JSS MAHAVIDYAPEETHA

JSS COLLEGE OF ARTS, COMMERCE & SCIENCE

(An Autonomous College of University of Mysore)
B.N. ROAD, MYSURU-570 025 KARNATAKA

B.Sc. (Honors) Degree Programme in Chemistry

NATIONAL EDUCATION POLICY (NEP) – 2020

CHOICE BASED CREDIT SYSTEM

(CBCS) WITH MULTIPLE

ENTRY AND EXIT OPTIONS

(I to VI semesters)

wef 2023-2024

SYLLABUS

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B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme to be implemented in the Department(wef 2023-2024)

COURSE-PHYSICS ,CHEMISTRY ((PC)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
I BSc	I	DSE 1 Th	FSA 42031	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 1 Pr	FSA 42031	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 1		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSE 2 Th	FSB 42031	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 2 Pr	FSB 42031	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 2		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
II BSc	III	DSE 3 Th	FSC 42031	Chemistry-3	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 3 Pr	FSC 42031	Chemistry-DSC-3 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	IV	DSE 4 Th	FSD 42031	Chemistry-4	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 4 Pr	FSD 42031	Chemistry-DSC-4 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 4		Electrochemistry ,corrossion and metallurgy	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C1		C2		C1	C2		
						L	t	p		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
III BSc	V	DSE 5 Th	FSE 42031	Chemistry-V	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 5 Pr	FSE 42131P	Chemistry-V Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 6 Th	FSE 42231	Chemistry-VI	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 6 Pr	FSE 42331P	Chemistry-VI Practical	04			2				25	-	-	-	-	10	10	05	50
	VI	DSE 7 Th	FSF 42031	Chemistry-VII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 7 Pr	FSF 42131P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 8 Th	FSF 42231	Chemistry-VIII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 8 Pr	FSF 42331P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50

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COURSE-CHEMISTRY, BIOTECHNOLOGY (CBt)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
I BSc	I	DSE 1 Th	FSA 42037	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 1 Pr	FSA 42037	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 1		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSE 2 Th	FSB 42037	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 2 Pr	FSB 42037	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 2		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
II BSc	III	DSE 3 Th	FSC 42037	Chemistry-3	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 3 Pr	FSC 42037	Chemistry-DSC-3 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	IV	DSE 4 Th	FSD 42037	Chemistry-4	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 4 Pr	FSD 42037	Chemistry-DSC-4 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 4		Electrochemistry ,corrossion and metallurgy	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C!		C2		C1	C2		
						L	t	p		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
III BSc	V	DSE 5 Th	FSE 42031	Chemistry-V	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 5 Pr	FSE 42131P	Chemistry-V Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 6 Th	FSE 42231	Chemistry-VI	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 6 Pr	FSE 42331P	Chemistry-VI Practical	04			2				25	-	-	-	-	10	10	05	50
	VI	DSE 7 Th	FSF 42031	Chemistry-VII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 7 Pr	FSF 42131P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 8 Th	FSF 42231	Chemistry-VIII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 8 Pr	FSF 42331P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50

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COURSE-CHEMISTRY,ZOOLOGY (CZ)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
I BSc	I	DSE 1 Th	FSA 42038	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 1 Pr	FSA 42038	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 1		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSE 2 Th	FSB 42038	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 2 Pr	FSB 42038	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 2		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
II BSc	III	DSE 3 Th	FSC 42038	Chemistry-3	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 3 Pr	FSC 42038	Chemistry-DSC-3 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	IV	DSE 4 Th	FSD 42038	Chemistry-4	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 4 Pr	FSD 42038	Chemistry-DSC-4 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 4		Electrochemistry ,corrossion and metallurgy	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C!		C2		C1	C2		
						L	t	p		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
III BSc	V	DSE 5 Th	FSE 42038	Chemistry-V	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 5 Pr	FSE 42138P	Chemistry-V Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 6 Th	FSE 42238	Chemistry-VI	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 6 Pr	FSE 42338P	Chemistry-VI Practical	04			2				25	-	-	-	-	10	10	05	50
	VI	DSE 7 Th	FSF 42038	Chemistry-VII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 7 Pr	FSF 42138P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 8 Th	FSF 42238	Chemistry-VIII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 8 Pr	FSF 42338P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50

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COURSE-CHEMISTRY, BOTANY(CB)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
I BSc	I	DSE 1 Th	FSA 42043	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 1 Pr	FSA 42043	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 1		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSE 2 Th	FSB 42043	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 2 Pr	FSB 42043	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 2		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
II BSc	III	DSE 3 Th	FSC 42043	Chemistry-3	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 3 Pr	FSC 42043	Chemistry-DSC-3 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	IV	DSE 4 Th	FSD 42043	Chemistry-4	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSE 4 Pr	FSD 42043	Chemistry-DSC-4 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE 4		Electrochemistry ,corrossion and metallurgy	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours /week	Number of credits			Total credits	Total hours		Max marks in theory exam	Continuous assessment							Total
													Theory				Practical			
													C!		C2		C1	C2		
						L	t	p		Th	Pr		Test	Assignment	Test	Assignment	Test	Test	Record	
III BSc	V	DSE 5 Th	FSE 42043	Chemistry-V	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 5 Pr	FSE 42143P	Chemistry-V Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 6 Th	FSE 42243	Chemistry-VI	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 6 Pr	FSE 42343P	Chemistry-VI Practical	04			2				25	-	-	-	-	10	10	05	50
	VI	DSE 7 Th	FSF 42043	Chemistry-VII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 7 Pr	FSF 42143P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50
		DSE 8 Th	FSF 42243	Chemistry-VIII	04	4	-	-	06	60	60	60	10	10	10	10	-	-		100
		DSE 8 Pr	FSF 42343P	Chemistry-VII Practical	04			2				25	-	-	-	-	10	10	05	50

