ETHIRAJ COLLEGE FOR WOMEN

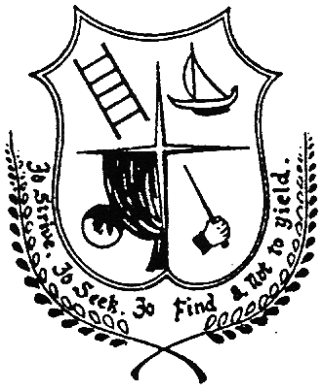
(AUTONOMOUS)

CHENNAI - 600 008

DEPARTMENT OF CHEMISTRY

Syllabus for

B.Sc. CHEMISTRY



CHOICE BASED CREDIT SYSTEM

OUTCOME BASED EDUCATION

(Syllabus effective from the Academic year 2021 -2022**)**

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B. Sc. Chemistry **Page No.**

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI – 600 008

DEPARTMENT OF CHEMISTRY
BACHELOR OF SCIENCE IN CHEMISTRY
CBC SYSTEM

(SYLLABUS EFFECTIVE FROM THE ACADEMIC YEAR 2021 -2022)

Department of Chemistry is revising syllabus with effect from the academic year 2021-2022 under CBC system with Part –IV and Part-V as specified by the Government of Tamil Nadu. Part IV and Part V components will seek to build the capacity of the students and provide inputs for their social service and social analysis capabilities.

Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is related to the number of lecture, tutorial and practical hours (LTP) for a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

REGULATIONS

1.ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Science in Chemistry course shall be required to have passed the Higher Secondary Examinations conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Syndicate of the University of Madras with Chemistry, Mathematics and Physics as subjects.

2.ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of the Degree only if she has undergone the prescribed course of study for a period of not less than three academic years, passed the examinations of all the six semesters prescribed and earned a total of 140 credits including Part-V. Students may earn extra credit by doing Add on Courses.

3. COURSE OF STUDY:

The main subject of study for Bachelor Degree in Chemistry consists of the following.

Study Components	**No. of courses**	**Credit per course**	**Total credits**
PART- I Tamil / Other languages	2+2=4	3	12
PART- II English	2+2=4	3	12
PART- III Core subject : Theory Practicals Elective Allied subject: Theory Practicals	 10 5 3 2+2=4 1	 - - 5 10+8 2	 43 17 15 18 2
PART – IV (a) Not studied Tamil upto XII Std. –shall take Tamil comprising of two courses (level 6th Std.) (b) Studied Tamil up to XII Std.-taken non –Tamil under Part – I shall take Advanced Tamil comprising of two courses. (c) Others who do not come under (a & b) can choose Non-Major Elective comprising of two courses. 2. Soft Skills 3. Environmental studies 4. Value Education	 1+1=2 4 1 1	 2 3 2 2	 4 12 2 2
PART - V Extension Activities	 1	 1	 1
TOTAL			**140**

4. PASSING MINIMUM:

A candidate shall be declared to have passed in each Theory/ Practical of the main subject of study wherever prescribed, if she secured NOT LESS THAN 40% of the marks prescribed for the end semester examination and also 40% in the sum of end semester examination and continuous assessment. There is no passing minimum for Continuous Assessment (CA).

PART I, II & III:

The maximum marks for CA is 40 and for End Semester examination is 60.
The aggregate mark for each paper is 100.

PART IV:

The maximum marks for the End Semester examination is 50 and the passing minimum is 40% and there is no continuous assessment.

5. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Part I, II, III & IV
Successful candidates passing the examination and securing the marks

(i) 60 % and above and

(ii) 50 % and above but below 60 % in the aggregate shall be declared to have passed the examination in the FIRST CLASS and SECOND CLASS respectively.

All other successful candidates shall be declared to have passed the examination in the THIRD CLASS.

Candidates who pass all the examinations (Part I, II, III and IV) prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for ranking.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

On obtaining an undergraduate degree the students will be able to:

PEO1: Apply and advance the knowledge and skills acquired, to become a creative professional in their chosen field.

PEO2: Engage in self-directed continuous learning, aimed at global competency, which will promote professional and personal growth

PEO3: Develop management skills and entrepreneurial skills, by harnessing core competencies tempered by values and ethics

PEO4: Work towards achieving economic and social equity for women through application of relevant knowledge

PEO5: Contribute to promoting environmental sustainability and social inclusivity

PROGRAMME OUTCOMES(POs):

On completion of the programme the students will be able to

PO1- Promote and apply scientific knowledge for finding sustainable solution to solve the issues pertaining to the society.

PO2- Analyse and formulate novel ideas to yield, substantial results in the fields of research.

PO3-Relate key concepts and scientific principle to various scientific phenomenon and their applications in day-to-day life

.

PO4- Cultivate unparalleled comprehension of fundamental concepts relevant to basic sciences leading to individual's progress and career advancement at the National and Global levels

PO5- To communicate effectively their views and ideas orally/ written in English and in mother tongue.

PO6 - Design solutions for complex problems and design system components or processes that meet the specific needs with appropriate consideration for public health and safety, cultural, societal and environmental conditions.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

The B.Sc. Chemistry Program is successful in imparting the students the following qualities.

PSO1: Gain knowledge in terms of principles, concepts, techniques and processes in core chemistry and related disciplines

PSO2: Acquire analytical skills through practical training using latest techniques, interpretation and presentation of data and skill sets in solving complex problems

PSO3: Analyse and evaluate scientific, socio-economic problems and provide independent solutions based on modern scientific approach

PSO4: Utilise the basic principles in the domain of chemistry and exchange ideas to sensitize the impact of the same on industry at large

PSO5: Apply the theoretical and experimental ideas of chemistry in building a safe environment and acquire entrepreneurship skills through effective communication

B.Sc. CHEMISTRY

(MAJOR and ALLIED)

(Syllabus effective from the Academic year 2021-2022)

OBJECTIVES OF THE COURSE:

(i) To provide the basic knowledge in Chemistry and to help students develop analytical skills and attitude.

(ii) To give the right platform for a future career in Pharmaceutical, Material chemistry and Applied Chemistry.

(iii) Non- Major Electives enable the students to be entrepreneurs.

PREAMBLE:

- Modification of course contents in few courses based on feedback from students and report given by Academic Audit panel members.
- Environmental studies in Semester -I and Value education in semester - II
- Part IV-Two Non- Major Electives one in each semester for II year
- Four Soft Skill Courses in semesters I, II, III & IV
- Two self-study papers (any one) in Semester V for Advanced learners
- CBCS is introduced in Major Elective paper offered in the VI Semester
- Practical Examinations are conducted once in an academic year ie., at the end of semester II, IV and VI
- Industrial visit is mandatory for Final year UG

COURSE PROFILE:

Total Credits: 140

Semester:	**I**	**II**	**III**	**IV**	**V**	**VI**	**NSS/NCC/Sports**
Credit :	**21**	**25**	**20**	**26**	**21**	**26**	**1**

Note : 1.Students taking up Self-study paper in semester V will get 2 extra credits

2. Students can take up Group Project/Project review and earn 1 extra credit

3. Students can take up NPTEL/ MOOC courses and earn 1extra credit for each course on completion.

B.Sc Chemistry Major Credits
Total Credits – 75 (Core credits – 60 & Elective Credits – 15)

Sem	Course Code	Part III (CORE) Title of the course	L	T	P	Total Hrs/ Week	TOTAL HOURS	Credits	Exam Hrs	Marks		
										CA	SE	Total
I	CH21/1C/GC1	Core 1-General Chemistry -I	4	3	0	7	105	5	3	40	60	100
II	CH21/2C/GC2	Core 2- General Chemistry -II	4	3	0	7	105	5	3	40	60	100
	CH21/2C/PR1	*Core3- Practical 1-Volumetric Analysis				3	90	4	3	40	60	100
III	CH21/3C/OC1	Core 4 – Organic Chemistry I	4	3	0	7	105	5	3	40	60	100
IV	CH21/4C/IC1	Core 5- Inorganic Chemistry I	4	3	0	7	105	5	3	40	60	100
	CH21/4C/PR2	*Core 6-Practical 2–Inorganic Qualitative Analysis				3	90	4	3	40	60	100
	CH21/4C/INT	INTERNSHIP (Not mandatory)						1				
V	CH21/5C/PHY	Core 7- Physical Chemistry	3	1	0	4	60	4	3	40	60	100
	CH21/5C/OC2	Core 8-Organic Chemistry II	3	1	0	4	60	4	3	40	60	100
	CH21/5C/IC2	Core 9- Inorganic Chemistry II	3	1	0	4	60	4	3	40	60	100
	CH21/5C/ANC	Core 10-Analytical Chemistry										
	CH21/5E/SPE	Elective 1 –Spectroscopy	3	1	0	4	60	4	3	40	60	100
	CH21/5S/POC	**Self Study- Polymer Chemistry**(OR)**	4	1	0	5	75	5	3	40	60	100
	CH21/5S/FOC	**Self Study- Food Chemistry (Not mandatory)						2	3			
VI	CH21/6C/APC	Core 11-Applied Chemistry	3	1	0	4	60	3	3	40	60	100
	CH21/6C/PHA	Core 12-Pharmaceutical Chemistry	3	1	0	4	60	4	3	40	60	100
	CH21/6E/CKE	Elective 2 –Chemical Kinetics and Electrochemistry	4	1	0	5	75	5	3	40	60	100
	CH21/6E/MAC	Elective 3- Materials Chemistry **(OR)**	4	1	0	4	75	5	3	40	60	100
	CH21/6E/AGC	Elective 3- Agricultural Chemistry										
	CH21/6C/PR3	*Core 13 Practical 3 – Organic Chemistry	0	0	4	4	120	3	3	40	60	100
	CH21/6C/PR4	*Core 14 Practical 4 – Gravimetric Analysis	0	0	4	4	120	3	3	40	60	100
	CH21/6C/PR5	*Core 15 Practical 5- Physical Chemistry	0	0	4	4	120	3	3	40	60	100

*Practical Examinations are conducted at the end of Even Semester (II, IV and VI Semesters)
Practical examination for CH21/6C/PR3 & CH21/6C/PR4 will be conducted in the forenoon and afternoon of the same day. **Self Study paper for Advanced Learners
L= Lecturehours, T=Tutorial hours, P=Practical hoursCA= Continuous Assessment marks, SE= End Semester
Note: 1.Students can take up NPTEL/ MOOC courses and earn extra credits
2. Students can take up group project/ project review during Semester V and earn extra credits

ALLIED CHEMISTRY: Credits: 20 [10 Credits for subjects offered by Department of Chemistry and 10 credits for subjects offered by other departments]

Sem	Course Code	PART III Title of the Course	L	T	P	Total Hrs/ Week	TOTAL HOURS	Credits	Exam Hrs	Marks		
										CA	SE	Total
1	CH21/1A/NGC	Allied Chemistry- General Chemistry	3	1	0	4	60	4	3	40	60	100
II	CH21/2A/NBC	Allied Chemistry -Bio Organic Chemistry	3	1	0	4	60	4	3	40	60	100
II	CH21/2A/PRA	Allied Chemistry Practical –Volumetric and Organic Analysis				2	60	2	3	40	60	100
III	CH21/3A/ZGC	Allied Chemistry - General Chemistry	3	1	0	4	60	4	3	40	60	100
IV	CH21/4A/ZBC	Allied Chemistry-Bio Organic Chemistry	3	1	0	4	60	4	3	40	60	100
IV	CH21/4A/PRA	Allied Chemistry Practical –Volumetric and Organic Analysis				2	60 60	2	3	40	60	100
III	CH21/3A/PGC	Allied Chemistry –General Chemistry- 1	3	1	0	4	60	4	3	40	60	100
IV	CH21/4A/PGC	Allied Chemistry- General Chemistry-2	3	1	0	4	60	4	3	40	60	100
IV	CH21/4A/PRA	Allied Chemistry Practical –Volumetric and Organic Analysis				2	60	2	3	40	60	100

L= Lecture hours, T=Tutorial hours, P=Practical hours

CA= Continuous Assessment marks, SE= End Semester marks

NON – MAJOR ELECTIVE: Credits 4

Sem	Course Code	PART IV (Non – Major Elective)	L hr	T hr	P hr	Total Hrs/ Week	TOTAL HOURS	Credits	Exam Hrs	End Semester Marks Maximum
III	CH21/3N/ COS	Non – Major Elective -1 - Cosmetology	2	0	0	2	30	2	2	50
IV	CH21/4N/ DPT	Non Major Elective -2 -Dyeing and Printing of textiles	2	0	0	2	30	2	2	50

L= Lecture hours, T=Tutorial hours, P=Practical hours

EVALUATION PATTERN

Theory: Continuous Assessment (CA)

Pattern for Continuous Assessment

			CA
Test I	2hrs.	50marks	10marks
Test II	2hrs.	50marks	10
Quiz/ Assignment/ Semester/ Field visit			10
Participatory Learning			10
Total			**40 marks**

Practical: Continuous Assessment

(a) One Test	-	10 marks
(b) Skill in practical	-	20 marks
(c) Record	-	10 marks
Total		**40 marks**

End Semester Examination questions are to be chosen from the question bank by the external Examiner and evaluated by both Internal and External Examiners. Duration of Examination is 3 and the maximum mark is 60.

Part IV –Non – Major Elective

- The end semester examination question papers are to be set and evaluated by internal examiner only.
- Duration of examination is 2 hours and the maximum mark is 50.
- No Continuous Assessment.

CA Question Paper Pattern - UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 7 x 2 Marks	One or Two Sentences	14	50
K1, K2	B – 2/3 x 8 Marks	250	16	
K2, K3	C – 1/2 x 20 Marks	500	20	

Question Paper Pattern for UG Part -IV

Knowledge level	Section	Word Limit	Marks	Total
K1,K2	A – 5 x 10 Marks	350	50	50

Rubrics for Continuous Assessment

Assignment: Appearance, contents, originality, presentation, schematic representation and diagram, bibliography.

Seminar: Organization, subject knowledge, visual aids, confidence level, presentation.

Participatory learning: Answering questions, clearing doubts, participation in discussion, attendance, communication and language.

Flipped/ Blended Learning – Information exchange, Group interaction, Clearing doubts

End Semester Examination question papers are to be set by the External Examiners and evaluated by both Internal and External Examiners.
Duration of examination is 3 hours and Maximum mark is 100.

Rubrics for Self Study Paper

Students with distinction in I & II year of study with no arrears are eligible to take self-study paper.
The self-study paper is optional and 2 extra credits are given.
No continuous assessment
Question paper will be set by the department. Single evaluation is done.

Rubrics for Internship

Internship is to be done at the end of Fourth Semester for a period of 14 days during summer holidays and is optional

Students can earn extra one credit on submission of the detailed report of the internship to the department

QUESTION PAPER PATTERN:

CORE, ALLIED, ELECTIVE (Major) Courses and SELF STUDY Paper*:

COMPONENT	NATURE OF THE QUESTION	MAXIMUM MARK
Part A	Definition/Short answers	20
Part B	Understanding, Descriptions / Problems	40
Part C	Application / Analysis / Synthesis / Evaluation	40

*Advanced Cognitive level
Part A: All 10 questions to be answered each carrying 2 marks with 2 questions from each unit [10Q x 2 = 20 MARKS]
Part B: All 5 questions to be answered [5Q x 8 = 40 marks] with an internal choice choosing one semester from each unit
Part C: 2 questions to be answered out of 4 questions covering all the 5 units with a maximum of 4 subdivisions (a,b,c,d) [2Q x 20 = 40 marks]

Template of the Question Paper Common to All Non Major Electives

Answer Any Ten Questions Out of Twelve Questions 10Q x 5=50

B.Sc. CHEMISTRY

CHOICE BASED CREDIT SYSTEM (CBCS)

From 2021-2022 Batch

COURSE PROFILE – SEMESTER I

Course Code	Course Title	Hours/ Week	Credits	Marks		
				CA	SE	Total
Part-I	Tamil/Hindi/French/Sanskrit	5	3	40	60	100
Part-II	English	5	3	40	60	100
Part – III						
CH21/1C/GC1	Core 1-General Chemistry I	7	5	40	60	100
	*Core Practical 1–Volumetric Analysis	3	-	-	-	-
MA21/1A/AM1	Allied Mathematics-I	6	5	40	60	100
Part-IV						
Part-IV UG21/1S/EVS	Environmental studies	2	2	-	50	50
	Soft Skill 1	2	3	-	50	50
Total		**30**	**21**			

*Practical Examinations are conducted at the end of Even Semester (II, IV and VI Semesters)

CA= Continuous Assessment marks, SE= End Semester marks

SEMESTER- I

Title of the Course: Core 1-General Chemistry-I

Teaching hours: 15 × 7 = 105 **Credits: 5**
Course Code: CH21/1C/GC1 **L T P 4 3 0**
Objective:

1. To provide basic concepts of chemical bonding.
2. To study the basic theoryrelated to qualitative and quantitative Analysis.
3. To study the basic concepts in organic chemistryto understand reaction mechanisms.
4. To provide the concepts and applications of thermodynamics.
5. To provide knowledge in thermochemistry, solutions and their behavior.

