICAL CHEMISTRY- I

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning objective:

To make the students understand, concepts related to kinetics of reactions, conductance and its applications, fundamentals of equilibrium electrochemistry, principles and applications of Molecular Spectroscopy.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Provide an insight into the kinetics aspects of chemical reactions and derive kinetic Equations
CO2	Discuss the basic of ionics and applications of conductance measurements
CO3	Discuss the basics of electrode potential, cell and its applications to practical purposes
CO4	Predict the vibrational spectrum of molecules
CO5	Analyze the application of laser Raman spectroscopy and insight into electronic spectroscopy

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	2	3	2	2	2	3	3	3	3	3	2
CO2	3	3	2	3	2	3	2	2	2	3	3	3	3	3	2
CO3	3	3	3	3	2	3	2	3	2	3	3	3	2	3	2
CO4	3	3	3	2	2	3	2	2	2	3	3	3	2	3	2
CO5	3	3	3	3	2	3	3	3	2	3	3	3	2	3	2

STRONGLY CORRELATED-3, MODERATELY CORRELATED–2,WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	s
1	**Unit 1: CHEMICAL KINETICS -I** 1.1. Rate of a reaction, Average and instantaneous rates, rate equation, rate law, Elementary and complex reactions, order and molecularity of a reaction (related problems). Factors affecting the rate of a reaction. 1.2. Rate constants, Derivation of rate constant expression & characteristics of zero, first, second(equal and different initial concentration) and third order (equal initial concentration only) reactions . 1.3. Methods of determination of orders of reactions **:** Van't Hoff differential method , Half life method ,Ostwald's isolation method. 1.4. Experimental methods of determination of rate constant of a reaction – Volumetric method and polarimetry. 1.5. Kinetics of complex reactions – Parallel, Consecutive and Chain reactions.	**15**	1
2	**Unit 2: ELECTROCHEMISTRY-I** 2.1 Arrhenius theory of electrolytic dissociation and its limitations, electrolysis 2.2 Faraday's laws of electrolysis and problems 2.3 Conductance: specific, equivalent and molar conductance of strong electrolyte and calculations, measurement using Kohlrausch's bridge 2.4 Oswald dilution law, variation of specific and equivalent conductance of strong and weak electrolytes with dilution, Kohlrausch's law for infinite dilution and applications.	**15**	2

	2.5 Debye - Huckle- Onsager theory of strong electrolytes (Derivation not required)- The conductance at high fields (Wein effect) and high frequencies (Debye-Falkenhagen effect). 2.6 Ionic mobilities: Determination of ionic mobility, abnormal ionic conductance's, -transport numbers, determination by Hittorf's method-Relationship between ionic mobilities and ionic conductance. 2.7 Application of conductance measurements: Determination of λ_∞ of strong electrolytes, Determination of K_a of weak acids, Determination of solubility product of a sparingly soluble salt and determination of ionic product of water.		
3	**Unit 3 ELECTROCHEMISTRY-II** **Ionic equilibrium:** 3.1 Ionic Product of Water- pH Scale- pH of weak acids and weak bases. Buffer solutions-mechanism of buffer action- derivation of Henderson equation and its applications. Buffer capacity, buffer range, application of buffer solution for the biochemical processes in the human body. **Equlibrium electrochemistry:** 3.2 Cells: Electrolytic & Galvanic cells – Reversible and irreversible cells. 3.3 Coulomb's law-electric field strength-electric potential -Outer potential, surface potential and inner potential- Electrochemical potential, Potential difference across electrode-electrolyte interface-Absolute electrode potential - Conventional representation of electrochemical cells. 3.4 Electromotive force of a cell and its measurement using Pogondorf's compensation principle. Relative electrode potential, Standard hydrogen electrode - Reference electrodes- Standard electrode potentials	**15**	

	3.5 Electrochemical series and its applications- Calculation of thermodynamic parameters of Cell reactions (ΔG, ΔH, ΔS and K). 3.6 EMF dependence on concentration- Nernst equation – Derivation and problems 3.7 Types of reversible electrodes – Gas electrode, metal/metal ion electrode- Amalgam electrode – metal- metal insoluble salt and its anion electrode and Redox electrodes-ion selective electrodes(glass electrode) Electrode reaction		
4	**Unit 4: SPECTROSCOPY 1** 4.1 **Interaction of radiation with matter**: Electromagnetic spectrum, quantisation of energy, Rotational, vibrational and Electronic energy levels- Difference between spectra of atoms and molecules-Absorption and emission spectra. 4.2 **Boltzmann distribution** (formula only): Relative population of translational, rotational, vibration and electronic energy levels at different temperatures. 4.3 **Microwave spectroscopy**: Rotational spectra of diatomic molecules, rigid rotator, selection rule for rotational transition, Frequency of spectral lines, calculation of inter-nuclear distance in diatomic molecules. Isotope effect. 4.4 **Infrared spectroscopy**: Vibrations of diatomic molecules, Harmonic and anharmonic oscillators, zero-point energy, selection rule for vibrational transition, determination of ZPE, v_{max} of dissociation, force constant- Fundamental band, Overtones and hot band (simple treatment-only concepts). isotope effect. 4.5 Vibration-rotation spectra of diatomic molecules-PQR branches	**15**	

5	**UNIT 5 SPECTROSCOPY II** 5.1 **Raman spectroscopy**: Rayleigh scattering and Raman scattering-Explanation based on quantum theory only, Stokes and antistokes lines in Raman spectra,Raman frequency, condition for molecule to be Raman active - Comparison of Raman and IR spectra-Raman and IR spectroscopy of CO_2 and N_2O as examples-Rule of mutual exclusion principle. Instrumentation. 5.2 **Electronic Spectroscopy**: Main features of UV and Visible spectra, Electronic states of diatomic molecules, Electronic transitions, Franck- Condon Principle, Beer Lambert's Law, Molar extinction coefficient, Electronic transition in polyatomic molecules-Solvent effect.	**15**	

Learning outcome: *At the end of the course, students will be able to predict rates and its importance, conductance and its applications and measure and apply electromotive force. The students would be able to predict the spectrum of simple molecules.*

REFERENCES TEXT BOOK:

1. Principles Of Physical Chemistry , Puri, Sharma Pathania
2. Physical Chemistry, Gilbert W. Castellan, 3rd edition
3. Physical Chemistry: Robert G. Mortimer
4. W. Atkins Advanced Physical Chemistry Oxford Press. 1990
5. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi
6. A text book of physical chemistry: KL Kapoor (Volume 5- kinetics)
7. Principals of physical chemistry,S H Maron and C F Prutton (Electro chemistry)
8. A Text book of Physical Chemistry, A S Negi, S C Anand
9. Physical Chemistry, J. Moore- 4th edn

10. Molecular Spectroscopy, Banwell
11. Text book of Physical Chemistry, Samuel Glasstone

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	10	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

End Semester examination question paper pattern (Max. marks: 100)

Common question paper

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -2 (Compulsory question)** **17)** a) Unit 1 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: ELECTIVE III - ANALYTICAL CHEMISTRY

Course Code :	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

This course is offered for students to have exposure to the Laboratory safety practices, Instrumental techniques. The student gets clear idea about the principle and Instrumentation of various techniques which are most useful in chemical Industries.