COURSE OUTCOMES
On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Gain knowledge in valence bond and molecular orbital treatment to explain chemical bonding in molecules. Predict the shapes of molecules based on VSEPR theory
CO 2	Learn the principles of qualitative analysis of cations and anions and theory behind quantitative Analysis – Volumetric and Gravimetric
CO 3	Utilize the concept of hybridisation to explain shapes of simple organic molecules. Gain in-depth knowledge on polar effects and its applications, structure and stability of short lived intermediates
CO 4	State and explain the first law of thermodynamics and its applications , principles of thermochemisty , calculate bond energy and derive Kirchoff equation
CO 5	Explain Henrys law, Raoults law , binary solutions – miscible and immiscible and their behaviour

COURSE OUTLINE

UNIT I: **Chemical bonding**: ionic bond - Madelung energy-polarization of ions Fajan's rule-covalent bond-Wave mechanical Principles involved in treatment of valence bond and molecular orbital theories - Shapes of molecules. VSEPRT BeF_2, BF_3, PF_5, SF_6, IF_7, H_2O, NH_3, IF_5, XeF_2, XeF_4, XeF_6 and $XeOF_4$, Molecular orbital theory as applied to N_2,,F_2 ,O_2-Super oxo and peroxo ions, CO and NO molecules, Comparison of VB and MO Theories. **21 hrs**

UNIT II: **Principles of qualitative analysis:** Laboratory Methods in Semimicro qualitative Analysis, Filtration and Washing of Precipitates, Heating of Solutions, Evaporation, Methods of Precipitating Sulphides-Types of Reactions involved in Qualitative Analysis-Dry Reaction-Precipitation Reactions- Complexation Reactions-Preparation of Solution for Cations Testing on Semi Micro Scale. Principles of quantitative analysis-Definition-Standardisation, Experimental requirements of Volumetric analysis- Types of Titrations. Indicators for Acid-Base Titrations, Precipitation,Titrations-Redox Titrations- Self Indicators-External Indicators-Gravimetric analysis -Conditions for Precipitation-Choice of Precipitants-Types of Organic Precipitants-Specific and selective precipitants-Sequestering Agents-Solubility of Precipitates-Theories of Precipitation-Co-Precipitation-Post Precipitation-Effect of Digestion-Washing of Precipitates-Types and Care of Crucibles. **21 hrs**

UNIT III: **Shapes of molecules**: Hybridisation and Geometry of molecule - Methane, Ethane, Ethylene, Acetylene and Benzene. Polar effects- Explanation with examples - Inductive effect, Inductomeric effect, Electromeric effect, Mesomeric effect, Resonance effect, Hyperconjugation and Steric effects-Steric inhibition of Resonance- Steric retardation and Steric acceleration. Cleavage of covalent bonds- Heterolytic fission-Carbocations, Carbanions-structure and stability. Homolytic fission- free radicals- structure and relative stability of free radical. **Alkanes:** Mechanism of free radical substitution of alkanes-halogenations of alkane- reactivity and selectivity. **21 hrs**

UNIT IV: **ThermodynamicsI:** Thermodynamic functions-state functions and path functions. Exact and inexact differential, Zeroth law of thermodynamics-statement, First law of Thermodynamics-statement, equation, Internal energy and enthalpy, relationship between molecular heat capacity at constant volume and constant pressure for an ideal gas-calculation of q, ΔE & ΔH for the expansion of ideal gases under reversible, isothermal and adiabatic conditions.**Thermochemistry** -Enthalpy of reaction, enthalpy of combustion, enthalpy of solutions, enthalpy of dilution, differential & integral heats of solution& dilution, laws of thermo Chemistry, bond energy, calculation of bond energy using thermo chemical data, application of bond energy data, variation of enthalpy of reaction with temperature-Kirchoff's equation. **21 hrs**

UNIT V: **Solutions:** Solutions of gases in liquids, factors influencing solubility of a gas, Henry's law. Solutions of liquids in liquids - Raoult's Law, vapour pressure of ideal solutions, vapour pressure of non-ideal solutions, vapour pressure- composition curves, boiling point-composition curves of completely miscible binary solutions, fractional distillation of completely miscible binary liquid solutions, azeotropic mixtures.Solubility of partially miscible liquids pairs, Phenol- water system, Triethylamine water system, nicotine-water system, effect of impurities on CST, distillation of immiscible liquid pairs. **21 hrs**

RECOMMENDED TEXT BOOKS:

1. Elements of Analytical Chemistry. R.Gopalan, P.S.Subramanian, K.Rengarajan- 3rd edition 2010
2. Principles of Inorganic Chemistry B.R.Puri L.R. Sharma &K.C.Kalia 28thedn – Vallabh publications.2003
3. Organic Chemistry by P.L.Soni , Sultan Chand and Sons, 28th edition , 2012
4. Organic Chemistry by Bahl &Arun Bahl ,11th edn ,Sultan Chand and Co.2010
5. Organic Chemistry by Morrison & Boyd ,7th edn , Pearson India 2011
6. Principles of Physical Chemistry – Puri & Sharma 41st edn Vishal Publishing Co. 2004.
7. Physical Chemistry – Samuel Glasstone, David Lewis, Palgrave Macmillan 1993
8. Guide book to mechanism in Organic Chemistry by Peter Sykes, 6th edition , Pearson Publications, 2003

REFERENCES:

1. Text book of Qualitative chemical analysis 1st edition- G.H.Jeffery, J.Bassett, J.Mendham, R.C.Deynery.
2. Text book of Quantitative Inorganic analysis-Vogal ELBS III edition, (1976) and IV Edition (1985)
3. Text book of Quantitative Inorganic analysis-Vogal ELBS III edition, (1976) and IV Edition (1985)
4. Organic Chemistry by Finar Vol II 3rd edition ELBS
5. Text book of Physical Chemistry by A.S.Negi & S.C.Anand. 1st edn New Age International.
6. Text book of Physical Chemistry – Kapoor Vol 1,2,3& 4. Mac Millan
7. Thermodynamics for chemists – Samuel Glasstone, Ist edition East West Press.
9. An Introduction to Chemical Thermodynamics by Rastogi & Misra, 6 th Revised editionVikas Publishing House.
10. Physical Chemistry by P.W. Atkins, 10 th edition Oxford University Press.

PERIODICALS:

1. Education in Chemistry
2. Indian academy of Sciences-Proceedings-Chemical Sciences
3. Current Science
4. Journal of Inorganic Chemistry
5. Journal of American Chemical Society

WEBSITES & e-LEARNING:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	1	2	1
CO 2	3	3	3	2	2
CO 3	3	2	2	3	2
CO 4	3	2	2	2	1
CO 5	3	1	2	2	2
Average	**3**	**2**	**2**	**2.2**	**1.6**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture **(**Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10 x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

COURSE PROFILE - SEMESTER II

Course Code	Course Title	Hours/Week	Credits	Marks		
				CA	SE	Total
Part-I	Tamil/Hindi/French/Sanskrit	5	3	40	60	100
Part-II	English	5	3	40	60	100
Part –III						
CH21/2C/GC2	Core 2-General Chemistry II	7	5	40	60	100
CH21/2C/PR1	*Core 3 Practical 1–Volumetric Analysis	3	4	40	60	100
MA21/2A/AM2	Allied Mathematics-II	6	5	40	60	100
Part-IV						
UG21/2S/VED	Value Education	2	2	-	50	50
UG21/2S/ECS	Soft Skill 2- English Language and Communication Skills II	2	3	-	50	50
Total		**30**	**25**			

CA= Continuous Assessment marks, SE= End Semester marks

SEMESTER- II

Title of the Course: Core 2- General Chemistry-II

Teaching hours: 15×7 = 105 **Credits: 5**
Course Code: CH21/2C/GC2 **L T P 4 3 0**

Objectives:

1. To learn the fundamentals in nuclear Chemistry.
2. To study the mechanism of addition reactions to alkenes and alkynes.
3. To understand the concept of aromaticity.
4. To study the mechanisms of Aromatic electrophilic, nucleophilic substitution and elimination reactions.
5. To study the concepts and applications of II and III law of Thermodynamics

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Gain knowledge on the fundamental particles of nucleus, stability, structure of nucleus and radioactivity
CO 2	Explain the mechanism of electrophilic and free radical addition to alkenes alkynes and dienes. Classify dienes , kinetic and thermodynamic control of reaction
CO 3	Apply Huckle s rule and differentiate between aromatic, anti-aromatic and non- aromatic compounds. Gain knowledge on the mechanism of aromatic, electrophilic, aliphatic nucleophilic substitution and elimination reactions
CO 4	Utilise the Second Law of Thermodynamics to predict the spontaneity of physical and chemical changes and to understand the concept of entropy and to learn the fundamental equations of thermodynamics
CO 5	Understand the idea about partial molar properties, Derive Gibbs Duhem equation ,variation of chemical potential with temperature and pressure and III law of thermodynamics

COURSE OUTLINE

UNIT I: **Fundamental particles of nucleus:** Nucleon terminology-isobars, isotopes, isomers, mirror nuclei, Composition of nucleus properties of nucleus- Nuclear forces operative between nucleons.Stability of nucleus, N/P ratio-curves-stability belts-Nuclear binding energy-mass defect, simple calculations involving mass defect and binding energy per nucleon. Magic numbers, Structure of Nucleus-Liquid drop model-shell model.Artificial transmutation of elements, Induced radioactivity,uses of radio isotopes. Hazars of radiation.Nuclear fission by thermal neutrons and nuclear fusion. **21hrs**

UNIT II: **Alkenes**-Mechanism of Electrophilic and Free radical additions of alkenes-Addition of hydrogen, halogens, hydrogen halides, Markonikoff's rule, Peroxide effect in hydrogen bromide addition- addition of sulphuric acid, water, hydroboration (Addition of diborane to ethylene and propylene only), ozonolysis, polymerization, hydroxylation with $KMnO_4$, allylic substitution by NBS.**Dienes**-Classification, stability and chemical reactivity-1,2 and 1,4- addition to conjugated dienes, kinetic and thermodynamic control of reaction-Diels-Alder reaction.**Alkynes**-Acidity of acetylene, Addition of water in presence of $HgSO_4$ catalyst, hydrogen, halogens, hydrogen halides, hydroboration and ozonolysis. **21 hrs**

UNIT III: **Aromaticity:** Huckel's rule of Aromaticity and its simple applications-Benzene, Naphthalene, Anthracene and Phenanthrene.**Polynuclearhydrocarbons-** Naphthalene, Anthracene -synthesis, properties, and uses.**Aromatic electrophilic substitution reaction**–orientation and reactivity- Mechanism of nitration, sulphonation, halogenations, Friedal craft's alkylation and acylation.**Aromatic nucleophilic substitution** - Activated aryl halides – Benzyne mechanism -Effect of substituents on reactivity.**Aliphatic nucleophilic substitution reaction**– Mechanism and stereochemistry of SN_1, SN_2, SN_i reaction- effect of solvents, leaving groups, nucleophiles and substrates. Elimination reaction-E1 and E2 eliminations-Mechanism and stereochemistry, dehydration of alcohols and dehydrohalogenation-Hoffmann and Saytzeff's rule. **21 hrs**

UNIT IV: **Thermodynamics II**:Need for second law, statements of second law, concept of entropy-definition-entropy changes in isothermal expansion of an ideal gas, cyclic, reversible and irreversible processes, physical transformation-calculation of entropy changes of an ideal gas with changes in temperature, volume and pressure. Entropy of mixing-Gibbs free energy-Helmholtz free energy- their variation with temperature, pressure and volume. Criteria for spontaneity, Gibbs Helmholtz equation, derivation and applications. Fundamental equations of thermodynamics-Maxwell's relationship- thermodynamic equation of state. **21hrs**

UNIT V: **Partial molar properties**: Partial molar free energy-chemical potential-Gibbs Duhem equation-chemical potential and other thermodynamic functions-relationship with enthalpy, internal energy and work function. Variation of chemical potential with temperature and pressure-chemical potential in a system of pure solid, pure liquid and ideal gas mixture. Gibbs–Duhem Margules equation. Concept of fugacity and activity. Determination of fugacity of gas-activity and activity coefficient. **Thermodynamics III**-Statement-Nernst heat theorem-Evaluation of absolute entropies from heat capacity measurements-exceptions to the third law. **21 hrs**

RECOMMENDED TEXTBOOKS:

1. Organic Chemistry by P.L.Soni , Sultan Chand and Sons, 28th edition , 2012
2. Organic Chemistry by Bahl &Arun Bahl ,11th edn ,Sultan Chand and Co.2010
3. Organic Chemistry by Morrison & Boyd ,7th edn , Pearson India 2011
4. Guide book to mechanism in Organic Chemistry by Peter Sykes, 6th edition , Pearson Publications, 2003
5. Physical Chemistry – Samuel Glasstone, David Lewis, Palgrave Macmillan 1993
6. Principles of Inorganic Chemistry B.R.Puri L.R. Sharma & K.C.Kalia 28thedn – Vallabh publications.2003
7. Text Book of Physical Chemistry – P.L.Soni – O.P.Dharmarha – U.N.Dash, Sultan Chand and Sons, 22nd revised edition.
8. Advanced Physical Chemistry – J.N.Gurtu and A.Gurtu, A Pragathi edition.
9. Principles of Physical Chemistry – Puri & Sharma 41stedn Vishal Publishing Co. 2000.
10. Atkins, Physical Chemistry, Julio de Paula Peter Atkins, 10th edition, Oxford University press.

REFERENCE BOOKS:

1. Organic Chemistry by Finar Vol II 3rd edition ELBS
2. Text book of Quantitative Inorganic analysis-Vogal ELBS III edition, (1976) and IV Edition (1985)
3. Textbook of Quantitative Inorganic analysis-Vogal ELBS III edition, (1976) and IV Edition (1985)
4. Textbook of Physical Chemistry by A.S.Neg&S.C.Anand. 1stedition, New Age International
5. Text book of Physical Chemistry – Kapoor Vol 1,2,3& 4. Mac Millan
6. Thermodynamics for Chemists–Samuel Glasstone, 2007. D. Van Nostrand Company.

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	1	2	1
CO 2	3	2	1	3	1
CO 3	3	2	2	2	2
CO 4	3	2	2	2	1
CO 5	3	2	2	2	1
Average	**3**	**2**	**1.6**	**2.2**	**1.2**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture **(**Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTERS I & II

MAJOR PRACTICALS

Title of the Course: Core 3- Practical 1 - Volumetric Analysis

Teaching hrs: 30 x 3=90 **Credits:4**

Course Code: CH21/2C/PR1

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Develop skills in volumetric estimation and preparesolutions of various molar concentrations.
CO 2	Apply the knowledge of pH to choose indicators for various types of volumetric analysis.
CO3	Understand the principle behind each volumetric experiment

ACIDIMETRY

1. Estimation of Borax - Standard Sodium carbonate.
2. Estimation of Oxalic acid - Standard Oxalic acid.
3. Estimation of Sodium carbonate and Sodium hydrogen carbonate present in a mixture
4. *Estimation of temporary and permanent hardness of water.

PERMANGANIMETRY

5. Estimation of Ferrous ammonium sulphate-Standard Ferrous sulphate.
6. Estimation of Oxalic acid- Standard Ferrous sulphate.
7. Estimation of water of crystallization in Mohr's salt by titration with Potassium Permanganate

*** DICHROMETRY**

8. Estimation of Ferrous ion against dichromate using diphenylamine as Internal indicator.

COMPLEXOMETRY

9. Estimation of Magnesium/Zinc using EDTA

***IODOMETRY**

10. Estimation of Copper-Standard Potassium dichromate

***CERIMETRY**

11. Estimation of Ferrous ion

***For internal assessment only**

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	3	3	1
CO 2	2	2	3	3	1
CO 3	3	1	1	1	1
Average	**2.3**	**2**	**2.3**	**2.3**	**1**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Hands on Practical training and Demonstration

END SEMESTER PRACTICALEXAMINATION

I B.Sc Chemistry SEMESTERS I & II

QUESTION BANK

Title of the Course: Core 3-Practical 1 -Volumetric Analysis **Time: 3 hrs**

Course code: CH21/2C/PR1 **Max. Marks: 60**

1. You are provided with oxalic acid solution. Estimate volumetrically the amount of oxalic acid present in the whole of the given solution. You are supplied with approximately decinormal solution of sodium hydroxide and pure crystalline oxalic acid. Get your burette and balance readings attested by the examiner.
2. You are given borax solution. Estimate volumetrically the amount of borax present in the whole of the given solution. You are supplied with approximately decinormal solution of hydrochloric acid and pure anhydrous sodium carbonate. Get your burette and balance readings attested by the examiner
3. You are given ferrous ammonium sulphate solution. Estimate volumetrically the amount of ferrous ammonium sulphate present in the whole of the given solution. You are supplied with approximately decinormal solution of potassium permanganate and pure crystalline oxalic acid. Get your burette readings attested by the examiner
4. You are given oxalic acid solution. Estimate volumetrically the amount of oxalic acid present in the whole of the given solution. You are supplied with approximately decinormal solution of potassium permanganate and pure ferrous ammonium sulphate crystals. Get your burette readings and the weights attested by the examiner.
5. You are given magnesium sulphate solution. Estimate volumetrically the amount of magnesium sulphate present in the whole of the given solution. You are supplied with approximately decinormal solution of EDTA and pure crystalline zinc sulphate. Get your burette and the weights attested by the examiner.
6. You are given a solution of a mixture of Sodium carbonate and Sodium hydrogen carbonate. Estimate volumetrically the amount of Sodium carbonate and Sodium hydrogen carbonate present in the mixture. You are supplied with approximately decinormal solution of Hydrochloric acid and pure anhydrous Sodium carbonate. Get your burette and the weights attested by the examiner.

SCHEME OF VALUATION

Continuous Assessment	**:**	**40 marks**
External marks	**:**	**60 marks [50+ 10 marks for Record]**
Total	**:**	**100 marks**

Volumetric analysis

Error upto 2%	:	50 marks
Error from 2.1% to 3%	:	45 marks
Error from 3.1% to 4%	:	35 marks
Error above 4%	:	20 marks
Arithmetic error	- reduce 1 mark	
Wrong calculation	- reduce 20% of the marks secured	
No calculation	- reduce 40% of the marks secured	

COURSE PROFILE - SEMESTER III						
Course Code	**Course Title**	**Hours/Week**	**Credits**	**Marks**		
				CA	**SE**	**Total**
Part –I	Tamil/Hindi/Sanskrit/French	5	3	40	60	100
Part-II	English	5	3	40	60	100
Part – III CH21/3C/OC1	Core 4- Organic Chemistry I	7	5	40	60	100
	*Core Practical 2-Inorganic Qualitative Analysis	3	-	-	-	-
PH21/3A/GP1	General Physics-I	4	4	40	60	100
PH21/4A/PPR	*Allied Physics Practicals	2	-	-	-	-
UG21/3N/BTA UG21/3N/ATA CH21/3N/COS	1a/1b/1c (1a – Basic Tamil , 1b-Advanced Tamil , 1c-Non-Major Elective -Cosmetology)	2	2	-	50	50
	Soft Skill - 3	2	3	-	50	50
Total		**30**	**20**			

CA= Continuous Assessment marks, SE= End Semester marks

SEMESTER- III

Title of the Course: Core 4-Organic Chemistry -I

Teaching hours: 15 × 7 = 105 **Credits: 5**

Course Code: CH21/3C/OC1 **L T P 4 3 0**

Objectives:

1. To study the reactionsof Phenols, alcohols, ethers and epoxides.
2. To study the mechanism of nucleophilic addition to carbonyl compounds and active methylene compounds.
3. To study the preparation and properties of Dicarboxylic acids and Heterocyclic compounds.
4. To study the reactions of Amines and Nitro compounds.
5. To study the synthesis and properties of Amino acids and structure of Proteins.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Compare the acidic character of alcohols and Phenols and understand the electrophilic substitution reactions of phenols
CO 2	Learn the mechanism of nucleophilic addition to carbonyl compounds and reactions of active methylene compounds
CO 3	Explain the preparation and properties of saturated and unsaturated dicarboxylic acids and heterocyclic compounds
CO 4	Gain knowledge on the reactions of nitro compounds, amines and synthetic application of diazonium salts. Learn the preparation and uses of various dyes
CO 5	Gain knowledge on the preparation and properties of different aminoacids ,synthesis of peptides, structure of proteins and functions of nucleic acids

COURSE OUTLINE

UNIT I: **Phenols and Alcohols**: Acidic character of Phenols & Alcohols-Explanation on the basis of resonance stabilization. Ring substitution in phenols-orientation of phenolic group towards electrophiles. Mechanism of esterification, nitration, sulphonation, halogenation, coupling with diazonium salts. Kolbe's reaction, Reimer Tieman reaction, Gattermann reaction, Houben Hoesch reaction and Phthalein fusion reaction. Alpha and beta naphthols-preparation, properties and uses. **Unsaturated alcohols**-Preparation and reactions of Allyl alcohol. **Ethers and epoxides**: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$. **21 hrs**

UNIT II: **Carbonyl Compounds**: Polarisation and acidity of alpha hydrogen in carbonyl compounds. Mechanism of Nucleophilic addition-Nucleophilic addition-elimination reaction with ammonia derivatives.Mechanisms of Aldol and Benzoin condensations, Perkin, Knoevenagel, Claisen, Wittig, Cannizaro and Reformatsky reactions. Mechanism of Reduction of carbonyl compounds with sodium borohydride, $LiAlH_4$, Wolf-Kishner, Clemmenson reduction and MPV reduction. Addition reactions of unsaturated carbonyl compounds: Michael addition. Characteristics reactions of Active methylene group-preparation and synthetic uses of Malonic ester, Acetoaceticesters and cyanoacetic esters. **Tautomerism**-definition- Keto-enol tautomerism (Identification, acid and base catalysed inter conversions, mechanism, preparations and characteristics) **21 hrs**

UNIT III: **Dicarboxylic Acids**- Preparation and properties of oxalic, Malonic, Succinic, Glutaric and Adipic acids. Unsaturated dicarboxylic acid - Preparation and properties of Maleic and Fumaric acid. Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group - Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann-bromamide degradation and Curtius rearrangement **Heterocyclic Compounds:** Aromaticity of heterocyclic compounds - Synthesis and reactions of Pyrrole, Furan, Thiophene, Pyridine, Quinoline, Isoquinoline and Indole with special reference to Skraup, Bischler, Napieralski and Fischer-indole synthesis. **21 hrs**

UNIT IV: **Nitro Compounds-** Conversions of nitrobenzene to ortho, para, meta dinitrobenzene, TNT. Aromatic nitrocompounds-Reduction in neutral, acidic and alkaline media. **Amines:** Basicity of amines, various reactions of amines, Diazotisation and its mechanism. Synthetic application of diazonium salts. Diazomethane and diazoacetic esters-preparation,structures and their synthetic uses**Dyes-**Theory of colour and constitution, classification-according to structure and method of application. Preparation and uses of 1.Azo dye-Methyl orange, 2. Triphenyl methane dye-Malachite green, 3. Phthalein dye-Phenolphthalein and fluorescein, 4. Vat dye-Indigo, 5.Anthraquinone dye-Alizarin **21 hrs**

UNIT V: **Aminoacids and Proteins:** Amino acids-Classification of amino acids-essential and non essential amino acids-Preparation of alpha amino acids-from halogenated acids, Gabriels phthalimide synthesis, Strecker synthesis. Properties and reactions-Zwitter ions, isoelectric points - peptide synthesis (Bergmann's method only)-structure determination of polypeptides-end group analysis. Proteins-Classification based on physical and chemical properties and physiological function- Primary and secondary structures of proteins-Helical and sheet structures (Elementary treatment only)-Denaturation of proteins-Colour reaction of proteins. Nucleic acids- Nucleoside, Nucleotides- functions of Nucleotides, Nucleotides as energy carriers, types of Nucleic acid, Structure and functions of nucleic acids. **21 hrs**

RECOMMENDED TEXT BOOKS:

1. Organic Chemistry by P.L.Soni , Sultan Chand and Sons, 28th edition , 2012
2. Organic Chemistry by Bahl&Arun Bahl,11th edn ,Sultan Chand and Co.2010
3. Organic Chemistry by Morrison & Boyd, 7th edn , Pearson India 2011 .
4. Guide book to mechanism in Organic Chemistry by Peter Sykes, 6th edition , Pearson Publications, 2003
5. Organic Chemistry by Jagadhamba Singh L.D.S. Yadav, Vol II and III, 11th edition- Pragathi publishers 2014.
6. Modern Organic Chemistry by M.K.Jain , S.C. Sharma , 4th edition – Vishal publishers 2015.

REFERENCE BOOKS:

1. Organic Chemistry by Finar Vol II, 3rd edition ELBS
2. UG-Organic Chemistry, Volume II, III Jagadamba Singh & L.D.S. Yadav, 8th edition 2013.

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of Inorganic Chemistry.
7. Journal of American chemical society

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	2	2
CO 2	3	2	2	3	3
CO 3	3	2	2	3	2
CO 4	3	3	2	2	2
CO 5	3	2	2	2	2
Average	**3**	**2.4**	**2.2**	**2.4**	**2.2**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk), Problem solving,

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

COURSE PROFILE - SEMESTER IV						
Course Code	**Course Title**	**Hours /Week**	**Credits**	**Marks**		
				CA	**SE**	**Total**
Part-I	Tamil/Hindi/French/Sanskrit	5	3	40	60	100
Part-II	English	5	3	40	60	100
Part – III CH21/4C/IC1	Core 5-Inorganic Chemistry I	7	5	40	60	100
CH21/4C/PR2	*Core 6-Practical 2– Inorganic Qualitative Analysis	3	4	40	60	100
PH21/4A/GP2	General Physics-2	4	4	40	60	100
PH21/4A/PPR	*Allied Physics Practicals	2	2	40	60	100
UG21/4N/BTA UG21/4N/ATA CH21/4N/DPT	1a/1b/1c (1a – Basic Tamil, 1b-Advanced Tamil, 1c-Non – Major Elective – Dyeing and Printing of Textiles)	2	2	-	50	50
	Soft Skill - 4	2	3	-	50	50
CH21/4C/INT	Internship (optional)		1			
Total		**30**	**26/27**			

CA= Continuous Assessment marks, SE= End Semester marks

SEMESTER- IV

Title of the Course: Core 5- Inorganic Chemistry-I

Teaching hours: 15 × 7 =105 **Credits: 5**

Course Code: CH21/4C/IC1 **L T P 4 3 0**

Objectives:

1. To provide the basic concepts in the field of metallurgy
2. To study the Synthesis and applications of polymers
3. To provide the importance of inorganic pigments
4. To study the extraction and separation of lanthanide and Actinide elements
5. To understand elementary structure of crystals

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Identify the different extraction methods -concentration, reduction and refining processes and apply it for Ti, V, Cr and Nickel.
CO 2	Gain knowledge on the preparation, properties and applications of polymers - polysiloxanes, polysilanes, polysilicates
CO 3	Demonstrate the important applications of Cast iron, Plain carbon, Alloy steels, Copper, Aluminium and their alloys.
CO 4	Understand the extraction and separation techniques of Inner transition elements such as thorium and uranium
CO 5	Identify the different elements of symmetry, predict the point group - (C_{2V}, C_{3V}& C_{2h} only) and to determine the structures of few crystal systems

COURSE OUTLINE

UNIT I: **Basic metallurgical processes**: ores, minerals-Metal ore mines in India, Principles of Metallurgy, General methods of extraction-concentration methods, reduction methods, refining processes. Extraction of Ti, V, Cr, Ni from their principle ores preparation and properties of compounds of Ti, V, Cr, Ni, co-oxides, halides oxyhalides and metal salts **21 hrs**

UNIT II: **Synthesis, Properties and Applications of polymers**: Main group containing polymers: polysiloxanes, polysilanes, Polysilicates-classification, preparation and applications. Transition metal containing polymers. Sulphur nitrogen polymers, Boron based polymers.

Maddrell's salts–coordination polymers with two and three dimensional network compounds. **21 hrs**

UNIT III: **Inorganic solids of technological importance:** Solid electrolytes- cationic, anionic, mixed inorganic pigments colour solids, white and black pigments. Molecular materials and fullerides, molecular materials & chemistry one dimensional metals, molecular magnets, inorganic crystals, Composition, Characteristics and applications of various types of Cast iron, Plain carbon and Alloy steels, Copper, Aluminium and their alloys like Duralumin, Brass and Bronze. **21 hrs**

UNIT IV: **Inner transition metals** – Lanthanides and Actinides - Extraction, Separation techniques-Solvent extraction and Ion Exchange methods, Extraction of thorium and uranium- Artificial synthesis of trans uranium elements- Significance of rare earths – Electronic Configurations – Common oxidation states– Lanthanide Contraction– consequences **21 hrs**

UNIT V: **Solid state**: Introduction-Elements of Symmetry-Symmetry operations. Classification into groups-Point groups of molecules- H_2O & NH_3 only. (Restrict to C_{2V}, C_{3V}& C_{2h})-Space lattice, Unit lattice, packing- hcp & ccp, Bravais Lattices-Different crystal systems, Miller indices, Designation of planes, X-ray diffraction, Bragg's equation, rotating crystallography method, powder diffraction-structure determination. Structure of rock salt. Sodium chloride, Cesium chloride Structures. Schottky and Frenkel defects. **21 hrs**

RECOMMENDED TEXTBOOKS:

1. Principles of inorganic Chemistry B.R.Puri L.R. Sharma & K.C.Kalia 28th edn – Vallabh publications.2003
2. Text Book of Inorganic Chemistry P.L.Soni M.Katyal 20th edn Sultan Chand & Sons. 2004.
3. Vogel's text book of quantitative Inorganic Analysis – Longman press.
4. Text book of qualitative Inorganic Analysis – Vogel ELBS III edn 1976, IV edn 1985.

REFERENCE BOOKS:

1. Theoretical inorganic Chemistry, M.C.day Jr and J.Selbin. Reinhold, Newyork 1962.
2. Inorganic Chemistry Shriver & Atkins 3rd edn, Oxford University Press 1999.
3. The nature of the chemical Bond, L.Pauling – 3rd edn, Cornell University Press,Newyork 1960.
4. Inorganic chemistry J. Huheey, Harper's Row Publishers.

PERIODICALS:

1. Current Science.
2. Education in Chemistry.
3. Journal of Nuclear Chemistry
4. Journal of American Chemical Society.

WEBSITES & e-LEARNING SOURCES:

- www.virtlab.com
- http://nptel.ac.in
- MATLAB
- mooc.org
- http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	2	3	2	3
CO 3	2	2	3	3	3
CO 4	3	2	3	2	2
CO 5	3	3	1	3	1
Average	**2.8**	**2.4**	**2.6**	**2.6**	**2.4**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTERS – III & IV

MAJOR PRACTICALS

Title of the Course: Core 6- Practical 2-Inorganic Qualitative Analysis

Course Code: CH 21/4C/PR2 **Credits: 4**

Teaching hours: 30 x 3 = 90

Analysis of a mixture containing two anions one of which is interferring and two cations.

Anions:

Non interfering Cl^-, Br^-, CO_3^{2-}, SO_4^{2-} and NO_3^-

Interferring PO_4^{3-}, BO_3^{3-}, F^-, $C_2O_4^{2-}$ and CrO_4^{2-}

Cations: Pb^{2+}, Cu^{2+}, Bi^{3+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+} and NH_4^+

Each student is expected to do the analysis of at least 6 mixtures.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Achieve skill in analysing the inorganic mixture systematically containing the two anions (interfering and non – interfering)
CO 2	Separate the two common cations under individual group separation and analyze the mixture for the cations present.
CO3	Write and submit a report on the systematic analysis of the inorganic mixture

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	2	1	2
CO 2	2	3	2	1	2
CO3	2	3	2	1	2
Average	**2**	**3**	**2**	**1**	**2**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Hands on Practical Training, Demonstration

END SEMESTER PRACTICAL EXAMINATION

II B.Sc Chemistry-Semesters-III & IV

QUESTION BANK

Title of the Course: Core 6-Practical 2-Inorganic Qualitative Analysis

Course Code: CH21/4C/PR2 **Time: 3hrs**

Max. Marks: 60

Analyze systematically the given mixture and report for one interfering anion,one non- interfering anion and two cations.