Course Outcomes: At the end of the Course, the Student will be able to:

CO 1.	Enumerate the background behind gravimetric analysis and learn basic statistical analysis required for chemist.
CO 2	Explain all the five thermo analytical techniques in detail and interpretation the thermogram.
CO 3.	To identify different currents, and distinguish metal ions by half wave potential from polarogram. To determine the end point of the titrations by amperometry. To interpret the presence of racemic mixture by polarimeter.
CO 4.	To analyse the mixture using column, paper, HPLC, and gas chromatography.
CO 5.	To deduce and quantify the presence of metal ions by flame emission and atomic absorption spectroscopy.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	2	3	2	2	3	3	3	3	2
CO2	3	3	2	3	2	3	2	2	3	3	3	3	2
CO3	3	3	3	3	2	3	2	3	3	3	2	3	2
CO4	3	3	3	2	2	3	2	2	3	3	2	3	2
CO5	3	3	3	3	2	3	3	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

Sl NO	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1 : GRAVIMETRIC ANALYSIS AND DATA ANALYSIS** 1.1 Methods of obtaining the precipitate -Conditions for Precipitation-Choice of precipitants -Advantages and disadvantages of using organic Precipitants-Types of organic Precipitants-Specific and selective precipitants - Sequestering agents- Co-precipitation (surface adsorption, mixed-crystal formation, occlusion, and mechanical entrapment, co precipitation error)- Post precipitation. 1.2 Errors – Definition – Classification – methods to reduce systematic errors - Theory of significant figures -Accuracy and Precision, Absolute and relative uncertainty, propagation of uncertainty -Gaussian distribution, arithmetic mean, median, range - Related problems - Mean deviation, standard deviation - Related problems	**15**	**CO1**
2	**UNIT 2: THERMOANALYTICAL METHODS** 2.1 Thermogravimetric Analysis-Principle, discussion of various components with block diagram- Discussion of thermograms- Silver nitrate, Copper Sulphate pentahydrate, Calcium oxalate mono hydrate 2.2 Differential Thermal Analysis-Principles, discussion of various components with block diagram- Discussion of thermograms- Calcium acetate mono hydrate, Calcium oxalate mono hydrate. Factors affecting TGA and DTA curves 2.3 Differential scanning calorimetric Analysis-Principle, discussion of various components with block diagram- Discussion of thermograms- Zinc sulphate, Zirconium oxide, Copper Sulphate pentahydrate 2.4 Thermometric titrations and applications- Mixture of Ca^{2+}, Mg^{2+}ions Vs EDTA	**15**	**CO2**
3	**UNIT 3: Polarography and Polarimetry** 3.1 Principle- over potential-concentration polarization-dropping mercury electrode (DME)-advantages and disadvantages- applications 3.2 Migration, convection and diffusion currents- Ilkovic equation (derivation not required) and its significance-Half wave potential ($E_{1/2}$) – significance.	**15**	**CO3**

	3.3 Experimental assembly-Half wave potential for electrodes-Dropping mercury electrodes, reference electrodes-circuit. Solutions-oxygen wave; factors affecting diffusion current. Polarography as an analytical tool in quantitative and qualitative analysis. 3.4 Amperometry-basic principles, types of titration curves and uses. 3.5 Polarimetry-principle-instrumentation-comparison of strength of acids-estimation of glucose.		
4	**UNIT 4: Basic Chromatographic Techniques** 4.1 Paper Chromatography –principles-experimental techniques and applications 4.2 Column Chromatography –principles-experimental techniques and applications 4.3 Thin layer Chromatography - principles-experimental techniques and applications 4.4 Gas chromatography- principles-experimental techniques-instrumentation and applications 4.5 High pressure liquid chromatography- principles-experimental techniques-instrumentation and applications	**15**	**CO4**
5	**UNIT 5 Atomic Spectrometric Methods** **5.1 Flame emission spectroscopy.** Introduction, Principle, Flame photometer, Nebulizer- burner system, Pressure regulators, optical system. Evaluation methods-Interferences-Applications **5.2 Atomic Absorption spectroscopy** Instrumentation, Hollow cathode lamp, Qualitative analysis-Application – Limitation.	**15**	**CO5**

REFERENCE BOOKS

1. S.M. Khopkar, Analytical Chemistry- Narosa Publishing House. 2002.
2. R. Gopalan, P. S. Subramanian, K. Rengarajan. Elements of Analytical Chemistry-Sultan Chand, 2009.
3. D. A. Skoog, 1985, Principles of Instrumental Methods of Analysis, III Edn. Saunders College Pubs.
4. Vogel's hand book of quantitative inorganic analysis- Longman, 1964.

5. D. A. Skoog and D. M. West, 1982 Fundamental of Analytical Chemistry, IV Edn. Old Reinhord& Winston Pubs.
6. B.K. Sharma, Instrumental methods of chemical analysis-Goel Publications. 2004.
7. Instrumental methods of analysis, H.H.Willard, L.I. Merrit Jr and J.A.Dean. Affiliated East West Press 1974.
8. Instrumental Methods Of Chemical Analysis by Dr.G.R.Chatwal, Sham Anand
9. Instrumental Approach to Chemical Analysis, by A.K.Srivatsava & P.C. Jain

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	25
Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

Common question paper pattern for Analytical Chemistry

Section A **(10 x 2 = 20 marks)** **Answer all the questions**	**Section B** **(5 x 7 = 35 marks)** **Answer all the questions**	**Section C** **(3 x 15 = 45 marks)** **Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	16) Unit - 1 (Compulsory question) 17) a) Unit 2 (or) b) Unit 3 18) a) Unit 4 (or) b) Unit 5

COURSE TITLE: ELECTIVE III - PHARMACEUTICAL CHEMISTRY

Course Code :	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Units	Learning objectives
01	To understand the common diseases and the cure To know the terms of pharmacology
02	To understand the mechanism of drug action
03	To acquire knowledge about chemotherapy and the antibiotics
04	To understand the drugs used for diabetes, hypertension, cholesterolemia
05	To acquire knowledge about various health promoting drugs

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	2
CO3	3	3	3	3	2	2	2	2	3	3	2	3	2
CO4	3	3	3	3	3	3	2	3	3	3	2	3	2
CO5	3	3	3	3	3	3	2	3	3	3	2	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No.	CONTENTS OF THE MODULE	Hrs	COs
1	**UNIT 1: INTRODUCTION** 1.1 Common diseases - Infective diseases - insect-borne, air-borne and water-bome hereditary diseases - Terminology – drug pharmacology, pharmacognesy, pharmacodynamics, pharmacokinetics, antimetabolites. 1.2 Absorption of drugs - routes of administration of drugs, factors affecting absorption. 1.3 Assay of drugs - chemical, biological immunological assays, LD_{50} and ED_{50} therapeutic index, drugdosage.	**15**	**CO1**
2	**UNIT 2: DRUGS** 2.1 Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants - tulsi, neem, keezhanelli - their importance. 2.2 Classification of drugs-biological chemical - Mechanism of drug action - Action at cellular and extra cellular sites. 2.3 Drug receptors and biological responses - Metabolism of drugs through oxidation, reduction hydrolysis and conjugate processes, factors affecting metabolism.	**15**	**CO2**
3	**UNIT 3: CHEMOTHERAPY** 3.1 Designation of drugs based on physiological action: Definition and two examples each of Anaesthetics – General, IV and local. 3.2 Analgesics - Nartcotic and synthetic- Antipyretics and anti-inflammatory agents. 3.3 Antibiotics – penicillin, Streptomycin, chloramphenicol, tetracycline – Antivirals. 3.4 AIDS - symptoms prevention, treatment - Cancer and neoplastic agents.	**15**	**CO3**
4	**UNIT 4: COMMON BODY ELMENTS**	**15**	**CO4**

	4.1 Diabetes - Causes, hyper and hypoglycemic drugs - Blood pressure - Sistolie & Diastolic 4.2 Hypertensive drugs - Cardiovascular drugs – antiarrhythmic, antianginals, vasodilators - CNS depressants and stimulants - Psychedelic drugs, hypnotics, sedatives (barbiturates, LSD) – 4.3 Lipid profile - HDL, LDL cholesterol lipid lowering drugs.		
5	**UNIT 5: HEALTH PROMOTING DRUGS** 5.1 Nutracenticals - vitamins A, B, C, D, E and Kmicronutrients Na, K, Ca, Cu, Zn, I - Medically important inorganic compounds of Al, P, As, Hg, Fe - Li examples each their role and applications - Organic Pharmaceutical acids; Agents for kidney function (Aminohippuric acid). 5.2 Agents for liver function (Sulfo bromophthalein). Agents for pituitary function (metyrapone). 5.3 Organic pharmaceutical bases - antioxidents, treatment of ulcer and skin diseases.	**15**	**CO5**

Text Book

Jayashree Ghosts, Pharmaceutical Chemistry, S. Chand and Company Ltd., 2006, New Delhi

Books for Reference

1) Lakshmi S., Pharmaceutical chemistry, S. Chand & Sons, 1995, New Delhi
2) Ashuttosh Kar, Medicinal chemistry. Wiley Eastern Ltd . 1993. New Delhi.
3) Divid William & Thomas Lemke, Foyes principles of medicinal chemistry, 5th edition, 2005. BI publishers
4) Romas Nogrady, Medicinal Chemistry, II edition 2004, oxford university, press

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**

Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	25
Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

Common question paper pattern for Pharmaceutical Chemistry

Section A **(10 x 2 = 20 marks)** **Answer all the questions**	**Section B** **(5 x 7 = 35 marks)** **Answer all the questions**	**Section C** **(3 x 15 = 45 marks)** **Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	16) Unit - 3 (Compulsory question) 17) a) Unit 1 (or) b) Unit 2 18) a) Unit 4 (or) b) Unit 5

COURSE TITLE CORE PAPER XII ORGANIC ANALYSIS AND GRAVIMETRIC ESTIMATIONS - PRACTICAL V

Course Code :	**Credits 05**
L:T:P:S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 06	**ESE Marks : 50**

Learning objective:

The objective of the course is to equip the students to determine the amount of ions present in precipitate and preparation of various inorganic complexes.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To determine amount of analyte to get precipitate.
CO2	To predict the percentage of analyte precipitate
CO3	Student can able to explain why is gravimetric analysis is more accurate than volumetric analysis
CO4	The students will get training in the quantitative analysis of metal ions and anions using gravimetric method.
CO5	Determination of purity and thermal stability of both the primary and secondary standard
CO6	Determination of composition of complex mixture
CO7	They are able to analysis simple organic compounds (mono & bi functional groups) qualitatively

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO								**PSO**				
	1 (KB)	**2** CT	**3** PS	**4** TO	**5** **com**	**6** LLL	**7** ETHIC	**8** IND	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
CO2	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**	**2**	**3**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
CO4	**3**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO6	**3**	**2**	**2**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO7	**3**	**2**	**3**	**3**	**1**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S No	CONTENTS OF MODULE		Cos
	GRAVIMETRIC ANALYSIS		
1	Estimation of sulphate as barium sulphate		**CO1**
2	Estimation of barium as barium sulphate		**CO2**
3	Estimation of lead as lead chromate		**CO3**
4	Estimation of calcium as calcium oxalate monohydrate		**CO3**
5	Estimation of nickel as $Ni(DMG)_2$ complex.		**CO4**
6	Estimation of Barium as Barium chromate		**CO4**
7	Estimation of Magnesium as Magnesium oxinate by precipitation from homogenous solution.		**CO5**
8	**ORGANIC ANALYSIS** Systematic analysis of organic compounds containing mono/ bifunctional group and characterization by confirmatory tests.,.Aldehyde (aromatic), ketone, ester, nitro compounds, Carbohydrate (reducing sugars only), Carboxylic acid (both saturated and unsaturated),dicarboxylic acid, Phenol, Aromatic Amine, Aliphatic Diamide., aromatic monoamide, anilides containing one functional group and characterization by confirmatory tests.		**CO6 &CO7**

REFERENCE BOOKS:

1. Furniss, B.S., et al., Vogel's Textbook of Practical Inorganic Chemistry, VII Edn. London, ELBS-Longman, (1984)
2. Venkateswaran, V. Veeraswamy,R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, II Edn. New Delhi, Sultan Chand and Sons, (1997)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	MODEL	ESE
Marks (out of 50)	**50**	**50**
Remember		
Understand		
Apply	25	25
Analyze	25	25
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

SCHEME OF VALUATION **TOTAL MARKS 50**

ORGANIC ANALYSIS (15) **RECORD 10**

GRAVIMETRIC ANALYSIS (25)

ORGANIC ANALYSIS (15)	GRAVIMETRIC ANALYSIS (25)
Elements =03 Aliphatic/Aromatic =02 Saturated/Unsaturated =02 Functional Group: =05 Derivative= 03	Less Than 2% = 25 2-3% = 20 3-4 % = 15 3-4 % = 10 More Than 4% = 0 5

COURSE TITLE: CORE XIII – ORGANIC CHEMISTRY – II

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

On taking this course, the student will develop knowledge in the structures and synthesis of monosaccharides, disaccharides and polysaccharides. The student will be able to synthesis amino acids and peptide and to demonstrate the primary, secondary, tertiary and quarternary structure of proteins. The student will be able to give the structure of different bases in the DNA and RNA. The student will be able to analyze the structure and the synthesis of alkaloids and terpenoids.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Develop knowledge in the representation and structure of carbohydrates. To understand the structural elucidation of glucose and fructose and its chemical reactions. (K2)
CO2	To understand the classification, source and synthesis of disaccharides and polysaccharides. (K1)
CO3	Generate ideas about the classification, synthesis and importance of amino acids, peptides and proteins. (K3)
CO4	Evaluate the structure and the importance of bases in DNA and RNA, nucleic acids, nucleotides, lipids and vitamins. (K5)
CO5	Analyze the structure and synthesis of alkaloids and terpenoids. (K4)

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**										**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	3	3	2	2	2	3	3	3	3	3	2
CO2	3	3	3	3	3	3	2	2	2	3	3	3	3	3	2
CO3	3	3	2	3	2	3	2	2	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. NO	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1: Carbohydrates – I** 1.1 Definition and Classification Fischer, Haworth and Conformational structures – Configuration – D,L-Ascending of carbon chain in sugars – Kiliani-Fischer synthesis - Descending of carbon chain in sugars-Ruff's synthesis. 1.3 Interconversion of sugars - Glucose to Fructose and Fructose to Glucose. 1.4 Reactions - Acetylation, Methylation, bisulphite addition, cyanohydrin, Oxime formation – Mechanism of Osazone formation, Action of con-H_2SO_4 and dil.alkali.acetal and hemiacetal . 1.5 Oxidation and Reduction: with Bromine water, Con .HNO_3, HIO_4, Benedict, Fehling's and Tollen's reagents, with HI, H_2/Ni and Na-Hg - Mutarotation. 1.6 Structural elucidation of Glucose and Fructose-Evidences for open chain and ring structure. Determination of ring size – Pyranose & Furanose forms - differentiation between epimers and anomers.	**15**	**CO1**
2	**UNIT 2 : Carbohydrates – II** 2.1 Disaccharides –Linkage, Classification, - Reducing and non-reducing sugars. Source, Constitution and Haworth projection - Structural elucidation of Sucrose , maltose and lactose. Polysaccharides -structure of starch , cellulose and cellobiose (Elucidation of structure is not required)- Hydrolysis products. Derivatives of cellulose- Preparation, structure and uses of cellulose nitrates, cellulose acetates, cellulose xanthates and ethyl cellulose.	**15**	**CO2**
3	**UNIT 3: Amino Acids, Polypeptides and Proteins**		**CO3**