SCHEME OF VALUVATION

Total Marks = 100 (CA 40+End Semester 60)

Each metal ion	24 marks	(2 x 12 marks)
Non- Interfering anion	12 marks	
Interfering anion	14 marks	
Record	10 marks	
Total	60 marks	

COURSE PROFILE - SEMESTER V						
Course Code	**Course Title**	**Hours/ Week**	**Credits**	**Marks**		
				CA	**SE**	**Total**
CH21/5C/PHY	Core 7- Physical Chemistry	4	4	40	60	100
CH21/5C/OC2	Core 8-Organic Chemistry II	4	4	40	60	100
CH21/5C/IC2	Core 9- Inorganic Chemistry II	4	4	40	60	100
CH21/5C/ANC	Core 10-Analytical Chemistry	4	4	40	60	100
CH21/5E/SPE	Elective 1 - Spectroscopy	5	5	40	60	100
CH21/5S/POC **(OR)** CH21/5S/FOC	Self Study Paper for Advanced learners - Polymer Chemistry **(OR)** Self Study Paper for Advanced learners - Polymer Chemistry		2		100	100
	*Core Practical 3 – Organic Chemistry	3	-	-	-	-
	*Core Practical 4 – Gravimetric Analysis	3	-	-	-	-
	*Core Practical 5- Physical Chemistry	3	-	-	-	-
Total		**30**	**21/23**			

CA= Continuous Assessment marks, SE= End Semester marks

SEMESTER - V

Title of the Course: Core 7- Physical Chemistry

Teaching hours: 15 X 4= 60 hrs **Credits: 4**

Course Code: CH21/5C/PHY **L T P 3 1 0**

Objectives:

1. To study the colligative properties and Nernst distribution law.
2. To understand the concepts in ionic equilibria.
3. To learn principles and photochemical processes.
4. To study the atomic structures in terms of quantum mechanical principles.
5. To study the Phase equilibria.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Perform calculations using mathematical equation that describes colligative effects .Understand Nernst distribution law and causes for deviation from law
CO 2	Acquire in-depth knowledge about ionization of acids and bases , solve problems related to ionization, pH , solubility product and buffer solutions
CO 3	Explain various photochemical laws and Jablonski diagram depicting various photophysical methods
CO 4	Analyse the need for quantum mechanics and the failure of classical mechanics, solve simple eigen value problems by using operator algebra and familiarise Schrodinger Wave equation
CO 5	Acquire knowledge of various components of system and learns basic terms of phase equilibria, plots of simple and compound phase diagram

COURSE OUTLINE

UNIT I: **Colligative Properties:** Osmosis and Osmotic pressure, Determination of molar mass of the solute from vapour pressure lowering, elevation in boiling point, Depression in freezing point and Osmotic pressure measurements. Vant Hoffs factors and deviations. **Nernst distributionlaw**, validity of the law, thermodynamic derivation, deviation from distribution Law – association, dissociation and chemical combination of the solute with one of the solvents. Applications – association and dissociation of a solute, complex ions and solvent extraction **12hrs**

UNIT II: **Ionic Equilibria:** Conductance and conductivity- equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes, Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale,

common ion effect. Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions.Solubility and solubility product of sparingly soluble salt - applications of solubility product principle. **12 hrs**

UNIT III: **Photochemistry**-Difference between thermal and photochemical processes - Laws of photochemistry - Grothus- Draper law, Beer-Lamberts law and Stark Einsteins law-Quantum yield. Jablonski diagram depicting various processes in excited state, Qualitative description of fluorescence, Phosphoresence, non-radiative processes (internal conversion, intersystem crossing), Photosensitization and Chemiluminescence. **12 hrs**

UNIT IV: Quantum Chemistry: Failures of classical theory, Black Body radiation, quantum theory of radiation, photoelectric effect, dual character of electron-de Broglie equation-Davisson and Germer experiment. Bohr's model atom (no derivation), spectrum ofhydrogen atom, Compton effect, Heinsberg uncertainty principle, postulates of quantum mechanics, Schrodinger wave equation (no derivation), significance of Ψ and Ψ^2Eigen values and eigen functions. **12 hrs**

UNIT V: Phase Equilibria: Definition of terms-phase, component, degrees of freedom, Gibbs phase rule – Derivation. Applications to one component systems-water, sulphur systems. Two component system- solid-liquid equilibria. Simple eutectic-Lead-silver system. Compound formation with congruent melting point-Magneisum-zinc system. Incongruent melting point-sodium-potassium system. Salt-hydrates- KI- water, $FeCl_3$-water, freezing mixtures. **12hrs**

RECOMMENDED TEXTBOOKS:

1. Principles of Physical Chemistry Puri and Sharma and Pathania 2003 Millenium edition, Vishal Publishing Co.
2. Undergraduate Physical Chemistry, Gurtu. Gurthu Volume I, II, III 5th edition (2013), Pragathi Prakashan
3. Text Book of Physical Chemistry – P.L.Soni – O.P.Dharmarha – U.N.Dash, Sultan Chand and Sons, 22nd revised edition.
4. Physical Chemisry, Peter Atkins. Julio De Paula, Ninth edition (2010), Oxford University press.

REFERENCE BOOKS:

1. Physical Chemistry by Bhal and Arun Bhal.
2. Photochemistry by Arora.
3. A Textbook of Physical Chemistry – K.L.Kapoor, Vol. 3, 2012 edition.
4. G. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
5. G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004).

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of Polymer Research

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	3	3	1
CO 2	3	2	3	2	1
CO 3	3	3	3	3	2
CO 4	2	3	3	3	1
CO 5	3	3	3	3	1
Average	**2.6**	**2.8**	**3**	**2.8**	**1.2**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER- V

Title of the Course: Core 8-Organic Chemistry-II

Teaching hours: 15 × 4 = 60 **Credits: 4**

Course Code: CH21/5C/OC2 **L T P 3 1 0**

Objectives:

1. To understand the concepts of stereoisomerism and asymmetric synthesis.
2. To study the structure and properties of Carbohydrates and lipids.
3. To study the conformational analysis of open chain compounds and cyclohexane ring systems
4. To study the mechanism of some rearrangement reactions.
5. To study the chemistry of natural products- Alkaloids and Terpenes

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Explain the concept of stereochemistry, apply Cahn Ingold Preglog rules to assign stereochemical descriptors R &S and E&Z . Concept of racemisation , resolution and asymmetric synthesis
CO 2	Classify carbohydrates , understand the constitution and structure of monosaccharides , structure and properties of di and poly saccharides , interconversion of monosaccharides
CO 3	Understand the concept of conformational analysis of acyclic alkanes and cyclohexane and draw energy profile diagram
CO 4	Classification of molecular rearrangements , mechanism of various molecular rearrangement reactions and its applications
CO 5	Elucidate the structure of few natural products -Alkaloids , terpenoids and water soluble vitamins

COURSE OUTLINE

UNIT I: **Stereoisomerism:** Definition-classification into optical and geometrical isomerisms. Geometric isomerism-cis and trans isomers, syn and anti and E,Z-nomenclature, Methods of assigning configuration, Auwer's skita rule.Optical isomerism-Optical activity-Specific rotations. Conditions for optical activity-assymmetrical center-chirality-chiral and achiral molecules-meaning of + and-/ d and l notations- Elements of symmetry-Racemisation- methods of racemisation and mechanism of racemisation- Resolution-methods of resolution(mechanical,seeding,biochemical and conversion into diastereoisomers)-Assymmetric synthesis-partial and asymmetric synthesis, Walden inversion, Projection formulae- Fischer, Flying Wedge, Saw horse and Newmann Projection formulae- Configurational notations of optical isomers-D and L notations, Cahn Ingold and Prelog rules-R,S-notations of optical isomers with one and two asymmetric carbons-Erythro and Threo representations. **12 hrs**

UNIT II: **Carbohydrates:** Carbohydrates-classification, constitution of glucose and fructose. Reactions of glucose and fructose-osazone formation, mutarotation and its mechanism-cyclic structures-pyranose and furanose forms. Haworth projection formula, Epimerisation. Configuration of monosaccharides -chain lengthening and chain shortening of aldoses, Interconversion of aldoses and ketoses. Disaccharides-Properties and structure of sucrose & maltose (Structural elucidation not necessary).Polysaccharides- Properties and structure of starch and cellulose (Structuralelucidation not necessary.**Lipids:**Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fatsand oils, Saponification value, acid value, iodine number. Reversion and rancidity **12 hrs**

UNIT III: **Conformationl Analysis:** Introduction of the terms conformers,configuration,dihedral angle,torsional strain and conformational analysis. Conformational analysis of ethane and n-butane with energy diagrams Conformers of Cyclohexane-boat,chair and skew boat forms-axial and equatorial bonds-ring flipping. **12 hrs**

UNIT IV: Molecular Rearrangements: Classification as Anionotropic,Cationotropic-intermolecular and intramolecular rearrangement. Mechanism of rearrangements-Pinacol-pinacolone, Beckmann, Benzidine, Hoffmann, Benzil-Benzilic acid and Claisen rearrangments. **12 hrs**

UNIT V: Natural Products: Terpenoids-classification, isoprene rule, Camphor and Alpha Pinene-structural elucidation. Alkaloids-General methods of isolation,their physiological action, Hoffmann's exhaustive methylation, Emde's modification and general methods of structure determination of Connine, Piperine and Nicotine. Vitamins-Thiamine, Riboflavin, Pyridoxine and Ascorbic acid-Structure, occurrence and biological importance- structural elucidation of Ascorbic acid only. **12 hrs**

RECOMMENDED TEXTBOOKS:

1. Stereochemistry: Conformation and Mechanism by P.S.Kalsi ,7th New Age International Pvt Ltd Publishers ,2015
2. Organic Chemistry by Morrison & Boyd, 7th edn , Pearson India 2011
3. Organic chemistry by Finar Vol I ,Pearson Education; 5 edition (2002)
4. Organic chemistry by Finar Vol II,Pearson Education; 5 edition (2002)

REFERENCES BOOKS:

1. Stereochemistry of carbon compounds by L.Eliel Mac Graw Hill
2. Chemistry of Natural Production by Gurdeep .R.Chatwal.Himalaya Publishing
3. UG-Organic Chemistry, Volume I, Jagadamba Singh & L.D.S. Yadav, 8th edition 2013.

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	2
CO 2	3	3	3	2	3
CO 3	3	3	2	3	2
CO 4	3	2	3	2	2
CO 5	3	2	3	2	3
Average	**3**	**2.6**	**2.6**	**2.2**	**2.4**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk& Talk) , Problem solving, Seminar, use of models

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER – V

Title of the course: Core 9- Inorganic Chemistry-II

Teaching hours: 15 x 4 = 60 **Credits: 4**

Course Code: CH21/5C/IC2 **L T P 3 1 0**

Objectives:

1. To focus on the basics of co-ordination chemistry,
2. To impart knowledge about various theories of co-ordination chemistry
3. To study about the stability constants of co-ordination complexes and its applications
4. To concentrate on Bio-Inorganic chemistry emphasizing on the role of metal ions in biological system.
5. To understand the structure and bonding in organometallic compounds.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Apply crystal field theory to describe magnetic properties of coordination compounds, stability of metal complexes and calculate thermodynamic parameters
CO 2	Create an overview knowledge on the stereochemistry of coordination compounds and elucidate the structure of metal complexes
CO 3	Formulate various extraction and separation techniques of transition metals.
CO 4	Explain and demonstrate the relationship between chemistry and biology in metabolic pathway
CO 5	Apply the knowledge about structure, bonding, stability and reactivity of simple organometallic complexes

COURSE OUTLINE

UNIT I: **Introduction to coordination compounds:** ligand classification, nomenclature of coordination compounds, isomerism in complexes-ionization, hydrate, position, linkage, geometrical, and optical isomerism. Kinetic vs Thermodynamic stability of complexes. **12 hrs**

UNIT II: **Coordination Chemistry I:**Theories of coordination-Werner, Sidgwick, EAN rule, Pauling's valence bond theory, Electroneutrality principle, Pi bonding concept, Inner & outer orbital complexes-Merits & Demerits. Crystal Field Theory,Octahedral and tetrahedral splitting, 10 Dq, Stabilization energy-CFSE. Measurement of 10Dq. Factors affecting 10Dq-Spectrochemical Series- Comparison of VBT and CFT-Jahn Teller effect. **12 hrs**

UNIT III: **Coordination Chemistry II** Stability constant- stepwise and overall stability constant, Job's method, Chelate effect. Introduction to macrocyclic ligand- Crown ethers. Synthesis and applications. Factors affecting stability of complexes. Chelate complexes with ethylene diammine, EDTA, DMG. Applications of complexes in Qualitative and Quantitative Analysis. **12 hrs**

UNIT IV: **Oxygen carriers:** Haemoglobin, Myoglobin, Bohr effect, Perutz mechanism-oxygen dissociation curves-Vitamin B12-Role of Cobalt-Zinc containing enzymes-Carboxy peptidase, Carbonic anhydrase. Function of Na^+/K^+ Mechanism of ion pump-Role of Calcium. Role of Copper in ascorbic acid oxidase, Function of ceruloplasmin, Transamination reactions- Role of Magnesium in Hexakinase. **12 hrs**

UNIT V: **Organometallic chemistry:** Ferrocene-Preparation Reactivity. Carbonyls and nitrosyls Structure and bonding-Preparation Reactivity. Alkene and Alkyne complexes. π bonding. Zeisse salt.Organo magnesium and Boron complexes - Preparation and uses of Ziegler-Natta catalyst **12 hrs**

RECOMMENDED TEXTBOOKS:

1. Principles of Inorganic chemistry B.R.Puri, L.R.Sharma & K.C.Kalia 28th edn, Vallabh Publications, 2003.
2. Co-ordination Chemistry, D. Banerjea, Tata McGraw Hill, 1993.
3. Vogel's text book of quantitative Inorganic Analysis – Longman press.
4. Inorganic Chemistry, J.E.Huheey, Harper & Collins NY, IV edn.

REFERENCE BOOKS:

1. Inorganic Chemistry D.F.Shrivers, P.W.Atkins, Oxford University Press, 3rd Edn. 1999.
2. Inorganic Chemistry K.F.Purcell & J.C.Kotz Swb Saunders Co. 1977.
3. Co-ordination Chemistry - SFA Kettle, ELBS, 1973.

PERIODICALS:

1.Resonance- Journal of science education

2.Education in Chemistry

3.Indian academy of sciences-proceedings - Chemical Sciences

4.Current Science

5.Journal of Indian chemical education

6.Journal of American chemical society

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4. mooc.org
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Mapping : Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	1	3	2
CO 2	3	3	2	2	2
CO 3	3	2	3	3	3
CO 4	3	2	1	1	3
CO 5	3	2	2	2	2
Average	**3**	**2.4**	**1.8**	**2.2**	**2.4**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture **(**Chalk and Talk)

ESE Question Paper Pattern UG

Bloom's Category	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER-V

Title of the Course: Core10-Analytical Chemistry

Teaching hours: 15 x 4 = 60 **Credits:4**

Course Code:CH21/5C/ANC **L T P 3 1 0**

Objectives:

1. To impart knowledge and skill in data analysis, separation techniques,
2. To expose to electroanalytical techniques
3. To introduce computer applications in chemistry.
4. To study the various separation techniques – Chromatography
5. To study the principle and estimation of ions by colourimetric methods

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Analyse data and prepare reports with precision and accuracy
CO 2	Utilize the principle and Instrumentation of Thermo analytical techniques in examiningthe thermal behaviour of complexes
CO 3	Demonstrate Electroanalytical methods and apply them in relevant fields
CO 4	Explain the preparation and separation techniques of various compounds.
CO 5	Compute the various volumetric parameters and constants employing Basic C-programs and Internet usage

COURSE OUTLINE

UNIT I: **Data Analysis:** Theory of errors-idea of significant figures and its importance with examples. Precision, Accuracy-methods of expressing accuracy-error analysis, minimizing errors, methods of expressing precision-average deviation-standard deviation and confidence limit. Reporting of data, Presentation of tabulated data, scatter diagram, Method of least squares, correlation for straight lines only. Gaussian distribution curves, Null hypothesis **12 hrs**

UNIT II: **Colorimetric Analysis**: Lambert's Law, Beer Lamberts Law, Validity and application, Methods of Colour Measurement using Duboscq Colorimeter, Photoelectric Colorimeter, Colorimetric estimation of selected ions- Fe, Ni, Cr, Determination of composition of complexes **12 hrs**

UNIT III: **Electro analytical methods**: Polarography - concentration polarization-DME-convection, migration and diffusion current-Ilkovic equation (derivation not required). Experimental assembly-electrodes-solutions current voltage curve - Effect of oxygen - Applications. **Electrogravimetry:** Introduction, theory, instrumentation for constant-Current methods-Applicatons **12 hrs**

UNIT IV: **Separation and Purification Techniques:** Separation techniques-principles involved in the separation of precipitates-solvent extraction. Purification of solid organic compounds-solvent extraction. Chromatography-Principles of adsorption, column chromatography-TLC and paper chromatography- R_f values-applications. Size exclusion chromatography-Theory, Gel filtration and Gel permeation. Ion exchange Chromatography-principle experimental Techniques-applications-separation of Zn-Mg, Co-Ni, Cd-Zn and chloride-Bromide. **12 hrs**

UNIT V: **Introduction to computers & its Applications:** Introduction to Computers-Characteristics of a Computer, Types of Computers, Block Diagram of a digital Computer Input & Output devices, memory Storage Systems. Central Processing Unit, Binary Numbers, Floating Points, Computational errors. Computer viruses high level and low level languages. Basic Introduction to C, Importance of C, Sample C programs, Basic Structure of C programs. Programming Style- Executive C program, algorithmic flow chart, Character set, C tokens Keywords and Identifiers Variable constant and data types. Declaration of variables. Deferring Symbolic Constants (Basic Constants Only). Application of C program in Chemistry: Determination of normality, Molarity and Molality of solutions, Calculation of pH. **12 hrs**

RECOMMENDED TEXT BOOKS:

1. Elements of Analytical Chemistry –R.Gopalan,P.S.Subramanian and K.Rengarajan Sultan Chand and Sons.
2. Instrumental methods of analysis by H.Willard, W.Merrit, J Dean. 6thedn Van Nostrand 1981
2. Computers and their applications to chemistry Ramesh Kumari, Narosa.
3. Text book of quantitative inorganic analysis- Vogal ELBS III Edition, (1976) and IV Edition (1985)
4. Polarography by Kapoor Sultan and Chand
5. ANSCIC by Balgurusamy
6. Fundamentals of Analytical Chemistry - Skoog, West and Holler, Saunders College Publishing, VI Edition, 1991, and VII Edition, 1996.
7. Chromatography –Harry and Calvin, Van Nostrand Reinhold Company, II Edition, 1967.
8. Quantitative Analysis Using Chromatographic Techniques – E.Katz, John Wiley & Sons Ltd, 1987

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

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2. http://nptel.ac.in
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Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	3	2	3	1
CO 2	3	3	2	2	3
CO 3	3	3	2	2	2
CO 4	3	3	2	2	2
CO 5	3	3	2	2	2
Average	**2.8**	**3**	**2**	**2.2**	**2**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk, LCD), Flipped Learning – E Content, Videos, Problem solving, Seminar, Quiz

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER-V

Title of the Course: Elective 1-Spectroscopy

Teaching hours: 15 X 5 = 75 **Credits: 5**

Course Code: CH21/5E/SPE **LTP 4 1 0**

Objective:

1. To introduce spectroscopy at basic level.
2. To learn the principles of various techniques.
3. To understand the working and instrumentation.
4. To study the applications of spectroscopic techniques.
5. To elucidate the structure of compounds.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Understand the principle ,instrumentation and applications of infrared spectroscopy in functional group identification and quantitative applications
CO 2	Comprehend the principle ,instrumentation and applications of Raman Spectroscopy
CO 3	Outline the basic principle, Instrumentation technique and applications of UV spectroscopy.
CO 4	Explain the theory, Instrumentation and applications of NMR spectroscopy
CO 5	Summarise the basic principle and theory behind Mass spectra and understand McLafferty rearrangement