	Amino acids - Definition, classification, Zwitter ions, isoelectric point. Preparation of glycine , alanine and phenyl alanine –Strecker's synthesis, Gabriel Phthalimide synthesis, chemical properties – Biuret, Millon's test- Xanthoproteic and Ninhydrin Test. Peptides and Proteins - Occurrence, classification(based Structural and chemical composition), Partial and complete hydrolysis, denaturation and annealing. Primary and secondary structure of proteins -End group analysis- N-terminal analysis - Enzymatic method, Dansyl method, Sanger and Edmand method – C terminal analysis -enzymatic method, hydrazinolysis ,hydanatoin formation method - Tertiary and Quaternary Structure of Proteins(elementary idea only).	**15**	
4	**UNIT 4 : Nucleic Acids, Vitamins and Lipids** 4.1 Nucleic acids- Components of DNA and RNA –Structure of bases - adenine, guanine, Thymine, Cytosine and Uracil. 4.2 Nucleosides and nucleotides (nomenclature)- Structure of polynucleotide- Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation – genomic sequence. (Basic idea only) 4.3 Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Steroids – structure of simple steroids –Cholesterol 4.5 Vitamins – Classification – based on structure and function-biological importance of Vitamins, Structures of Vitamin A and Vitamin D. Structural elucidation of Vitamin C.	**15**	**CO4**
5	**UNIT 5: Alkaloids and Terpenoids**	**15**	**CO5**

	5.1 Alkaloids: Definition, Classification, Extraction (elementary treatment).General methods for determining structure - Chemical methods-uses. 5.2 Structural elucidation and synthesis of Conine, Piperine , Nicotine ,Papavarine. 5.3 Terpenes and Terpenoids: Classification, Isoprene and special isoprene rules, Isolation, General methods of structural determination-Chemical methods. 5.4 Structural elucidation and synthesis of Citral, Geraniol, α – Terpineol.		

TEXTBOOKS:

1. Finar I.L., Organic Chemistry, Vol. 1& 2, 6th edition, Addison Wesley Longman Ltd. England(1996)
2. Morrison R.T., Boyd R.N., Organic Chemistry, 6th edition, Allyn & Bacon Ltd., Newyork (2006)
3. Bahl B.S., Arun Bahl, Advanced Organic Chemistry, 12th edition, Sultan Chand and Co., NewDelhi (1997)
4. Pine S.H., Organic Chemistry, 4th edition, Mc-Graw-Hill International Book Company New Delhi(1986)
5. Seyhan N. Ege, Organic Chemistry, 5th edition , Houghton Mifflin Co., New York, (2004)
6. P.S.Kalsi, Stereochemistry, Conformation Analysis and Mechanism, 2nd Edition, Wiley Eastern Limited, Chennai (1993)
7. Jain.M.C., Sharma.S.C., Modern Organic Chemistry, Vishal Publication (1967).
8. Janice Gorzynski Smith., Organic Chemistry, 5th Edition, New Delhi, Mc-Graw-Hill International Book Company, New Delhi (2010)
9. Bruice Paula Yurkani.,Organic Chemistry, 8th Edition , Pearson (1938)
10. Richard O.C. Norman., James M. Coxon., Principles of Organic Synthesis, 3rd Edition (1993)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 50%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4

End Semester examination question paper pattern (Max. marks: 100)

Common question paper

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

Course Title: CORE XIV - INORGANIC CHEMISTRY II

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning objective:

The objective of the course is to equip the students to Application of coordination compounds Qualitative analysis detection of metal ions and quantitatively analysis and types of organometallic compounds on the basis of the nature of metal-carbon bond and non-ionising-general properties of ionizing solvent: electrical conductance, dipole moment, dielectric constant, viscosity, associated molecules, Fundamental particles of the nucleus-classification of fundamental particles-nucleon terminology of nuclides and Artificial radioactivity- Uses of radio isotopes-tracer technique, structural study-study of reaction mechanism

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Rationalize the applications of coordination compounds in both qualitative and quantitative analysis.
CO2	Rationalize the synthesis, structure, bonding, properties organo-metallic compounds like Zeise's salt and ferrocene.
CO3	Understand the properties of Clathrate compounds and non-aqueous solvents like ammonia and sulphur di-oxide.
CO4	Qualitatively interpret a decay series. Recognize a band stability plot and be able to predict the type of decay that a nucleus will undergo based on its composition relative to the band of stability.
CO5	understated and calculate the mass defect for a nuclear reaction and calculate nuclear binding energy Define the age of an object (radiochemical dating) Differentiated Artificial radioactivity and induced radioactivity, how energy produced from different type of reactor

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**2**	**1**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**2**
CO2	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**

CO3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**3**
CO5	**3**	**2**	**3**	**3**	**1**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	**2**
CO6	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO7	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE	Hrs	COS
1	**COORDINATION CHEMISTRY-II** Application of coordination compounds in analytical chemistry: 1.1 Qualitative analysis- detection of metal ions; Cu^{2+} in presence of Cd^{2+}, Ni^{2+} in the presence of Co^{2+}, Estimation of Fe^{3+} and Al^{3+} using oxine; detection of chloride ions. 1.2 Quantitative analysis-Inner metallic complexes- I order inner complexes- II order inner complexes- Application of I order inner metallic complexes in gravimetric determination of metal ions-Separation and estimation of metal ions by ion-exchange and solvent extraction methods. Complexation and chemistry of photography. 1.3 Complexometric titrations-definition-chelon, complexing agents, complexometric titration and examples. Complex formation reactions and selection of complexometric titrants-methods employed in complexometric titrations-direct titration, back titration, replacement of substitution titration, indirect titration, estimation of multiple cations in a mixture.	**15**	**CO1**
2	**ORGANOMETALLIC COMPOUNDS-II** **2.1** Sigma base -pi acid ligands, pi base-pi acid ligands. Structure and bonding of Organo-metallic compounds of alkenes, alkynes, allyls and 1,3 butadiene and cyclopentadiene. Hapticity and fluxional nature of cyclopentadiene. **2.2** Metallocenes: Ferrocene-Preparation, properties, structure and bonding. General stability of I transition series metallocene on the basis of MO theory.	**15**	**CO2**

	2.3 Metal carbonyls –mono and polynuclear -Ni, Fe, Cr, Co and Mn- structures and bonding. (Ex. $Ni(CO)_4$, Cr $(CO)_6$, $Fe(CO)_5$, $Mn_2(CO)_{10}$, $Co_2(CO)_8$, $Fe_2(CO)_9$.). Application of IR spectroscopy in studying the M-CO pi-back bonding. 2.4 EAN rule (18 electron rule) molecular orbital approach- - explanation of 18 electron rule in metal carbonyl and formation of some carbonyls on the basis of this rule. Ex. $Ni(CO)_4$, Cr $(CO)_6$, $Fe(CO)_5$, $Mn_2(CO)_{10}$, $Co_2(CO)_8$, $Fe_2(CO)_9$.		
3	**CLATHRATE COMPOUNDS AND NON-AQUEOUS SOLVENTS** 3.1 Clathrate compounds– Clathrates of noble gases, phenol and quinol-its uses. Silicones - synthesis, properties and uses. 3.2 Non Aqueous Solvents: Classification of solvents-*Cady-Esley* rule-protic and aprotic –acidic, basic, amphiprotic-ionising, non-ionising-general properties of ionizing solvent: electrical conductance, dipole moment, dielectric constant, viscosity, associated molecules. 3.3 Chemistry of liquid NH_3: acid-base reactions-amphoteric behavior-formation of ammoniates-ammonialysis-complex formation- redox reaction- precipitates formation-extreme dissociation of weak acid-solubility of substances in liquid NH_3-advantages and disadvantages of liquid NH_3 as solvent. 3.4 Chemistry of SO_2 as solvent: acid-base reactions-amphoteric behavior-solvation reaction and formation of solvents-solvolysis-complex formation reaction- redox reaction- precipitate formation-organic reactions in liquid SO_2.	**15**	**CO3**
4	**NUCLEAR CHEMISTRY-I** 4.1 Nuclear radius, nuclear volume-nuclear mass and nuclear forces operating between the nucleons. Nuclear stability-N/P ratio, curves, stability belts. 4.2 Nuclear binding energy, Mass defect, simple calculations involving mass defect binding energy per nucleon, and packing fraction. Magic numbers-liquid drop model, shell model. 4.3 Natural radioactivity - radioactive series including neptunium series - group displacement law.	**15**	**CO4**

5	**NUCLEAR CHEMISTRY-II** 5.1 Applications: employing gamma radiations-food products testing of metal castings-pest control by irradiation-employing isotopes: tracer technique-structural study ($S_2O_3^{2-}$ only)-study of reaction mechanism- study of equilibria-study of photosynthesis. radio isotopes in medicine-radio carbon dating. 5.2 Nuclear fission- characteristics of nuclear fission- nuclear fusion-characteristics of nuclear fusion. Nuclear reactors-the design and construction of the nuclear reactor-safety measure and location of the nuclear reactor.	**15**	**CO5**

REFERENCE BOOKS

1. Puri B.R., Sharma, L.R., Kalia, K., Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Lee J. D., Concise Inorganic Chemistry, UK, Blackwell science (2006)
3. Madan, R.D., Tuli,G.D Malik.W.U Principles of Inorganic Chemistry, S. Chand, 1999.
4. Miessler, G. L. and Tarr, D. A. Inorganic Chemistry III Edition, 2004.
5. Soni P. L. Text Book of Inorganic Chemistry, S. Chand & Co., New Delhi, 2006.
6. Cotton and Wilkinson. Advanced Inorganic Chemistry. Wiley Eastern Limited. 1988.
7. B.K. Sharma. -Industrial Chemistry Geol Publications. 2002.
8. Sarkar. R, General and Inorganic Chemistry Part I Books and Allied (P) Ltd.2006.
9. Sarkar .R, General and Inorganic Chemistry Part II Books and Allied (P) Ltd.2006.
10. R. D. Madan. Modern Inorganic Chemistry. Sultan Chand and Company Ltd. 2006.
11. Advanced Inorganic Chemistry Vol I and II by S. P. Banerjee. Books and Allied (P) Ltd. 2003.
12. Advanced Inorganic Chemistry Vol I and II by Satya Prakash, G. D. Tuli, S. K. Basu and R.D Madan S. Chand & Co., New Delhi, Reprint. 2012.
13. Asim K. Das Fundamental concepts of Inorganic Chemistry. 2008. Vol. 1-7. II Edition. (CBS Publications)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	5	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4

End Semester examination question paper pattern (Max. marks: 100)

Common question paper

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE: CORE PAPER XV - PHYSICAL CHEMISTRY II

Course Code :	**Credits 05**
L:T:P:S : 5:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Learning objective:

To make the students understand how quantum chemistry is developed, appreciate the applications of Boltzmann statistics, concepts related to kinetics of reactions, conductance and its applications and fundamentals of equilibrium electrochemistry

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	To analyze the Boltzmann statistics, partition function and thermodynamic parameters.
CO2	Quantitatively calculate the effect of temperature on the rate of a reaction using collision theory and ARRT which helps him to plan the chemical reaction.
CO3	Use the concept of overvoltage for the selection of suitable electrodes in the constructionof battery or electrolysis**.** They will be able to control the corrosion using thermodynamic and kinetic concepts and also utilizing passivation.
CO4	Explain the foundation for the advanced group theory which finds wider applications infields such as quantum chemistry, spectroscopy etc. They can discuss and explain the various photochemical and photo physical processes
CO5	To predict the NMR and ESR of the molecules.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**		**7**	**8**	**1**	2	3	4	5
CO1	**3**	**3**	**3**	**2**	**1**		**1**	3	3	2	3	3	3
CO2	**3**	**3**	**3**	**1**	**2**		**1**	3	3	3	3	3	3
CO3	**3**	**3**	**3**	**1**	**1**		**2**	3	3	2	3	2	2
CO4	**3**	**3**	**3**	**1**	**2**		**3**	3	3	2	3	3	3
CO5	**3**	**3**	**3**	**3**	**1**		**2**	3	3	3	3	2	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLYCORRELATED - 1

Sl NO	*CONTENTS OF MODULE*	*Hrs*	
1	**Unit 1: STATISTICAL THERMODYNAMICS** 1.1 **P**robability, microstates (permutations) and macro states (configurations), most probable distribution (dominant configuration) 1.2 Distribution applied to ideal gases- Maxwell–Boltzmann statistics, derivation and significance, partition function, translational partition function, derivation and calculations. 1.3. Derivation of thermodynamic parameters like internal energy(U), enthalpy(H), entropy(S), Helmholtz free energy(A) and Gibbs free energy(G) for monatomic gases from partition function.	**15**	**CO1**
	Unit 2: CHEMICAL KINETICS –II Catalysis & adsorption 2.1 Effect of temperature on reaction rates – concept of activation energy, energy barrier- Arrhenius equation. 2.2 Theories of reaction rates – Collision theory –Failures of collision theory and correction factors- Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate for a bimolecular reaction (based on thermodynamic concept) – significance of entropy, enthalpy and free energy of activation. Comparison of Arrhenius theory, collision theory and ARRT. 2.3 Catalysis- Homogeneous and heterogeneous catalysis- Enzyme catalysis-Effect of temperature and pH on enzyme catalyzed reactions. Derivation of Michaels –Menton equation –	**15**	**CO2**

	Adsorption - Freundlich adsoption - Langmuir adsorption –B.E.T theory of multilayer adsorption-B.E.T Equation (no derivation)		
	Unit 3: ELECTRO CHEMISTRY-III 3.1 Electrochemical cells: Types, Chemical cells with and without transport-Concentration cells, membrane potential, pace maker cells. 3.2 Concentration cells with and without transport, Liquid junction potential. 3.3 Application of EMF measurements: Determination of Valency of ion, solubility product (concentration cell and chemical cell method) and activity co-efficient of an electrolyte. 3.4 Determination of pH using Hydrogen, quinhydrone and glass electrodes and determination of pKa of weak acids by potentiometric method. 3.5 Potentiometric titrations: Strong Acid vs strong base, Mixture of strong acid and weak acid Vs strong base, Polybasic acid with strong base, Redox titrations, Precipitation titrations, Mixture of halides Vs $AgNO_3$. 3.6 Acid-Storage batteries, Fuel Cells, Decomposition potential, Overvoltage. 3.7 Corrosion: General and electrochemical theory of corrosion, prevention of corrosion, passivation.	**15**	**CO3**