COURSE OUTLINE

UNIT I: **Infrared Spectroscopy:** Origin of IR spectroscopy-Simple Harmonic oscillator model of vibrator-Zero point energy-Force constant & bond strengths- Anharmonicity-Morse potential energy diagram- Energy of vibrational levels. Rotational fine structure, Born-Oppenheimer approximation, normal modes of vibration, fundamentals, overtones, hot bands, selection rules. Instrumentation, single and double beam instrument- Applications-Organic structural elucidation-simple problems, Hydrogen bonding, kinetic studies, identifying cis-trans isomers, linkage isomers, tautomers, impurity detection–quality control-Base line correction method-Quantitative application. **15 hrs**

UNIT II: **Raman Spectroscopy:** Origin-Stokes and antistokes lines-Quantum theory- Classical theory. Vibrational Raman spectra-selection rule- polarisability ellipsoids-Changes in polarisability ellipsoids of water and CO_2 during vibrations-plot of polarisability vs

displacement coordinate-rule of mutual exclusion principle-instrumentation-depolarization ratio-usefulness-connection to Raman spectroscopy-application. **15 hrs**

UNIT III: **UV-Vis Spectroscopy**: Energy levels – molecular orbitals. Electronic transitions types-Broad nature of bands. vibrational and rotational transitions accompanying. Selection rule-Effect of Substitution and conjugation-Bathochromic, Hypsochromic, hyper and hypochromic shifts. Instrumentation-Woodward Feiser rules. Applications-Qualitative and Quantitative analysis. Uses of Beer-Lambert law **15 hrs**

UNIT IV: **NMR Spectroscopy:** ^{1}H NMR only-Origin-Nuclear Zeeman effect. Instrumentation-Chemical shift.Factors affecting chemical shift. Spin spin coupling-fine structure, Pascals triangle-intensity ratio- Fermi contact interaction-Proton count Integration ratio. AB, AX spectrum-Exchange reaction-ethanol spectrum-AMX-Simple problems **15 hrs**

UNIT V: **Mass Spectroscopy**-Basic principles. Theory-instrumentation-ion production. Molecular ion, Fragment ions, Meta stable peaks-Fragmentation pattern in alkanes, alkenes, alkynes, alcohols, & aromatic alcohols, phenols, Toluene McLafferty rearrangement-nitrogen rule-ring rule. **15 hrs**

RECOMMENDED TEXT BOOKS:

1. Applications of absorption spectroscopy of organic compounds by J.Dyer
2. Spectroscopy of Organic chemistry by P.S.Kalsi.

REFERENCE TEXTBOOKS:

1. Organic spectroscopy by William Kemp 3rd edn W.H.Freeman & Co,1991
2. Spectroscopic methods in organic chemistry by Silverstein Bassler
3. Instrumental method of analysis by H.Willard, W.Merrit, J Dean. 6th edn Van Nostrand 1981
4. Fundamental of molecular spectroscopy, C.N.Banwell McGraw Hill Newyork 1966
5. Gurudeep R.Chatwal and Sham K.Anand , Instrumental methods of chemical analysis, Himalaya publishing house, 2016.
6. Subramanian P.S. Gopalan R., Rangarajan K , Elements of Analytical chemistry, Sultan Chand and Sons, 2003.
7. Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

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Mapping: Course Outcomes with Programme Specific Outcomes

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CO 1	3	3	2	1	2
CO 2	3	3	2	2	1
CO 3	3	3	2	2	1
CO 4	3	3	2	1	1
CO 5	3	3	2	2	1
Average	**3**	**3**	**2**	**1.6**	**1.2**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1

No Correlation – 0

Teaching Methodology: Lecture (CHALK & TALK, LCD), Flipped Learning – E Content, Videos, Problem solving, Seminar, Quiz

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

Semester-V
Self Study Paper for Advanced Learners

Title of the Course: Polymer Chemistry **Credits: 2**
Course Code: CH21/5S/POC

Objectives:

1. To learn the importance of polymers
2. To study the techniques for characterization of polymers
3. To study the various structure and properties of polymers
4. To study the processing of polymers
5. To appreciate the significance and applications of polymers

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Gain depth knowledge on various types of polymerization method
CO 2	Learn to characterize polymers by various techniques such as spectroscopy, XRD and microscopy
CO 3	Correlate the structure of polymers with their properties
CO 4	Describe different polymer processing techniques
CO 5	Acquire knowledge regarding the application of functional and biomedical polymers

COURSE OUTLINE

UNIT I: **Basics**: Importance of polymers-Basic Concepts-Monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization-condensation, addition, radical, chain-ionic and co-ordination and co-poymerization. Polymerization conditions and polymer reactions. Polymerization in homogenous and heterogenous systems.

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UNIT II: **Polymer Characterization**: Polydispersion-average molecular weight concept-Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weights-End group, viscocity, light scattering, osmotic and ultracentrifugation methods. Analysis and testing of polymers- chemical analysis of polymers, spectroscopic methods, X-ray diffraction study, microscopy. Thermal analysis and physical testing-tensile strength. Fatigue, impact, Tear resistance. Hardness and abrasion resistance.

UNIT III: **Structure and Properties**: Morphology and order in crystalline polymers-configurations of polymer chains. Crystal structures of polymers- Morphology of crystalline polymers, strain-induced morphology, crystallization and melting. Polymer structure and physical properties-crystalline melting point Tm-melting points of homogenous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tg-Relationship between Tm and Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization

UNIT IV: **Polymer Processing**: Plastics, elastomers and fibres - Compounding, Processing techniques-calendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

UNIT V: **Properties of Commercial Polymers:**Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers-Fire retarding polymers and electrically conducting polymers. Biomedical polymers-contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

Reference Books :

1. Textbook of Polymer Science, F.W. Billmeyer Jr, Wiley
2. Polymer Science, V.R. Gowariker, N.V. Viswanathan and J. Sreedhar, Wiley-Eastern
3. Functional Monomers and Polymers, K.Takemoto, Y. Inaki and RM. Ottanbrite
4. Contemporary Polymer Chemistry, H.R. Alcock and F.W. Lambe, Prentice Hall.
5. Physics and Chemistry of Polymers, J.M.G. Cowie, Blackie Academic and Professional

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K2,K3	A – 10x 2 Marks	One or Two Sentences	20	100
K3, K4	B – 5/8 x 8 Marks	250	40	
K4, K5	C – 2/4 x 20 Marks	500	40	

Semester- V

Self Study Paper for Advanced Learners

Title of the Course: Food Chemistry

Course Code: CH21/5S/FOC **Credits: 2**

Objectives:

1. To familiarize students about food chemistry and its nutritional importance.
2. To study the importance of Nutrition & balanced diet.
3. To acquire knowledge on modern food & Beverages.
4. To understand food adulteration & poisoning method.
5. To know the chemistry of food preservation method, processing & packing technology.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Explain various sources, constituents of food and usage of food in relation to health
CO 2	Understand the concept of balanced diet and create awareness about nutritional requirements
CO 3	Discuss the effect of modern food &beverages on social problems
CO 4	Assess food adulteration, its causes and remedies for the problems
CO 5	Discuss the importance of food preservation and quality control in Food chemistry

UNIT I: **Food:** Sources of food, functions of food, constitutions of food, food groups, usage of food, food in relation to health, advantages & disadvantages.

UNIT II: **Nutrition & Balanced diet:** Nutrition – Calorific value of food stuff - RQ of food (Respiratory quotient of food) – basal metabolic rate – factors influencing BMR, specific dynamic action of food (SDA). Energy requirement of individual diet & its componenting, protein requirements- Nutritional value of carbohydrates – fibers in the diet, dietary sugars - nutritional aspects of lipids.

UNIT III: **Modern food & Beverages:** Snack foods, production of bread, bun & biscuits, candy manufacturing, caromelisation, fast foods, instant food, dehydrated food, spicy foods, Beverages – soft drinks, fruit juices, soda & alcoholic beverages (Types & content of alcohol). Ex: carbonation, addition to alcohol, cirrhosis of liver and social problems.

UNIT IV: **Food adulterations & food poisoning:** Food adulteration – intentional, unintentional – common adulteration in food items – milk, oil, ghee, butter, wheat, rice, coffee powder, tea powder, Chili & Turmeric powder. Food poisoning – Diseases due to food stuff- first aid to food poisoning – causes and remedies for acidity, gastritis, indigestion & constipation.

UNIT V: **Quality control:** Food preservation & processing, food determination, methods of preservation, and food processing, Specifications & standards – PFA, FPO, FDA, AGMARK, DRUG LICENCE, WHO STANDARDS. ISI Specifications, packaging of foods, classification, material usage of packing.

Reference Books:

1. Swaminathan. M., Advanced text book on Food and Nutrition, volume I and II printing and publishing CO., Ltd., Bangalore. 1993.
2. Owen R Fennema, Food chemistry, Marcel Decker Inc., New York. 1996.
3. Srilakshmi. B., Food Science, New age International Pvt. Ltd. Publisher, III ed. 2003
4. Sivasanker. B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., New Delhi 2002.
5. Alex V. Ramani, "Food Chemistry", MJP Publishers, Chennai, 2009.
6. Seema Yadav, Food chemistry, Anmol Publishing Ltd, New Delhi.

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K2,K3	A – 10x 2 Marks	One or Two Sentences	20	100
K3, K4	B – 5/8 x 8 Marks	250	40	
K4, K5	C – 2/4 x 20 Marks	500	40	

COURSE PROFILE - SEMESTER VI						
Course Code	**Course Title**	**Hours/ Week**	**Credits**	**Marks**		
				CA	**SE**	**Total**
CH21/6C/APC	Core 11-Applied Chemistry	4	3	40	60	100
CH21/6C/PHA	Core 12-Pharmaceutical Chemistry	4	4	40	60	100
CH21/6E/CKE	Elective 2 –Chemical Kinetics and Electrochemistry	5	5	40	60	100
CH21/6E/MAC	Elective 3- Materials Chemistry	5	5	40	60	100
CH21/6C/PR3	*Core 13 – Practical 3-Organic Chemistry	4	3	40	60	100
CH21/6C/PR4	*Core 14 – Practical 4-Gravimetric Analysis	4	3	40	60	100
CH21/6C/PR5	*Core 15-Practical 5- Physical Chemistry	4	3	40	60	100
Total		30	26			
Credits at the end of 6 semesters			139			
Part V	NCC/NSS/Sports/CSS	-	1	-	-	-
	Total Credits		**140**			

CA= Continuous Assessment marks, SE= End Semester marks

SEMESTER- VI
Title of the Course: Core 11- Applied Chemistry

Teaching hours: 15 x 4 = 60 **Credits: 3**

Course Code: CH21/6C/APC **L T P 3 1 0**

Objectives:

1. To know the processes involved in dairy products, sugar and paper manufacture.
2. To inculcate basic knowledge and awareness in agricultural chemistry
3. To minimize the use of hazardous substance through Green chemistry.
4. To learn the need of chemistry in agriculture.
5. To get exposure in usage of chemical products in day to day life.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Explain different processes involved in dairy products -boiling, pasteurization, sterlization and homogenisation
CO 2	Describe various stepsin sugar industry-double sulphitation process, refining, grading of sugar and explain the process required for manufacture of paper industry
CO 3	Acquire knowledge on the importance of green chemistry and compare the greenness of various solvents
CO 4	Study importance of cosmetic chemistry and their applications in soaps and detergents**,t**ooth paste, Oils, Shampoos.
CO 5	Gain knowledge in the use of chemistry in daily life and study about the various waste water treatments

COURSE OUTLINE

UNIT I: **Dairy Chemistry:** Milk definition, general composition-physico changes taking place in milk due to boiling, pasteurization, sterilization and homogenisation explanation. Components of milk – lipids, proteins carbohydrates vitamins, ash and mineral matters names and functions. Definition and compositions of cream, butter, ghee, ice-cream, stabilizer and emulsifier. Milk powder, definition and need for making manufacture of whole milk powder by spray drying process. **12 hrs**

UNIT II: **Sugar And Paper Industry:** Sugar industry: double sulphitation process, refining and grading of sugar. Saccharin synthesis and uses of sugar substitute. Ethanol: manufacture from molasses by fermentation. Paper industry: manufacture of paper: production of sulphite pulp and conversion to paper (bleaching, filling, sizing and calendaring). **12 hrs**

UNIT III: **Green Chemistry:** Introduction and need of green chemistry, Principles of green chemistry-Green synthesis (Example: microwave and ultrasound assisted reaction) Green solvents- ionic liquids, supercritical fluids. Biocatalysis: importance of biocatalysis in green chemistry. Future trends in Green Chemistry - Oxidation reagents and catalysts, Green chemistry in sustainable development. **12 hrs**

UNIT IV: **Cosmetic Chemistry:**Soaps & detergents- Types of soaps, cleansing action of soaps, synthetic detergents face powder, Shampoosand Tooth paste –General methods of preparation and uses. Essential oils & their importance in cosmetic industry with respect to Geraniol, sandalwood oil, rose oil, Eucalyptus. Hazards of cosmetics **12 hrs**

UNIT V: **Chemistry in daily life:** Synthetic food Additives, Preservatives, colourants and flavours Water treatment: Domestic waste water treatment -Treatment by primary and secondary process. Glass: composition, manufacture and uses Cement: Manufacture: wet and dry process, composition and setting of cement **Batteries:** Primary and secondary batteries, Working of following batteries: Pb storage and Li – battery, Solar cell.
12 hrs

RECOMMENEDED TEXT BOOKS:

1. Fundamentals of Applied chemistry by Jayshree Ghosh Sultan chand & co
2. Industrial Chemistry by B.K.Sharma.Goel publishing house.
3. Elements of Analtyical Chemistry by R Gopalan P.S Subramaniyan K. Rangarajan Sultan & co

REFERENCE BOOKS:

1. Frontiers in Applied Chemistry, Biswas. A.K., Narosa publishing house, 1989
2. Applied Chemisry Vermain , O.P, Narula A.C, theory and books
3. Industrial ChemistryE.Stocchi :, Vol –I , Ellis Horwood Ltd.UK.
4. Agricultural ChemistryB.A Yagodin (Ed)., 2 volumes, MIR publishers (Moscow), 1976.
5. Riegel's Handbook of Industrial chemistryJ.A. Kent:, CBS Publishers, New Delhi.
6. New Trends in Green Chemistry byAhluwalia, V.K & Kidwai, MR, Anamalaya publishers (2005).
7. Introduction to green chemistry, Matlack , A.S.Marcel Dekker (2001)
8. Text book of Cosmetology by Mary Healy Eastern Economy Reagents/Prentice Hall –Edition
9. The complete book of beauty care – Aruna Anand

PERIODICALS:

1. Education in Chemistry
2. Current Science

WEBSITES &e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	2	3	3	3
CO 2	3	3	3	2	3
CO 3	3	3	3	3	3
CO 4	3	2	3	2	3
CO 5	3	3	3	2	3
Average	**3**	**2.6**	**3**	**2.4**	**3**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology : Lecture (Chalk & Talk,)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER-VI

Title of the Course: Core 12-Pharmaceutical Chemistry

Teaching hours: 15 x 4= 60 **Credits: 4**
Course Code: CH21/6C/PHA **L T P 3 1 0**

Objectives:

1. To make the student understand important of terminologies,the cause and treatment involved in bacterial and viral diseases.
2. To focus on the drugs which are essential as antibiotics
3. To provide information on the classification and the importance of anaesthetics
4. To focus on the clinical uses and adverse effects of analgesics
5. To focus on the blood composition and its importance in terms of hematological agents

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Acquire knowledge on the various terms involved in pharmaceutical chemistry ,causes of common diseases , drugs and diagonstic tests
CO 2	Gain wide knowledge on structure, synthesis and clinical uses of various antibiotics.
CO 3	Classify anesthetics and demonstrate the need for anesthetics in human life.
CO 4	Gain knowledge on various analgesics, its clinical use and adverse effect.
CO 5	Study the main functions of blood, clotting , hypertension and hematological agents.