	Unit 4: GROUP THEORY AND PHOTOCHEMISTY (15 HOURS) 4.1 Symmetry operations, Symmetry elements- axis of symmetry, plane of symmetry, centre of symmetry, improper axis of symmetry and identity element as applicable to H_2O, NH_3, BF_3 and CH_4 molecules. 4.2 Illustration of mathematical rules for the group using symmetry operations of H_2O molecule-Construction of group multiplication table for C_2v and C_3v point groups. 4.3 Laws of photo chemistry: Beer-Lambert, Grothus–Draper and Stark – Einstein laws. 4.4 Quantum efficiency. Photo chemical reactions – rate law – comparison between thermal and photochemical reactions 4.5 Photo physical processes, Fluorescence and Phosphorescence-photosensitization-Chemiluminescence.	**15**	**CO4**
	UNIT 5 : Resonance Spectroscopy (NMR & ESR) 5.1 **NMR:** Introduction -NMR active nuclei- Nulcear Spin states- Selection Rule-Feature of g_N & β_N , Boltzmann distribution-Spin spin splitting-TMS-Applications 5.2 **ESR**: Introduction-ESR active species-Electron spin states-Hyper fine interaction-Features of of g_e & β_e -DPPH-Applications.	**15**	**CO5**

Learning objective: *After the completion of the course, students will be able to interpret Boltzmannn statistics, ensemble, and predict spectra of gases, quantify the effect of temperature on the rate of a reaction. They will also be able to understand the importance of catalyst, adsorption and electrochemical cells. After studying photochemistry and group theory, he will be able to understand the quantization of energy in confined systems and understand some basic photo physical photochemical process.*

REFERENCES TEXT BOOK

1. Principles Of Physical Chemistry , Puri, Sharma Pathania
2. Physical Chemistry, Gilbert W. Castellan, 3rd edition
3. Physical Chemistry: Robert G. Mortimer
4. W. Atkins Advanced Physical Chemistry Oxford Press. 1990
5. Physical Chemistry 4th Edition, Robert J. Silbey , Robert A. Alberty , Moungi G. Bawendi
6. A text book of physical chemistry: KL Kapoor (Volume 5- kinetics)
7. Principals of physical chemistry,S H Maron and C F Prutton (Electro chemistry)
8. R.K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 1992.
9. Quantum Chemistry, Second Edition, Donald A. McQuarrie
10. Group theory an its applications, Salahuddin Kunju, G Krishnan
11. A Text book of Physical Chemistry, A S Negi, S C Anand
12. Physical Chemistry, J. Moore- 4^{th} edn
13. Molecular Spectroscopy, Banwell
14. Text book of Physical Chemistry, Samuel Glasstone
15. NMR in Chemistry-A mutlinuclear Introduction – William Kemp (macmillan)
16. Molecular Spectroscopy by K.V. Raman, R.Gopalan and P.S.Raghavan (Bangalore Thomson Learning Asia Pvt.Ltd.)

ASSESSMENT PATTERN CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**15**	**100**
Remember	20	20		40
Understand	20	20		40
Apply	10	10	10	20
Analyze			5	
Evaluate				
Create				

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	38.1
Understand	38.1
Apply	21.4
Analyse	2.4
Evaluate	
Create	

Common question paper pattern

Section A (10 x 2 = 20 marks) Answer all the questions	**Section B (5 x 7 = 35 marks) Answer all the questions**	**Section C (3 x 15 = 45 marks) Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	**16) Unit -1 (Compulsory question)** **17)** a) Unit 2 (or) b) Unit 3 **18)** a) Unit 4 (or) b) Unit 5

COURSE TITLE : CORE PAPER XVI POLYMER CHEMISTRY

Course Code :	**Credits 4**
L:T:P:S : 0:0:3:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVE:

To impart basic knowledge of Polymer Chemisrty.

To provide a comprehensive understanding of the basic principles of synthetic fibers and rubbers.

COURSE OUTCOMES:

At the end of the Course, the Student will be able to:

CO1	To know about basics of polymerization
CO2	To learn about properties polymers
CO3	To understand the basic concepts resins and plastics
CO4	To know about synthetic fibers and rubbers
CO5	To learn about degradation of polymers

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	1	2	2	2	2	3	3	3	3	3
CO2	3	3	3	1	3	2	2	2	3	3	3	2	2
CO3	3	3	3	1	2	2	2	2	3	3	2	2	2
CO4	3	2	3	1	3	2	2	2	3	3	3	3	3
CO5	3	2	2	3	2	2	2	2	3	3	3	2	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.NO	CONTENTS OF MODULE		COs
1	**Unit-I: Methods of polymerization:-** 1.1 Basic concepts of polymer chemistry: Repeating unit, degree of polymerization, classification, stereochemistry of polymers and nomenclature of stereoregular polymers. 1.2 Chain, free radical, ionic and ring opening polymerizations. Ziegler–Natta catalyst involvement in step polymerization ring opening polymerization. 1.3 Copolymerization: Block and graft copolymers–preparation.	15	**CO1**
2	**Unit-II: Properties of polymers:** 2.1 Polymerization techniques: Bulk, solution, suspension and emulsion polymerization. Melt, solution and interfacial polycondensation. Solid and gas phase polymerization. 2.2 Molecular weight and size: Number and weight average molecular weights. Polydispersity and molecular weight distribution in polymers, the practical significance of polymer molecular weights and size of polymers.(Molecular weight determination is not required) 2.3 Glass transition temperature: Concept, associated properties and determination. Glassy solids and glass transition. Factors influencing it. 2.4 Crystallinity in polymers: Polymer crystallisation, structural and other factors affecting crystallisability and effect of crystallinity on the properties of polymers.	15	**CO2**
3	**Unit-III: Resins and plastics:-** 3.1 Processing: Calendering, die casting, rotational casting. Compression, injection, blow and extrusion moulding. thermoforming, foaming and reinforcing techniques. 3.2 Synthetic resins and plastics: Manufacturing and applications of polyethylene, PVC, teflon, polystyrene, polymethylmethacrylate, polyurethane, phenol formaldehyde resins, urea – formaldehyde and melamine – formaldehyde resins and epoxy polymers.	15	**CO3**
4	**Unit-IV: Synthetic fibers and rubbers:-** 4.1 Synthetic fibers: Rayon, nylons, polyesters, acrylics, modacrylics and spinning techniques. 4.2 Synthetic rubber: SBR,butylrubber, nitrile rubber, neoprene, silicone rubber and polysulphides. 4.3 Conducting polymers and applications.	15	**CO4**

5	**Unit-V: Degradation of polymers:-** 5.1 Polymer degradation: Types - thermal, mechanical, photo, hydrolytic and oxidative degradations. 5.2 Additives for polymers: Fillers, plasticisers, thermal stabilizers, photostabilizers, antioxidants and colourants. 5.3 Biodegradable polymers and their applications.	15	**CO5**

REFERENCE BOOKS:

1. Introduction to Polymer Chemistry - Charles E. Carraher Jr
2. Text Book of polymer science - V.R.Gowariker, Viswanathan, J. and Jagdev.
3. Principles of Polymerization by George Odian.
4. Polymer Science by Billmeyer.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (40 Marks)

Bloom's Category	**MODEL**	**ESE**
Marks (out of 50)	**60**	**60**
Remember		
Understand		
Apply	30	30
Analyze	30	30
Evaluate		
Create		

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	
Understand	
Apply	50
Analyse	50
Evaluate	
Create	

COURSE TITLE: ELECTIVE IV - APPLIED CHEMISTRY

Course Code	**:**	**Credits**	**04**
L:T:P:S	**: 4:0:0:0**	**CIA Marks**	**: 50**
Exam Hours	**: 03**	**ESE Marks**	**: 50**

LEARNING OBJECTIVES:

This course aims to explain the crucial role of building materials, pharmaceuticals and dairy products which are popular in different dominions of science, technologies, industries and integral part in vital life processes. In addition, currently budding research applications of nano chemistry will also be discussed in detail.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define the importance of building materials describing their properties and uses in the daily life.
CO2	Understand the composition and functions of Paints & Coatings
CO3	Summarise the importance of petrochemical and products.
CO4	Predict the chemical formulation of drugs which are chronically used.
CO5	Compare the size of objects of nano and micro levels with bulk entities and Explain the importance of surface area where wide field applications are formulated based on nano particles.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	**UNIT 1: BUILDING MATERIALS** 1.1 Glass – definition – composition – types- properties and uses. 1.2 Ceramics - definition – composition – types- properties and uses. 1.3 Cement - definition – composition – types- properties and uses. 1.4 Refractories - definition – composition – types- properties and uses.	**12**	
2	**Unit 2: Paint Technology:** 2.1 Definitions and general classifications; paints, varnishes and lacquers; their components and functions; coating binders, media/vehicles, pigmentations, paint manufacture; dispersion, soaking, flocculation, emulsion, stabilization, coating applications; mechanism of film formation; 2.2 modern surface coatings; properties of surface coatings and their films; film ageing; 2.3 Indian and global picture of paint industry; career in paint technology.	**12**	
3	**UNIT 3:PETROCHEMICALS** 3.1 Crude oil - constitution and distillation - composition of different distillates - pour points, depressants, drag reducers, viscosity reducers, ignition point, flash point octane number – cetane number- cracking - catalysts used in petroleum industries - structure selectivity and applications. 3.2 Manufacture of synthetic petrol - Dergius and Fischer Tropsh processes - Manufacture of petrochemicals and petrochemical polymers. 3.3 Manufacture of higher olefins, Acetaldehyde, Acetic acid, Ethylene glycol, glycerine, Acetone, phenol, carbon disulphide, vinylacatate, Cumene, chloroprene, Butane diols, Xylenes, Linear alkyl benzenes and their Sulphonates	**15**	

4	**UNIT 4: PHARMACEUTICAL CHEMISTRY** 4.1 Designation of drugs based on physiological action; Definition and examples- Anesthetics – General, intravenous and local – Analgesics – Narcotic and Non narcotics – Antipyretics and Anti-Inflammatory Agents – Antibiotics 4.2 AIDS – symptoms prevention, treatment	**12**	
	4.3 Cancer and neoplastic agents. 4.4 Diabetes – Causes, hyper and hypoglycemic drugs – 4.5 Blood pressure – Systolic & Diastolic Hypertensive drugs 4.6 Cardiovascular drugs – anti-arrhythmic, anti-anginals, vasodilators		
5	**UNIT 5: NANO CHEMISTRY** 5.1 Nanochemistry - definition, Classification of nano materials based on the size, shape, surface morphology. chemical methods of preparation of nano particles (Gold, Silver, Cadmium, Zinc- Sulphides, Selenides), XRD, characterization, Surface area (BET equation), SEM, TEM (Elementary idea) 5.2 Nano particles - Properties of Nano particles, General method of Preparation-sol gel technique. 5.3 Application of Nanoparticles in various fields- Basic idea.	**12**	

TEXT BOOKS AND REFERENCES

1. S.Shanmugham. Nano technology, M. J. P. Publishers, 2010.
2. V.Raghavan, Physical Metallurgy Prentile hall of India, New Delhi, 1989
3. Jayashree Ghosh, pharmaceutical chemistry, S. Chand and Company Ltd., 2006, New Delhi.
4. Lakshmi S., Pharmaceutical chemistry, S. Chand & Sons, 1995, New Delhi.
5. Ashuttoshkar, Medicinal Chemistry, Wiley Eastern Ltd., 1993, New Delhi.
6. David William & Thomas Lemke, Foyers Principles of medicinal chemistry, 5^{th} edition, 2005, BI publishers.
7. Nano-The essentials, understanding nanoscience and nano technology – Mcgraw Hill Professional,2008
8. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
9. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
10. .S.S. Dara, “A text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.

11. Organic Coating Technology, Volume I, by Henry Fleming Payne, John Wiley & Sons.
12. Basics of Paint Technology, Part I & II, by V.C.Malshe&MeenalSikchi
13. Surface Coatings, Volume I, by OCCA Australia (Prepd.), Chapman and Hall
14. Outlines of Paint Technology, III Ed. By W.M.Morgans, Edward Arnold

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	25
Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

Common question paper pattern for Applied Chemistry

Section A **(10 x 2 = 20 marks)** **Answer all the questions**	**Section B** **(5 x 7 = 35 marks)** **Answer all the questions**	**Section C** **(3 x 15 = 45 marks)** **Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	16) Unit - 1 (Compulsory question) 17) a) Unit 2 (or) b) Unit 3 18) a) Unit 4 (or) b) Unit 5

COURSE TITLE: ELECTIVE IV - INDUSTRIAL CHEMISTRY

Course Code :	**Credits 04**
L:T:P:S : 4:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

Course Outcomes: At the end of the Course, the Student will be able to:

Units	Learning objectives
01	Explain the importance of various types of dyes and its applications.
02	Elaborate on the importance and work of petrochemical industries.
03	Quote the composition of the contents used in the manufacture of fertilizers.
04	Explain the preparation of soaps, types of detergents, procedures adopted in leather and pesticide industry.
05	Narrate the procedure for the extraction of metals and environmental problems caused by chemical industries.

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MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	3	3	3	2	2	1	2	2	3	2	3	2	3
CO2	3	3	3	2	2	1	2	2	3	2	3	2	3
CO3	3	3	3	2	3	2	2	2	3	3	3	3	3
CO4	3	3	3	2	3	2	3	3	3	3	3	3	2
CO5	3	3	3	2	3	2	3	3	3	3	3	3	2

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S. No.	CONTENTS OF THE MODULE	Hrs	COs
1	**UNIT 1: INDUSTRIAL REQUIREMENTS** Dyes – Introduction- classification - Phenolphthalein , methyl orange, congo red, bismark brown, malachite green, crystal violet , fluorenscein and indigo – Characterization, preparation, properties, structure and uses.	**12**	**CO1**
2	**UNIT 2: PETROCHEMICAL INDUSTRIES** 2.1 Crude oil - constitution and distillation - composition of different distillates - pour points, depressants, drag reducers, viscosity reducers, ignition point, flash point octane number – cracking - catalysts used in petroleum industries - structure selectivity and applications. 2,2 Manufacture of synthetic petrol - Dergius and Fischer Tropsh processes - Manufacture of petrochemicals and petrochemical polymers. Manufacture of higher olefins, Acetaldehyde, Acetic acid, Ethylene glycol, glycerine, Acetone, phenol, carbon disulphide, vinylacatate, Cumene, chloroprene, Butane diols, Xylenes, Linear alkyl benzenes and their Sulphonates	**12**	**CO2**
3	**UNIT 3: FERTILIZERS** Fertilizers – Definition - Raw materials, manufacture (flow chart chemical process with equations) of ammonium nitrate, ammonium sulphate, urea, calcium cyanamide, calcium ammonium nitrate, sodium nitrate, ammonium chloride, ammonium phosphate, super phosphate of lime, NPK fertilizers.	**12**	**CO3**
4	**UNIT 4: OILS, SOAPS AND DETERGENTS**	**12**	**CO4**

	4.1 Oils - difference between oils and fats - manufacture of cotton seed oil and soybean oil - refining of oil - manufacture of soaps - toilet and transparent soaps. 4.2 Detergents - synthetic detergents -surface active agents and their classification - manufacture of anionic, cationic and non-ionic detergents and shampoo. 4.3 Manufacture of leather - hides - Vegetable and chrome tanning finishing.		
5	**UNIT 5:** Environmental problems of chemicals industries – methods of control - sewage treatment and waste management. Synthesis, properties, uses of : DDT, dinitrophenols, BHC, gammaxene, malathion, parathion	**12**	**CO5**

REFERENCE TEXT BOOKS

1) Sharma B. K. Industrial Chemistry, Geol publishing House, 2003, Meerut.
2) Drydense C.E, Outlines of Chemical Technology. Gopala rao, Eastwest press, New Delhi
3) Shreve RV, Chemical Process Industries, TataMc Graw Hill publishing company, Mumbai
4) Steines H., Introduction to petrochemicals, Pergaman Press.
5) Alan Cottrel, An introduction to Metallurgy. Orient Longman (2000)

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	**CIA I**	**CIA II**	**CIA III**	**ESE**
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	**Weightage %**
Remember	25

Understand	25
Apply	20
Analyse	15
Evaluate	10
Create	5

Common question paper pattern for Industrial Chemistry

Section A **(10 x 2 = 20 marks)** **Answer all the questions**	**Section B** **(5 x 7 = 35 marks)** **Answer all the questions**	**Section C** **(3 x 15 = 45 marks)** **Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	16) Unit - 3 (Compulsory question) 17) a) Unit 1 (or) b) Unit 2 18) a) Unit 4 (or) b) Unit 5

ELECTIVE V: ENTREPRENEURSHIP COURSE:
COURSE TITLE: MANUFACTURING AND MARKETING STRATEGIES OF SOAPS

Course Code :	**Credits 02**
L:T:P:S : 2:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

LEARNING OBJECTIVES:

This course aims to transform knowledge into an creative business idea in soap making where the students can meet the growing competition of the globe as job creators rather than job seekers.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Define the way to start with the innovative idea and its analysis
CO2	Summarise the general method of preparation of soap and its cleansing properties.
CO3	Quote the list of recipes to make their own product with composition.
CO4	Design their creative logo and slogan with labeling output of the product.
CO5	Assess the novelty and usefulness of the designed product and thereby marketing strategies and sales promotions.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

CO/PO/PSO	**PO**								**PSO**				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

STRONGLY CORRELATED -3, MODERATELY CORRELATED – 2, WEAKLY CORRELATED -1

S.No.	CONTENTS OF MODULE	Hrs	COs
1	Unit 1 Innovative idea- Survey on brands available in market- influence of social media- SWOC analysis of business product- investment plan- revenue plan- targeted customers.	**6**	**CO1**
2	Unit 2 Introduction - Soaps – Types of soaps – saponification process- cold process- liquid soap- hot process- total fatty matters (TFM) and grades of soap-bathing bars- types- Cleansing action of soaps- limitations.	**6**	**CO2**
3	Unit 3 Designing a recipe of soap – amount of alkali required - calculations –saponification value- regular precautions- soap making process – colours- essential oils – other additives – curing process – TFM value – calculations.	**6**	**CO3**
4	Unit 4 Logo designing – slogan for the product- marketing of products – contents to be present in the label- capital investment- profit calculations	**6**	**CO4**
5	Unit 5 Sales promotion - Types of consumer promotions – consumer promotions for increasing short run sales- consumer promotions for increasing long-term objectives Researching consumer promotions – pre testing consumer promotions- consumer promotion evaluation - Trade promotion research – pretesting trade promotions- measuring effectiveness - Sales analysis and sales fore casting	**6**	**CO5**

REFERENCE TEXT BOOKS

1. Selinger B.K., Chemistry in the market place; Sydney 1998.
2. G.D.Gem Mathew., Chemistry in Everyday life.
3. Melvin Crask, Richard J.Fox., Marketing Research Principles and applications.

ASSESSMENT PATTERN

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	CIA I	CIA II	CIA III	ESE
Marks (out of 50)	**50**	**50**	**10**	**100**
Remember	20	20		30
Understand	20	20		30
Apply	10	10		15
Analyze				15
Evaluate			5	10
Create			5	

ESE- Semester End Examination (100 Marks; weightage 60%)

Bloom's Category	Weightage %
Remember	20
Understand	20
Apply	25
Analyse	15
Evaluate	10
Create	10

Common question paper pattern for Manufacturing and Marketing Strategies of Soaps

Section A **(10 x 2 = 20 marks)** **Answer all the questions**	**Section B** **(5 x 7 = 35 marks)** **Answer all the questions**	**Section C** **(3 x 15 = 45 marks)** **Answer all the questions**
1) Unit-1 2) Unit-1 3) Unit-2 4) Unit-2 5) Unit-3 6) Unit-3 7) Unit-4 8) Unit-4 9) Unit-5 10) Unit-5	11) a) Unit-1 (or) b) Unit-1 12) a) Unit-2 (or) b) Unit-2 13) a) Unit-3 (or) b) Unit-3 14) a) Unit-4 (or) b) Unit-4 15) a) Unit-5 (or) b) Unit-5	16) Unit - 2 (Compulsory question) 17) a) Unit 1 (or) b) Unit 3 18) a) Unit 4 (or) b) Unit 5

ELECTIVE V: ENTREPRENEURSHIP COURSE:
COURSE TITLE: BASIC IDEAS ON COSMETOLOGY

Course Code :	**Credits 02**
L:T:P:S : 2:0:0:0	**CIA Marks : 50**
Exam Hours : 03	**ESE Marks : 50**

S.No.	CONTENTS OF MODULE	Hrs	COs
1	Unit 1 Innovative idea- Survey on brands available in market- influence of social media- SWOC analysis of business product- investment plan- revenue plan- targeted customers.	**6**	**CO1**
2	Unit 2 Introduction - Cosmetics – creams and lotions, lip stick, nail polish, perfumes, after shave lotions- deodorants - General formulation – toxicology of cosmetics	**6**	**CO2**
3	Unit 3 Designing a recipe of nail polish/lip stick using natural colourants - regular precautions- essential oils – other additives	**6**	**CO3**
4	Unit 4 Logo designing – slogan for the product- marketing of products – contents to be present in the label- capital investment- profit calculations	**6**	**CO4**
5	Unit 5 Marketing strategies- Principle 1 : All Customers are Different - Managing Customer Heterogeneity- Principle 2: All Customers Change - Managing Customer Dynamics – Principle 3 :All Competitors React - Managing Sustainable Competitive Advantage – Principle 4: All Resources are Limited - Managing Resource Tradeoffs	**6**	**CO5**

CERTIFICATE COURSE: ELECTROPLATING AND WATER ANALYSIS

1. ELECTROLYSIS AND ITS APPLICATIONS (15 HOURS)

1.1 Faraday's Law of electrolysis – electrolysis of water- Pourbaix diagram – oxygen &hydrogen evolution theory- Electroplating.

1.2 Over potential-Decomposition potential- corrosion- prevention of corrosion-sacrificial anodic protection- Impressed current-Cathodic protection- Corrosion inhibitors-Paints and its constituents – E' Van's diagram- Galvanization

2. PRACTICAL EXPERIMENTS (15 HOURS)

(I) WATER ANALYSIS

1. Analysis of the following Parameters Using Water Analyzer Instrument – pH, Dissolved oxygen, Salinity, conductivity, total dissolved solids, temperature measurement, colorimetric measurement, Turbidity measurement
2. Purification of water for domestic use– A pilot study.
3. Determination of total, temporary and permanent hardness Using EDTA titration
4. Determination of BOD and COD
5. Determination of percentage efficiency adsorption of heavy metal (Fe) using various adsorbents.

(II) ELECTROPLATING USING ELECTROLYSIS

1. Electroplating of zinc
2. Electroplating of Nickel
3. Separation of metals from a coin