COURSE OUTLINE:

UNIT I: Introduction-Terminologies used-molecular pharmacology, pharmacodynamics, pharmacophore, metabolites, antimetabolites, bacteria virus fungi-Clinical chemistry-causes of common diseases and their treatment by drugs- Jaundice, piles and cancer.**Covid-19-pandemic**: Coronavirus, Covid-symptoms, Causes, types of tests, treatment and preventive measures. Types of vaccines used for precovid-19. Diagnostic tests for sugar, salt, cholesterol in blood and urine-First aid in emergencies. **12 hrs**

UNIT II: **Antibiotics**-Definition and mode of action. Structure and clinical uses of chloroamphenical, penicilin, Streptomycin and tetracyclines. SAR and synthesis of chloramphenical and penicillin only. Hypoglycemic drugs and antineoplastic drugs. **12 hrs**

UNIT III: **Anaesthetics**-Definition-general and local classification- Gaseous-nitrous oxide, ethers halothane, trichloroethylene only - Intraveneous anaesthetics. Thiopentone, sodium, methohexitone and propandiol, local anaesthetics-esters-cocaine- benzocaine, procaine, amides-cinchocaine-Tranquilizers, sedatives, hypnotics and psychodelic drugs (LSD, Hashish). **12 hrs**

UNIT IV: Analgesics, antipyretics and anti-inflammatory agents-Classification, action and analgesics, narcotic and synthetic analgesics-pethidine and methadone. Salicylic acid and its derivatives, p-amino phenol derivatives, indolyl, aryl-acetic acid derivatives- clinical uses and adverse effects. **12 hrs**

UNIT V: **Blood**-Grouping, composition, Rh factor, Blood pressure-hypertension and hypotension Function of plasma proteins. Role of blood as oxygen carrier. Clotting mechanism-Hematological Agents-Anticoagulant and coagulant drugs-Heparin, coumarine, citric acid, quinoxaline- Vitamin K, proteins, and amino acids. **12 hrs**

RECOMMENDED TEXT BOOKS:

1. Pharmaceutical chemistry, Dr.S.Lakshmi, 3rd edn. Sultan and sons
2. A text book of synthetic drugs O.D.Tyogi M.Yadav, 4th edn 1996 ANMOL publications Pvt.Ltd
3. A text book of pharmaceutical chemistry – Jayashree ghosh 1st edn Sultan Chand & sons.
4. Essentials of Bio chemistry –U.Satyanarayanan – Books & Allied (p) ltd
5. Organisation pharmaceutical chemistry by Harikisher singh etal
6. Synthetic drugs O.P Agarwal
7. Synthetic drugs- Gurdeep Chatwal's Medical laboratory, Ramnaik –Sood

REFERENCE BOOKS:

1. Text books of pharmaceutical chemistry Batlay and Drivers
2. Text book of pharmaceutical chemistry – Raviling
3. Bio chemistry – A L Lehninger
4. A text book of bio chemistry – S.Ambika
5. Medicinal chemistry – A Sutosh kar – New age

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in
6. https://www.who.int/

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	2
CO 2	3	3	3	2	3
CO 3	3	3	2	3	2
CO 4	3	2	3	2	2
CO 5	3	2	3	2	3
Average	**3**	**2.6**	**2.6**	**2.2**	**2.4**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology : Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER - VI

Title of the Course: Elective 2 – Chemical Kinetics & Electrochemistry

Teaching hours: 15 x 5 = 75 **Credits: 5**

Course Code: CH21/6E/CKE **L T P 4 1 0**

Objectives:

1. To study the concepts of Chemical kinetics.
2. To learn the theories of Chemical kinetics.
3. To study the ionic conductivity.
4. To study the electrochemical systems
5. To study the applications of emf measurements

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Acquire in depth knowledge in theories of chemical kinetics and concepts of activation energy.
CO 2	Determine rate law of chemical change based on experiment data and be able to identify the reaction order of a chemical change.
CO 3	Gain knowledge of electrolytic, metallic conductivity, migration, transport phenomena, the skill to carry out quantitative ionic estimation by experiments and graphs.
CO 4	Evaluate the potential of electrochemical system based on thermodynamic data, derive rigorous expression for Nernst equation for emf of cell.
CO 5	Discuss the irreversible processes like passivity corrosion, and calculate thermodynamics parameters of galvanic cells.

COURSE OUTLINE:

UNIT I: **Chemical Kinetics I** -: Rate of chemical reactions, factors affecting the rate of a chemical reaction, order and molecularity of a reaction. Derivation of rate constants for zero, first, second and third order reactions (equal concentration of reactants) derivation of time for half change- methods of determining order of a reaction- van't Hoff differntial rate method, integrated rate expression method, half life method and Ostwald's isolation method- experimental methods involved in the study of kinetics- volumetry, manometry, polarimetry and colorimetry. **15 hrs**

UNIT II: **Chemical Kinetics II** - Complex reactions – reversible, parallel and consecutive reactions (only examples) Effect of temperature on the rate of reactions- Arrhenius equation , concept of energy of activation- calculation of Arrhenius parameters.Collision theory and derivation of rate constant for bimolecular reaction- Lindemann's theory of unimolecular reactions- Absolute Reaction rate theory (ARRT). Thermodynamic derivation of rate constant for a bimolecular reaction. Comparison of collision theory with ARRT- Significance of entropy and free energy of activation. **15 hrs**

UNIT III: **Electrochemistry I:** Conductance in electrolytic solutions, Cell constant- Measurement cell constant, equivalent conductivity, Kholrauschs law and its application-relation between specific, equivalent and molecular conductivity, Effect of dilution on Conductivities. Ionic mobility, transport number, determination by Hittorf's and Moving boundary method, Debye-Huckel Onsager theory, equation (no derivation), verification. Debye Falkenhagen, Debye-Wein effect, Debye-Huckel limiting law (no derivation). Applications of conductivity measurements- determination of pH, Ka, Ksp, conductometric titrations-acid-base titrations and precipitation titrations. **15 hrs**

UNIT IV: **Electrochemistry II:**Galvanic cells- reversible and irreversible cells, e.m.f and its measurements- standard cell. Types of reversible electrodes-metal/metal ion, metal amalgam/metal ion, metal insoluble salt/anion, gas electrode, redox electrode. Electrode reaction, measurement of electrode potentials using reference electrodes- Standard hydrogen electrode, calomel electrode.Derivation of Nernst equation for emf of cells and electrode potentials-sign convention, sign of e.m.f and spontaneity of a reaction, calculation of ΔG and ΔH from emf data. Chemical cells with and without transport, concentration cells with and without transference.Significance of liquid junction potential and salt bridge. **15 hrs**

UNIT V: **Electrochemistry III:**Application of Gibbs Helmholtz equation in the calculation of thermodynamic quantities in Galvanic cells. Determination of pH using quinhydrone electrode and glass electrode. Potentiometric titrations- acid.-base titrations, redox titrations, precipitation titrations, valency of ions, transport-number, K_{sp} and activity coefficient of electrolytes. Irreversible electrode processes- polarisation and over voltage, decomposition voltage. Determination of decomposition voltage and over voltage. Corrosion-mechanism, types and methods of prevention. 1**5 hrs**

RECOMMENDED TEXT BOOKS:

1. Text book of Physical Chemistry by Puri & Sharma 41st edn Vishal Publishing Co. 2004
2. Physical chemistry by Samuel Glasstone , David Lewis, Palgrave Macmillan 1993
3. Text book of Physical Chemistry by A.S.Negi & S.C.Anand. 1st edn New Age International
4. Text book of Physical Chemistry - Kapoor Vol 1,2,3& 4. MacMillan
5. Text Book of Physical Chemistry – P.L.Soni-O.P.Dharmarha – U.N.Dash, Sultan Chand and Sons, 22nd revised edition.
6. Advanced Physical Chemistry – J.N.Gurtu and A.Gurtu, A Pragathi edition.

REFERENCE BOOKS:

1. Electrochemistry – Samuel Glasstone
2. Chemical Kinetics - Laidler.
3. J.Rajaram, J.C.Kuriacose- Kinetics of Mechanism of Chemical Transformations, reprint, Macmillan India Ltd., 2000 G.
4. M. Barrow: Physical Chemistry Tata McGraw-Hill (2007).
5. G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004).

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	1
CO 2	2	3	3	3	1
CO 3	3	3	3	2	1
CO 4	2	3	3	2	1
CO 5	2	2	3	3	3
Average	**2.4**	**2.8**	**3**	**2.6**	**1.4**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk& Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER - VI
Title of the Course: Elective3- Materials Chemistry

Teaching hours: 15 x 5 = 75Hrs **Credits: 5**

Course Code: CH21/6E/MAC **L T P 4 1 0**

Objectives:

1. To introduce the world of polymer materials
2. To study the synthetic methods and characterization of polymer materials
3. To study the speciality materials and their applications
4. To introduce and give an insight into the fascinating area of nanoscience and its development.
5. To learn the experimental techniques of nano scale synthesis, properties and characterization.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Gain knowledge to classify polymer structure and explain the mechanism , kinetics of polymerisation reactions
CO 2	Learn the industrial preparation of polymers , skill to characterise polymers in terms of structure and molecular weight
CO 3	Correlate and classify ceramics and composites on the basis of their properties and applications
CO 4	Differentiate atomic scale materials from macro and micro scale in terms of structure and preparation
CO 5	Correlate the variation of properties of materials with size and distinguish allotropes of carbon on dimension

COURSE OUTLINE

UNIT I: **Introduction to Polymers-**Classification of polymers- natural and synthetic polymers.Thermoplastic and thermosetting. Functionality- degree of polymerization. Types and mechanism of polymerization- Addition (free radical, cationic, anionic), condensation and co polymerization **15 hrs**

UNIT II: **Industrial Preparation characterization and application-** 1) PVC 2) Polyamide 3) PMMA 4) Phenolic Formaldehyde resin 5) Polysilane 6) Poly urethane 7) Poly carbonate. Number average (Cryoscopy and Ebullioscopy) and weight average (Light scattering technique) **15 hrs**

UNIT III: **Speciality materials**- Ceramic &Refractory materials-Introduction, classification, properties, raw materials, manufacturing and applications. Basic concepts of composite materials- metal matrix, fibre polymer matrix and fibre reinforced composites. **15 hrs**

UNIT IV: Overview ofNano structures and Nanosynthesis- Origin of nano in ages. Quantum confinement- 1D,2D,3D and zero dimension. Experimental techniques for preparation, Bottom up - Sol- gel, Solvothermal, Coprecipitation, Chemical Vapour and Physical Vapour deposition. Top down- Mechanical grinding, ball milling, microlithography **15 hrs**

UNIT V: Nano scaleproperties and nano materials- Size dependent variation in physical,chemical, optical, mechanical properties. Electrical properties- electrical conductivity, Magnetic properties- dia, para ferro and ferri and super Para magnetism. Nano materials- wires, tubes, CNT, graphene and nano clays 1**5 hrs**

RECOMMENDED TEXT BOOKS:

1. Introductory polymer chemistry – G.S.Mishra New Age 2007
2. Polymer science-V.R.Gowriker, N.V.Viswanathan and Jayadev sreedar New Age 2006
3. Principles of polymer science –P.Bhadur, N.V.Sastry, Alpha Science International Ltd 2005
4. Nanoscience and Nanotechnology: Fundamentals to Frontiers, M.S. Ramachandra Rao, Shubra Singh Wiley, India, First edition 2013.
5. Nano: The essentials, T. Pradeep Tata McGraw-Hill Publishing Company Limited, 2007.

REFERENCE BOOKS:

1. E.A.Collins, J.Bares and E.W.Billmeyer- Experiments in Polymer science, Wiley Inter science, Newyork 1973
2. Polymer science and Technology – Joel Fried 2nd edn., Prentice Hall PTR 2003
3. Polymer Chemistry an introduction M.P.Steven 3rdedn., Oxford Univ Press, USA 1999.
4. Nanostructure & Nanomaterials: Synthesis, properties & Applications G. Cao, Imperial College Press, 2004.

PERIODICALS:

1. Resonance- Journal of science education
2. Education in Chemistry
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in
6. http://nanozone.org/
7. http://www.understandingnano.com/

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	2	3
CO 2	3	3	3	2	3
CO 3	3	3	3	2	3
CO 4	3	3	3	2	3
CO 5	3	3	3	2	3
Average	**3**	**3**	**3**	**2**	**3**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER - VI

Title of the Course: Elective-3 Agricultural Chemistry

Teaching hours: 15 × 5 =75 **Credits: 5**

Course Code: CH21/6E/AGC **L T P 4 3 0**

Objectives:

1. The course helps the students to acquire knowledge about the importance of Agricultural chemistry.
2. To familiarize the students about the chemistry of soil, herbicides, pesticides, manure for crops.
3. To give the students a basic knowledge in genetically modified food & various issues related to it.

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Compare soil types & its properties, fertility management and formation
CO 2	Explain the chemistry of NPK fertilizer and their function in plants
CO 3	Classify manures and understand the concept of Green manuring
CO 4	Analyze the benefits & effects of pesticides, insecticides, herbicides & fungicides
CO 5	Acquire knowledge on the importance of genetically modified foods

COURSE OUTLINE

UNIT I: **Soil:** Introduction to soil – soil classifications & survey – properties of soil – soil texture – soil water – soil temperature – soil colloids – soil minerals – soil pH – acidity & alkalinity Buffering of soil – soil fertility – soil formation **15 hrs**

UNIT II: **Fertilizers:** Definition – classification of fertilizer – Straight, mixed and Complex fertilizer - nitrogenous – phosphate & potash fertilizers – effect of fertilizer on plant growth – commercial method of preparation of urea, Ammonium phosphate, Triple superphosphate – Secondary nutrients – micronutrients and their function in plants.**15 hrs**

UNIT III: **Manures:** Definition-Classification of manure, importance of organic manures, properties & methods of preparation of bulky manures – Farm yard manure – fish manure – compost – Green manuring – night soil – Biogas- concentrated organic manure, importance of C: N ratio in rate of decomposition. **15 hrs**

UNIT IV: **Pesticides:**Historical background of pesticides – classification of Pesticides – methods of pest control – insecticides – DDT, BHC – Herbicides – 2, 4 D & 2, 4, 5, 7 – fungicides – borderaux mixture. Benefits of pesticides –Adverse effects of pesticides. **15 hrs**

UNIT V: **Genetically modified organisms**: Genetically modified crops – Actualities & potential, Resistance to genetically modified foods – moral issues, political issue,health & environmental issues. Benefits of genetically modified food, organic foods. **15 hrs**

Reference Books:

1. Chemistry of the Environmental, 3rd Edn, 2017 Thomas G Spiro, Kathleen p – Roberts, William M. Stigliani viva books, New Delhi
2. Agricultural Chemistry – M. Subhashini, 2017, Crystal publishers, Chennai.
3. Brady. N. C. The Nature & properties of soils- Emasia publishing. Housae (P) Ltd.
4. B. A. Yagodin. Agricultural Chemistry, vol I & II Mir Publishers (Mos COW), 1976 new century books (P) Ltd.
5. R. Cremlyn, Pesticides, JhoneWiley New York 1978
6. Jayashree Ghost., Fundamental concept of Applied 72hem., S. Chand & CO Ltd.,
7. T.D. Biswas & S.K. Mukejee – Text book of soil Science, II edn.
8. A. K. De – Environmental Chemistry.
9. Das, P.C., Manures and fertilizers, Kalyani publishers, New Delhi,1993

Mapping: Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	1	3	3	2
CO 2	3	1	2	2	3
CO 3	2	1	2	2	3
CO 4	3	1	3	3	3
CO 5	3	1	2	3	2
Average	**2.8**	**1.7**	**2.4**	**2.6**	**2.6**

KEY: Strongly correlated –3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTERS – V & VI

MAJOR PRACTICAL

Title of the Paper: Core 13- Practical 3-Organic Chemistry

Teaching hours: 30 x 4 = 120 **Credits: 3**

Course Code: CH21/6C/PR3

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Develop skill required for qualitative analysis of organic compounds and determination of boiling point.
CO 2	Analyze organic compounds systematically and prepare and exhibit suitable derivatives.
CO3	Co rrelate the methodology with the theory behind the reactions , write and submit the report for the identified organic compound

1.Determination of Boiling point of liquids

* 2. Estimation of Aniline

*3**.**Preparation based on the following reactions

(a) Oxidation

(b) Nitration

(c) Bromination

(d) Esterification

(e) Hydrolysis

(f) Diazotisation & Coupling

4. **Analysis of organic compounds** with one functional group & characterization with one derivative –Aromatic Aldehyde, Aromatic / Aliphatic Ketone ,Aromatic/ Aliphatic, Mono, Di, Unsaturated and saturatedCarboxylic acid, Primary, secondary & Tertiary Amine, Simple Phenol, Resorcinol & β- Naphthol, AromaticEster, Aromatic mono amide and Diamide, Anilide, Mono Nitro and poly nitro compound and Carbohydrate (Monosaccharide).

The students will report on the following

- Aromatic/Aliphatic
- Saturated /Unsaturated
- Elements present [Nitrogen, Sulphur and halogens]
- Functional group
- Solid derivative

*For internal assessment only.

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	2	3	2
CO 2	3	2	2	3	2
CO3	3	2	2	3	2
Average	**3**	**2**	**2**	**3**	**2**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Hands on Practical Training, Demonstration

ENDSEMESTER PRACTICAL EXAMINATION

III B.Sc SEMESTERS-V& VI

QUESTION BANK

Title of the Paper: Core 13- Practical-3-Organic Chemistry **Time: 3hrs**

Course Code: CH21/6C/PR3 **Max. Marks: 60**

(1) Systematically carry out suitable test on the given organic substance and report on the following

(a) Aliphatic/ Aromatic

(b) Saturated/ Unsaturated

(c) Elements present or absent-(Nitrogen, Sulphur and Halogens)

(d) Functional group

Confirm the above by a suitable colour reaction and prepare atleast one solid derivative and submit it for evaluation

Substances to be given-Benzaldehyde, Acetophenone, 2- Butanone , Glucose, Ethyl benzoate, Cinnamic acid, Succinic acid , Phthalic acid, Benzoic acid , Phenol ,Resorcinol, β- Naphthol, Nitrobenzene, Aniline, N,N- Dimethylaniline, Acetanilide, Benzamide, Urea

(2) Determine the boiling point of given liquid –Water, butan-2-one, butan-1-ol, Propan-2-ol

Scheme of valuation

Total marks = 100 (CA 40 and End Semester 60)

Organic analysis - 35 marks

Physical constant- 15 marks

Record -10marks

---

60 marks

Organic analysis-(a) Aliphatic/ Aromatic-4 marks (2x2)

(b)Saturated/ Unsaturated-4marks (2x2)

(c)Elements present or absent-6marks (3x2)

(d)Preliminary reaction -10marks

(e) Functional group-6marks

(f) Derivative-5marks

Physical constant- ±2°C -15 marks

±3°C -13 marks

±4°C -10 marks

>4°C - 6 marks

SEMESTERS - V& VI

MAJOR PRACTICALS

Title of the Course: Core14: Practical 4-Gravimetric Analysis

Teaching hours: 30 x 4 = 120 **Credits: 3**

Course Code: CH21/6C/PR4

COURSE OUTCOMES
On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Apply the principles of Gravimetric analysis and evaluate the weight of the precipitate using a single pan balance
CO 2	Use silica crucible for Gravimetric estimation of Ba as barium sulphate
CO 3	Use sintered crucible for Gravimetric estimation of Ni, Cu, Ca, Ba, Pb, Zn and Cl

1. Estimation of Lead as Lead chromate.
2. Estimation of Zinc as Zinc Oxinate
3 Estimation of Barium as Barium chromate.
4. Estimation of Barium as Barium sulphate.
5. Estimation of calcium as calcium oxalate monohydrate.
6. Estimation of Sulphate as Barium Sulphate
*7. Estimation of Nickel as Nickel dimethyl glyoximate complex.
*8. Estimation of Copper as cuprous thiocyanate.
*9. Estimation of Chloride assilver chloride.

* INTERNAL ASSESSMENT ONLY

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	3	3	3
CO 2	3	3	3	3	1
CO 3	3	3	3	3	1
Average	**3**	**2.7**	**3**	**3**	**1.7**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Hands on Practical Training, Demonstration

ENDSEMESTER PRACTICAL EXAMINATION

III B.Sc Chemistry- SEMESTERS – V& VI

QUESTION BANK

Title of the Course: Core14: Practical 4-Gravimetric Analysis

Course Code: CH21/6C/PR4 **Time: 3 hrs**
Max. Marks: 60

1. Estimate the amount of barium present in the whole of the given solution. You are provided with 5% K_2CrO_4 solution.
2. Estimate the amount of sulphate present in the whole of the given solution.You are provided with 4% $BaCl_2$ solution.
3. Estimate the amount of barium present in the whole of the given solution. You are provided with 2N H_2SO_4 solution.
4. Estimate the amount of Lead present in the whole of the given solution.You are provided with 5% $K_2Cr\ O_4$solution.
5. Estimate the amount of Zinc present in the whole of the given solution. You are provided with 1% Oxine solution.

SCHEME OF VALUATION

Continuous Assessment – 40 marks
End Semester –60 marks (50 + 10 marks for Record)
Total - 100 marks

Error up to 2%	**-**	**50 marks**
2.1 -3%	**-**	**45 marks**
3.1-4%	**-**	**35 marks**
>4 %	**-**	**20 marks**

SEMESTERS –V & VI

MAJOR PRACTICALS

Title of the Course: Core 15- Practical 5-Physical Chemistry

Teaching hours: 30 x 4 =120 **Credits: 3**

Course Code:CH21/6C/PR5

COURSE OUTCOMES

CO No.	CO Statement
CO 1	Explain the principles of conductivity , potentiometry, kinetics and phase rule experiments
CO 2	Identify the strength of unknown solutions by potentiometric and Conductometric methods
CO 3	Calculate the rate constant for first order, second order kinetics , and zero order kinetics by carrying out appropriate experiments

1. KINETICS

Determination of rate constant

i. I order kinetics - Acid catalysed hydrolysis of an ester

ii. II order kinetics - Reaction between potassium perdisulphate and potassium iodide

iii. Zero order kinetics - Acid catalysed iodination of acetone.

2. Determination of K_f and Molecular Weight by Rast's Macro method

3. PHASE RULE

i. CST of Phenol-water system

ii. Effect of electrolyte on CST of phenol –water system and determination of concentration of the electrolyte.

iii. Determination of transition temperature of hydrated salts- Sodium acetate, sodium thiosulphate, strontium chloride (any one)

4. ELECTROCHEMISTRY

Conductivity

i. Determination of cell constant

ii. Equivalent conductance of strong and weak electrolyte solutions of atleast five different concentrations and to determine $\Lambda\infty$ for strong electrolyte

iii. Strong acid Vs Strong base - HCl against NaOH

iv. *Weak acid Vs strong base - CH_3COOH against NaOH

v. *Dissociation constant of a weak acid

5. POTENTIOMETRY

Acid base titration – HCl against NaOH

6 . *DISTRIBUTION LAW

Determination of

i. *Distribution coefficient of iodine between water and CCl_4

ii. *Equilibirium constant of the equilibrium

$KI + I_2 \longleftrightarrow KI_3$

iii. *Association factor of benzoic acid in benzene.

* For Internal Assessment only.

Mapping: Course Outcomes with Programme Specific Outcomes

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	2	1
CO 2	3	3	3	2	1
CO 3	3	3	3	2	1
Average	**3**	**3**	**3**	**2**	**1**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Hands on Practical Training, Demonstration

END SEMESTERPRACTICAL EXAMINATION

III B.Sc. CHEMISTRY – SEMESTERS V &VI

QUESTION BANK

Title of the Course: Core 15- Practical 5-Physical Chemistry **Time: 3hrs**

Course Code: CH21/6C/PR5 **Max. Marks: 60**

1. Determine the rate constant for the acid catalysed hydrolysis of the given ester with the given acid solution at room temperature.
2. Determine the rate constant of the reaction between potassium iodide and potassium persulphate at room temperature.
3. Find out the rate constant for the iodination of acetone at room temperature, using the given acid solution as catalyst.
4. Determine the molecular weight of the given solute. You are provided with a suitable solvent whose K_f value is----------
5. Determine theK_f of the given solvent. You are provided with a suitable solute whose molecular weight is ----------
6. Find out the concentration of the given sodium chloride solution. You are provided with pure phenol and solutions of sodium chloride.
7. Determine the transition temperature of the given hydrated salt, by thermometric method.
8. Find out the cell constant of the given conductivity cell using 0.1M and 0.01M potassium chloride solutions, whose specific conductivities are given. Determine the equivalent conductance of the given two solutions of known concentrations.
9. Determine the strength of the given hydrochloric acid by conductometric titration. You are provided with sodium hydroxide of known strength
10. Determine the strength of the given hydrochloric acid by potentiometric titration. You are provided with sodium hydroxide of known strength

SCHEME OF VALUATION

External Marks (60) + Internal Marks (40) = 100 Marks

Record	-	10 marks
Manipulation	-	15 marks
Experiment	-	35 marks
		60 marks

1. **Kinetics** Marks

Below a factor of 10	-	35
By a factor of 10	-	25
Above	-	10

2. **Molecular Weight & K_f** Marks

Error upto 10%	-	35
10 – 20%	-	30
Upto 30%	-	20
> 30%	-	10

3. **Phenol – NaCl** Marks

Error upto 10%	-	35
10 – 20%	-	30
Upto 30%	-	20
> 30%	-	10

4. **Transition Temperature** **Marks**

Error upto 2^oC	-	35
Upto 4^oC	-	30
Upto 6^oC	-	20
>6^oC	-	10

5. **Conductivity**

l/a $\Lambda_1\Lambda_2$

Error upto 10%	-	15+10+10
Upto 15%	-	10+8+8
> 15%	-	5+4+4

6. **Conductometric Titration**& Potentiometric Titration

Error upto 10%	-	35
10 – 20%	-	30
Upto 30%	-	20
> 30	-	10

SEMESTER- I

(For I B.Sc. N&D / II B.Sc. AZB)

Title of the course: Allied Chemistry-General Chemistry

Teaching hours: 15 x 4 =60 **Credits: 4**
Course Code: CH21/1A/NGC **L T P 3 1 0**
CH21/3A/ZGC

Objectives:

1. To have knowledge in food analysis.
2. To impart knowledge in Stereoisomerism.
3. To studybiochemical separation techniques and create an awareness on organic compounds used as dyes.
4. To understand the basic aspects of structure and bonding in Inorganic complexes
5. To study the applications of Co-ordination Complexes

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Outline the chemistry underlying the properties and reactions ofvarious food products.
CO 2	Explain the concept of stereoisomerism and assign R & S configurations to stereoisomers
CO 3	Use basic concepts of separation techniques and gain knowledge on classification of organic dyes.
CO 4	Familiarize the concepts and theories involved in chemical bonding and application of MOT to homonuclear diatomic molecules
CO 5	Explain the key features of coordination compounds and applications of Complexes in qualitative and quantitative analysis

COURSE OUTLINE

UNIT I: **Analysis of food products:** Nutritional value of foods, idea about processing and analysis of food preservations and adulteration. Calorific value of Food. Standard caloric content in carbohydrates, Proteins and Fats. Oxidation of food stuffs. Synthetic food Additives, food colourants and flavours. **12 hrs**

UNIT II: **Stereo isomerism:**Optical isomerism, elements of symmetry, cause of optical activity, Lactic acid and tartaric acid, racemisation, resolution, R&S configuration, Geometrical isomerism of maleic and fumaric acid, keto-enol tautomerism. **12 hrs**

UNIT III: **Biochemical separation techniques and Dyes:**Chromatography-Principle and application of column, paper, thin layer and Ion exchange chromatography. Electrophoresis- Principles, apparatus and application. Ultracentrifugation-principle. Dyes- Classification- Triphenyl methane dyes, Malachite green, p-rosaniline, azodyes-methyl orange, aniline yellow, food colours. **12 hrs**

UNIT IV: **Chemical bonding**:Molecular orbital theory, bonding, antibonding and nonbonding orbitals. Molecular orbital configuration of H_2, N_2, O_2 and Fluorine. Bond order, Diamagnetism and paramagnetism. Hydrides- classification, preparation and properties. Diborane, Sodium borohydride and Borazole-preparation, properties and structure. **12 hrs**

UNIT V: **Coordination Chemistry**:Nomenclature, Coordination Compounds, shapes of d-orbitals, Theories of Co-ordination complexes- Werner's theory, Sidgwicks theory and Pauling's theory. Theory and structure of Chelation, Haemoglobin and Chlorophyll. Application of complexes-Qualitative and Quantitative analysis. **12 hrs**

RECOMMENDED TEXT BOOK:

1. Text book of BioChemistry – Ambika Shanmugam.
2. Essentials of Biochemistry – Sathyanarayanan.

REFERENCE BOOKS:

1. Organic Chemistry- P.L.Soni, 28th edn, Sultan Chand and Sons (1999)
2. Principles of Inorganic Chemistry- B.R.Puri, L.R.Sharma & K.C.Kalia 28th edn, Vallabh publications (2003).
3. Nelson, D.L & Cox, M.M. Lehningers Principles of Biochemistry 7th Ed. W.H.Freeman

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	2	2	1
CO 2	3	1	1	2	2
CO 3	3	3	2	2	1
CO 4	3	2	2	2	2
CO 5	3	2	2	2	2
Average	**3**	**2**	**1.8**	**2**	**1.6**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk& Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER-II

(For I B.Sc. N&D/ II B.Sc. AZB)

Title of the course: Allied Chemistry- Bio organic Chemistry

Teaching hours: 15 x 4 = 60 **Credits: 4**

Course Code: CH21/2A/NBC **L T P 3 1 0**
CH21/4A/ZBC

Objectives:

1. To impart basic knowledge on carbohydrates metabolism.
2. To study the metabolism of lipid
3. To understand the role of amino acids and enzymes in human physiology.
4. To know about the physiological function of hormones.
5. To learn vitamins and protein structures

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Explain the classification – preparation and properties of carbohydrates and structure of nucleic acids
CO 2	Comprehend the concept of conversion of energy in biosystem, classifications of enzymes and factors governing enzyme action
CO 3	Outline the classification of hormones and its mechanism of action.
CO 4	Differentiate water soluble vitamins from fat soluble vitamins and learn biological importance of vitamins B1, B2, B12, C, A, D, E and K.
CO 5	Demonstrate knowledge in classification, biological functions, chemical and physical properties of Lipids

COURSE OUTLINE

UNIT I: **Carbohydrates and its metabolism:** Classification-preparation and properties of monosachharides- glucose and fructose, discaccharides-Sucrose, Polysaccharides- starch and cellulose. **Nucleic Acids:** Nucleosides and Nucleotides, Structure of DNA (Watson – Crick model) and RNA types, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation. **12hrs**

UNIT II: **Concept of energy in biosystem:** Conversion of food into energy, glycolysis, TCA cycle, glycogenolysis, glycogenesis and gluconeogenesis. **Enzymes**-Definition, classification, nomenclature, specificity, isoenzymes, factors affecting enzyme activity-substrate concentration, pH and temperature, Michaelis-Menten equation, enzyme inhibitors- competitive, non-competitive and uncompetitive. **12hrs**

UNIT III: **Hormones**: Definition, classification, mechanism of action of hormones-General functions. Posterior pituitary hormones-Oxytocin and anti-diuretic- Structure and function. Chemotherapy- Preparations, uses and mode of action of sulpha drugs, structure and use of penicillin and chloromycetin. Covid-19 Corona virus, Basic structure, causes, Symptoms, Mode of Transmission, Diagnosis and treatment, Precautions, vaccines **12hrs**

UNIT IV: **Vitamins**: Definition,Classification-Water solulble vitamins B_1,B_2,B_3,B_6 and B_{12} and Vitamin C. Fat soluble vitamins-A,D,E,K-Occurrence, deficiency diseases, biochemical roles and daily requirements. Steriods- Cholesterol, physical properties and biological function only. **12hrs**

UNIT V: **Lipids and its metabolism**: Classification of lipids–saponifiable and non saponifiable lipids, phospholipids- different types, their consitutents, functions. Fatty acids- saturated - stearic and palmitic, formulae, unsaturated - oleic acid and essential fatty acids. Characterisation by iodine value, RM Value, acid number, saponification value (Definitions only). **Amino acids**- Classification and structures, amphoteric nature, isoelectric point, peptide bond. Proteins-Classification, Primary structure, protein digestion, transamination, oxidative deamination and urea cycle- inter -relationship of protein. **12hrs**

RECOMMENDED TEXT BOOK:

1. Text book of BioChemistry – Ambika Shanmugam.
2. Essentials of Biochemistry – Sathyanarayanan.

REFERENCE BOOKS:

1. Text book of natural products by chatwal – Vol I Himalayan Publication.
2. Text book of BioChemistry - Agarwal, Goel Publications.
3. Fundamentals of BioChemistry – J. L. Jain, Sultan Chand and Sons.
4. Text book of Pharmaceutical Chemistry- Jayashree Ghosh

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http:/swayam.gov.in
6. https://www.who.int/

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	1	2	3
CO 2	3	2	1	2	2
CO 3	3	2	2	2	2
CO 4	2	2	2	2	1
CO 5	3	2	1	2	1
Average	**2.8**	**1.8**	**1.4**	**2**	**1.8**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk& Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER- III
(For II B.Sc. Physics)

Title of the course: Allied Chemistry-General Chemistry 1

Teaching hours: 15 x 4 =60 **Credits: 4**

Course Code: CH21/3A/PGC **L T P 3 1 0**

Objectives:

1. To introduce the concepts of qualitative and quantitative analysis and separation techniques
2. To bring an exposure to the applications of coordination chemistry
3. To provide the basic concepts in organic chemistry
4. To inculcate basic knowledge in photochemistry
5. To enable the students to understand the basic principles of electrochemistry

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Explainthe concept of qualitative and quantitative analysis and basic idea about chromatography technique.
CO 2	Study the key aspects and theories of coordination compounds and their biological role
CO 3	Learn the concept of electronic effects and its application on properties ,Huckles rule and mechanism of aromatic electrophillic substitution reactions.
CO 4	Explain the fundamentals of photochemistry and laws governing it and identify difference between radiative and non radiative transition with the help of jablanski diagram
CO 5	Gain knowledge of electrolytic, metallic conductivity, migration, transport phenomena, pH and buffers, calculate thermodynamics parameters of galvanic cells, and evaluate the potential of electrodes

COURSE OUTLINE

UNIT I: **Analytical Chemistry-** Introduction to Quantitative and Qualitative Analysis- Principle of volumetric analysis –Primary and secondary standards - separation techniques-extraction-distillation-crystallization-chromatographic separations-Principles and application of column, paper, thin layer, gas liquid and ion-exchange. **12 hrs**

UNIT II: **Coordination chemistry:** Definition of terms, classification of ligands, Nomenclature of coordination compounds. Theories of co-ordination complexes- Wernerstheory, Sidgwick's theory and Pauling theory. Chelation, stability of complexes, Biological role of Haemoglobin and Chlorophyll,Application of complexes-Qualitative and Quantitative analysis. **12 hrs**

UNIT III: **Polar Effects:** Inductive, electromeric, mesomeric, hyperconjugative and steric effects-influence of effects in properties of compounds-Acidity and Basicity. Aromaticity-Huckles Rule concept of delocalization,Resonance energy-Benzene, **Electrophilic substitution**: Electrophilic substitution in benzene- Mechanism of nitration, halogenation, alkylation, acylation and sulphonation. **12 hrs**

UNIT IV: **Photochemistry-**Beer-Lambert's law**,** Grothurs-Draper's law, Stark-Einstein's law of photochemical equivalence. Differences between thermal and photochemical processes-Quantum yield- Examples with hydrogen and chlorine reaction. Photosynthesis, Jablonski diagram-Radioactive process- Fluorescence, Phosphorescence, non-radiative process-Internal conversion and Intersystem crossing, Chemiluminescence, Photosensitization-only definition with examples. **12 hrs**

UNIT V: **Electrochemistry:** Definition of specific, equivalent and molar conductance and their determination, effect of dilution on conductance, Ostwald's dilution law, Kohlrausch's law and its applications Galvanic cells, Emf, Standard cell-Weston cadmium cell. Standard hydrogen electrode and calomel electrode in e.m.f. measurements Standard electrode potentials and its applications. Henderson equation, applications of pH and buffer in biological systems and Industries. **12 hrs**

RECOMMENDED TEXT BOOKS:

1. Allied Chemistry- Gopalan and Sundaram, III edn, Sultan Chand and Sons.

REFERENCE BOOKS:

1. Organic chemistry, P.L.Soni 28thedn.,Sultan Chand and Sons 1999.
2. Principles of Inorganic chemistry, B.R.Puri, L.R.Sharma & K.C.Kalia 28thedn., Vallabh publications 2003.
3. Principles of Physical chemistry – Puri & Sharma 41st edn Vishal Publishing Co. 2004
4. Essentials of Physical Chemistry- Bahl and Arun Bahl, Sultan Chand and Sons.2009
5. Elements of Analytical Chemistry –R.Gopalan,P.S.Subramanian and K.Rengarajan Sultan Chand and Sons.

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. MATLAB
4. mooc.org
5. http://swayam.gov.in

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	1
CO 2	3	2	1	1	2
CO 3	3	2	2	2	1
CO 4	3	2	2	2	2
CO 5	3	2	2	1	1
Average	**3**	**2.2**	**1.8**	**1.6**	**1.4**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

SEMESTER-IV

(For II B.Sc Physics)

Title of the course: Allied Chemistry- General Chemistry 2

Teaching hours: 15 x 4 = 60 **Credits: 4**
Course Code: CH21/4A/ PGC **L T P 3 1 0**

Objectives:

1. To expose the students to the industrial applications of silicones and fertilizers
2. To gain knowledge on metal extraction and refining
3. To get acquainted with colloids
4. To introduce the concept of stereo isomerism in organic chemistry
5. To introduce the concept of phase rule and phase diagram

COURSE OUTCOMES
On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Compilesynthesis , properties and uses of silicones, fuel gases, inter halogen compounds and fertilisers
CO 2	Learn the general methods of extraction of metals and apply for extraction of Copper, Uranium and Thorium
CO 3	Outline the general idea about colloids and emulsions ,classification, preparation, stability and uses
CO 4	Gain knowledge about geometrical isomerism, conformation and configurational isomerism and assign R & S notations to stereoisomers
CO 5	Define phase, equilibrium, component, degree of freedom and phase rule and draw the phase diagram for a two component system

COURSE OUTLINE

UNIT I: **Industrial Chemistry:** Silicones-synthesis, properties and uses. Fuel gases-Natural gas, water gas, semiwater gas, carbureted water gas, producer gas.Inter halogen compounds ICl, BrF_3,IF_5, IF_7- preparation, properties, hybridizationand structure, Fertilisers-Urea, Super phosphate of lime, Triple super phosphate. **12 hrs**

UNIT II: **Metallurgy:**General methods of extraction of metals. Types of ores, methods of ore dressing, types of furnaces, reduction methods, types of refining, Van Arkel, Zone refining, Extraction of Copper, Uranium and Thorium **12 hrs**

UNIT III: **Colloids:** Colloids state of matter-classification-Sols-dialysis-electro osmosis-electrophoresis-stability of Colloid-protection action – Hardy-Schulze law-gold number-Emulsion: Types of emulsion- emulsifier with examples- Gels: Classification and preparation- Application of Colloids. **12 hrs**

UNIT IV: **Stereoisomerism**: Geometrical isomerism of maleic and fumaric acid, cis, trans, E & Z nomenclature of geometrical isomers, Optical isomerism, elements of symmetry, cause of optical activity, Specific rotation-Determination of Specific rotation, Lactic acid and tartaric acid, Resolution, Racemisation and Walden inversion, Configuration-D&L, R&S. **12 hrs**

UNIT V: **Phase rule**: Definition of terms in phase rule, Gibbs phase rule (no derivation) one component systems-water and sulphur systems, Reduced phase rule-two component system, Simple eutectic system. Eg. Lead-silver & Potassium iodide-water system **12 hrs**

RECOMMENDED BOOKS:

1. Allied Chemistry- Gopalan and Sundaram, III edn.,Sultan Chand and Sons.

REFERENCE BOOKS:

1. Organic Chemistry P.L.Soni 28th edn Sultan Chand and Sons 1999
2. Principles of Inorganic chemistry B.R.Puri, L.R.Sharma & K.C.Kalia 28thedn, Vallabh publications 2003
3. Principles of Physical chemistry – Puri & Sharma 41st edn Vishal Publishing Co. 2004
4. Essentials of Physical Chemistry- Bahl and Arun Bahl, Sultan Chand and Sons.2009

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4. mooc.org
5. http://swayam.gov.in

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	3	2
CO 2	2	3	1	2	1
CO 3	3	2	1	3	1
CO 4	3	2	1	2	1
CO 5	3	2	1	1	1
Average	**2.6**	**2.2**	**1**	**2.6**	**1.2**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

ALLIED CHEMISTRY PRACTICAL

I YEAR- SEMESTER I & II
(I B.Sc. N&D)
&
II YEAR- SEMESTER III & IV
(for II B.Sc. AZB & II B.Sc. PHYSICS)

Title of the Course: Allied Chemistry Practical-Volumetric &Organic Analysis

Teaching hours: 30 x 2=60 **Credits: 2**

Course Code: CH21/2A/PRA & CH21/4A/PRA

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Perform a titration and calculate the amount of the substance present in unknown solution
CO 2	Analyse the given organic compounds systematically
CO3	Prepare a systematic report on the analyses and submit

VOLUMETRIC ANALYSIS

A**cidimetry- Alkalimetry**

1. Estimation of Borax using Methyl orange as indicator.
2. Estimation of Oxalic acid using Phenolphthalein as indicator.

Permanganimetry

3. Estimation of ferrous ammonium sulphate.
4. Estimation of oxalic acid.

Complexometry

5. Estimation of Magnesium/Zinc using EDTA

Dichrometry

6.*Estimation of ferrous ion using diphenyl amine as internal indicator.

Iodometry

7.*Estimation of copper sulphate using standard potassium dichromate.

***For internal assessment only**

ORGANIC ANALYSIS

Systematic Analysis of Organic Compounds with one functional group- Aromatic Aldehyde, Mono and dihydric phenols, β-Naphthol, Aromatic monocarboxylic acid, Aliphatic and Aromatic dicarboxylic acids, Carbohydrates-monosaccharide,Aliphatic diamide and Primary Aromatic Amine

1. Detection of elements- Nitrogen, Sulphur and Halogens.
2. Identification of Aliphatic or Aromatic compounds.
3. Identification of Saturated or Unsaturated compounds.
4. Identification of Functional group

Mapping: Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	2	2	1
CO 2	3	2	2	2	1
CO 3	3	2	2	2	1
Average	**3**	**2**	**2**	**2**	**1**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Hands on Practical training and Demonstration

END SEMESTER PRACTICAL EXAMINATIONS

(For I B.Sc N&D, II B.Sc. AZB & II B.Sc. PHYSICS)
SEMESTER II/IV

QUESTION BANK

Title of the Paper: Allied Chemistry Practical-Volumetric& Organic Analysis

Paper Code: CH21/2A/PRA& CH21/4A/PRA **Time: 3hrs**

Max. Marks: 60

1. Analyze volumetrically the amount of sodium carbonate present in the whole of the given solution. You are provided with a standard solution of sodium hydroxide and a link solution of hydrochloric acid.

2 Estimate the amount of Borax present in the whole of the given solution. You are given a standard sodium carbonate solution and a link hydrochloric acid solution.

3. Estimate the amount of hydrochloric acid present in the whole of the given solution. You are provided with a standard solution of sulphuric acid and a link solution of sodium hydroxide.

4. Estimate the amount of oxalic acid present in the whole of the given solution. You are provided with a standard solution of hydrochloric acid and a link solution of sodium hydroxide.

5. Estimate the amount of Ferrous sulphate present in the whole of the given solution. You are provided with a standard solution of ferrous ammonium sulphate and a link solution of potassium permanganate.

6. Estimate the amount of Ferrous ammonium sulphate present in the whole of the given solution. You are provided with a standard solution of oxalic acid and a link solution of potassium permanganate.

7. Estimate the amount of oxalic acid present in the whole of the given solution. You are provided with a standard solution of ferrous sulphate and a link solution of potassium permanganate.

8. Estimate the amount of Magnesium sulphate present in the whole of the given solution. You are provided with a standard solution of Magnesium sulphate and a link solution of EDTA.

SCHEME OF VALUATION

Total Marks - 100

External Marks (60) + Internal Marks (40) =100 Marks

Record	- 10
Volumetric analysis	- 25
Organic Analysis	- 25
Total Marks	**60**

Scheme of Valuation:Volumetric Analysis

Error upto 2%	- 25 marks
Error upto 2.1 - 3%	- 20 marks
Error upto 3.1 - 4%	- 15 marks
Error >4%	- 10 marks

Arithmetic error	- Reduce 1 mark.
Wrong calculation	- Reduce 20% of the marks
No calculation	- Reduce 40% of the marks

Analyse the given organic substance and report for the following.

a. Aromatic or Aliphatic
b. Saturated or Unsaturated
c. Presence or Absence of the elements -Nitrogen, Sulphur and Halogens
d. Functional group present

List of substances given for Analysis

1. Benzaldehyde
2. Phenol
3. β-Naphthol
4. Resorcinol
5. Glucose
6. Benzoic acid
7. Phthalic acid
8. Succinic acid
9. Aniline
10. Urea

Scheme of Valuation:Organic Analysis: 25 Marks

Elements	(3x 2)	6 Marks
Aliphatic or Aromatic	(2 tests x 2)	4 Marks
Saturated or Unsaturated	(2 tests x 2)	4 Marks
Preliminary reactions	6 Marks	
Functional group tests	5 Marks	

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	2	2	1	3	2
CO 2	2	3	1	2	1
CO 3	3	2	1	3	1
CO 4	3	2	1	2	1
CO 5	3	2	1	3	1
Average	**2.6**	**2.2**	**1**	**2.6**	**1.2**

KEY: Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology:

Lecture (Chalk & Talk, LCD) , Flipped Learning – E Content, Videos, Problem solving, Seminar, Quiz

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5/8 x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

PART-IV NON MAJOR ELECTIVE

SEMESTER-III

(Common to II Year B.A/B.Sc./B.Com)

Title of the Course: Non Major Elective 1 -Cosmetology

Teaching hours: 15x2=30 **Credits: 2**

Course Code: CH21/3N/COS **L T P 2 0 0**

Objectives:

1. To improve one's own personal appearance and develop self-confidence.
2. To impart skill in cosmetology.
3. To acquire knowledge in cosmetic science

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Identify a positive attitude and a sense of personal integrity, practice proper grooming, skin care, massage, facial and make-up purposes.
CO 2	Use the basic skills necessary for applying lotions/creams, hair treatment/hair styling knowledge about cosmetic hazards and quality control.
CO 3	Apply knowledge for performing facials, make-up, waxing, manicures and pedicures.

COURSE OUTLINE:

UNIT I: Selfanalysis, grooming, professional behavior, skin care, theory of massage, facials, facial manipulation, make-up- purpose and types- corrective make-up using optical illusions. **10 hrs**

UNIT II: Hair oils and hair creams, hair removers- temporary removal of hair, depilation process and epilation process. Permanent removal of hair. Hazards of cosmetics and quality control. **10 hrs**

UNIT III: Face creams: Types of face creams-cold, vanishing, cleaning and bleaching creams-preparation and application. Hand lotions and creams-simple method of preparation. Manicure, pedicure, waxing, make-up & hair style. **10hrs**

RECOMMENDED TEXT BOOKS:

1. Text book of Cosmetology by Mary Haely Eastern Economy edition.
2. The complete book of beauty care- Aruna Anand.

WEBSITES & e-LEARNING SOURCES:

1. www.virtlab.com
2. http://nptel.ac.in
3. mooc.org
4. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	1	2	3	3
CO 2	3	3	3	3	3
CO 3	3	1	1	3	3
Average	**3**	**1.7**	**2**	**3**	**3**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk & Talk)

Question Paper Pattern

Knowledge level	Section	Word Limit	Marks	Total
K1,K2	A – 5 x 10 Marks	350	50	50

PART IV – NON MAJOR ELECTIVE

SEMESTER – IV

(Common to II B.A/B.Sc./B.Com.)

Title of the Course: Non Major Elective 2- Dyeing and Printing of Textiles

Teaching hours: 15x2=30 **Credits: 2**
Course Code: CH21/4N/DPT **L T P 2 0 0**

Objective:

1. To have a knowledge about the types and characteristics of dyes
2. To impart skill in dyeing and printing of textiles
3. To inculcate entrepreneur skills in textile dyeing

COURSE OUTCOMES

On completion of the course the student will be able to:

CO No.	CO Statement
CO 1	Explain the different types of natural and synthetic dyes
CO 2	Gain practical knowledge on various dyeing methods
CO 3	Acquire skill and knowledge on various printing techniques

COURSE OUTLINE

UNIT I: Dyes: Classification-Main types of dyes, and their characteristics-Natural dyes and synthestic dyes, Natuual dyes based on plant origin. Synthetic dyes-cationic, anionic, direct dyes, mordant dyes, vat dyes and sulphur dyes. **10 hrs**

UNIT II: Basic methods of dyeing-stock dyeing, Top dyeing, Dope dyeing, Yarn dyeing, Piece dyeing, Beck dyeing, Jig dyeing, Padding. . **10 hrs**

UNIT III: Methods of printing-Block, Roller, Screen, Tie and dye, Batik and Kalamkari printingtechniques. **10 hrs**

RECOMMENDED TEXT BOOK:

1. Textiles- Fibre to Fabrics- Dr.Bernard, P.Lorbman

WEBSITES & e-LEARNING SOURCES:

2. www.virtlab.com
3. http://nptel.ac.in
4. mooc.org
5. http://swayam.gov.in

Mapping : Course Outcomes with Programme Specific Outcomes

CO / PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	2	2	2	1
CO 2	3	2	2	2	1
CO 3	3	2	2	2	1
Average	**3**	**2**	**2**	**2**	**1**

KEY : Strongly correlated – 3 Moderately correlated -2 Weakly correlated -1 No Correlation – 0

Teaching Methodology: Lecture (Chalk& Talk)

Question Paper Pattern

Knowledge level	Section	Word Limit	Marks	Total
K1,K2	A – 5 x 10 Marks	350	50	50

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS), CHENNAI-600 008

END SEMESTER EXAMINATION

TEMPLATE OF THE QUESTION PAPER

Common to all UG Core, Elective and Allied Theory

Title of the Course - Max. Marks: 100

Course code- Time: 3 hrs

SECTION-A

ANSWER ALL THE QUESTIONS **10Q×2=20 marks**

Question Numbers 1-10
Definition, statement or very short answers with 2 lines, Choosing 2 question from each of the 5 units in the syllabus.

Section B

Answer all the Questions **5Q × 8=40 marks**
Question numbers 11 to 15 (5 Questions)

5 Questions to be given with an internal choice choosing one question from each unit (ie)

11a or 11b

Section-C

Answer any two questions **2Q × 20=40 marks**

Question Numbers 16-19 (4 Questions)

4 questions to be given with a maximum of 4 subdivisions (a, b, c, d) giving equal weightage to all the five units in the syllabus.

Note: Equal weightage to be given to all the 5 units in the syllabus

Section-A=10Q x 2 marks	= 20 marks
Section-B=5Q x 8 marks	= 40 marks
Section C=2Q x 20 marks	= 40 marks
Total	**= 100 marks**

ESE Question Paper Pattern UG

Knowledge level	Section	Word Limit	Marks	Total
K1	A – 10x 2 Marks	One or Two Sentences	20	100
K1, K2	B – 5 (internal choice) x 8 Marks	250	40	
K2, K3	C – 2/4 x 20 Marks	500	40	

ETHIRAJ COLLEGE FOR WOMEN (AUTONOMOUS)
CHENNAI-600 008

END SEMESTER EXAMINATION

Template of the Question Paper Common to All Non Major Electives

Title of the Course: Non Major Elective 1 - Cosmetology

Title of the Course: Non Major Elective 2- Dyeing and Printing of Textiles

Course Code: CH21/3N/COS &CH21/4N/DPT **Max.Marks: 50**

Time: 2 hrs

ANSWER ANY TEN QUESTIONS OUT OF TWELVE QUESTIONS **10Q × 5 = 50**

NOTE: Equal weightage to be given to all the three units in the syllabus.

Question Paper Pattern for Part -IV

Knowledge level	Section	Word Limit	Marks	Total
K1,K2	A – 5 x 10 Marks	350	50	50