Program Outcomes:

By the end of the program the students will be able to:

(Refer to literature on outcome-based education (OBE) for details on Program Outcomes)

1. **PO. 1:** To create enthusiasm among students for chemistry and its application in various fields oflife.
2. **PO. 2:** To provide students with broad and balanced knowledge and understanding of key concepts inchemistry
3. **PO. 3:** To develop in students a range of practical skills so that they can understand and assess risks and work safely measures to be followed in thelaboratory.
4. **PO. 4:** To develop in students the ability to apply standard methodology to the solution of problems inchemistry
5. **PO. 5:** To provide students with knowledge and skill towards employment or higher education in Analytical chemistry or multi-disciplinary areas involvingchemistry.
6. **PO.6:**To provide students with the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical Industries of well-trainedgraduates
7. **PO. 7:** To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types ofproblems.
8. **PO. 8:** To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible workethics.

Details of the B.Sc (Honors) degree programme in Chemistry

Semester	Course Type DSC								DSE				OE		
	THEORY	L	T	P	PRACTICALS	L	T	P		L	T	P	L	T	p
I	**A1**	4	0	0	**P-1**	0	0	2					3	0	0
II	**A2**	4	0	0	**P-2**	0	0	2					3	0	0
III	**A3**	4	0	0	**P-3**	0	0	2					3	0	0
IV	**A4**	4	0	0	**P-4**	0	0	2					3	0	0
V	**A5** **A6**	3 3	0 0	0 2	**P-5** **P-6**	0 0	0 0	2 2	A1	3	0	0			
VI	**A7** **A8**	3 3	0 0	0 0	**P-7** **P-8**	0 0	0 0	2 2	A2	3	0	0			
VII	**A9** **A10** **A11**	3 3 4	0 0 0	0 0 0	**P9** **P10**	0 0	0 0	2 2	A3 RESEARCH METHADOLOGY	3 3	0 0	0 0			
VIII	**A12** **A13** **A14**	4 4 3	0 0 0	0 0 0					A4 PROJECT	3 0	0 0	0 6			
TOTAL CREDITS	69								21						

DSC: DISCIPLINESPECIFICCOURSE

DSE: DISCIPLINESPECIFICELECTIVE

OE: OPENELECTIVE.

L : T : P = Lecture : Tutorial :Practical

GENERAL REQUIREMENTS AND OTHER INFORMATIONS.

Scheme of Instructions

1. **Title and Commencement**: As per the university guidelines (12 Ref.letterUA2/379/2016-17).
2. Undergraduate programme offered with multiple entry and exitoptions

   Faculty of Science–
   Certificate – 2 semesters
   Diploma– 4semesters
   Bachelor of Science (B.Sc. 6 Semesters)
   Bachelor of Science. Honors (B.Sc.Hons, 8 Semesters)

3. **Semester and Programme Structure:**

   The credit pattern for the course is L:P

3. **Subject Combinations:** As per the university guidelines (Ref. letterUA2/379/2016-17).
4. **Eligibility for Admission.**

   For B.Sc program only those students who have completed PUC with chemistry or its equivalent examination with science subjects are eligible.

5. **Medium of Instruction:** The medium of instruction shall be English/Kannada.
6. **Scheme of the Program:** As per the university guidelines (Ref.letterUA2/379/2016-17)**.**
7. **Course Registration**: As per the university guidelines (9.1 to 9.6 Ref.letterUA2/379/2016-17)**.**
8. **Attendance:** As per the university guidelines (10.1 and 10.2 Ref.letterUA2/379/2016-17)
9. **Valuation:**Aspertheuniversityguidelines(Ref.letterAC2(S)/151/2021-22,dated18/08/2021
10. Ifthestudenthaspassedinthepracticalexambysecuringprescribedmarksneednotreappear for the practical exam if he/she has failed in the theoryexam.
11. **Passing Criteria**

    A student is considered to have passed the course, only on securing a minimum of 40% from internal assessment and end examination marks put together.

    A student can take end exam irrespective of the marks scored in internal assessment of a particular course

    In case a student secures less than 30% in end exam or absent for end examination, the student is said to have not completed the course. The student shall complete the course by reappearing only the end examination conducted by the university.

    Makeup examination: As per the university guidelines (16. Ref. letterUA2/379/2016-17).

    Percentage and Grading: As per the university guidelines (17 Ref. letter UA2/379/2016-17)**. 18 to 22.**As per the university guidelines (Ref. letterUA2/379/2016-17)

Scheme of Examination for DSC 1 and 8
(I to VI Semesters)

Credits L : P		**Theory**	**Practical**	**Maximum marks**
4 : 0	**Internal assessment**	**40** C1 = 10 + 10 =20 C2= 10 + 10 =20 (test and assignment)	**25** C1= 10 C2 =10 + Record 5	
0 : 2	**Summative Assessment**	**60** (C3)	**25**	
Duration of the end examination		2.30 hours	4 hours	
		100	**50**	**150**

Scheme of Examination for Open elective

Credits L : P	Theory	Maximum marks
3: 0	Internal assessment	**40** C1 = 10 + 10 = 20 C2= 10 + 10 = 20 (test and assignment)
	Summative assessment	**60** (C3)
Duration of the end examination		2 hours
		100

FSA42031/FSA42037/FSA42038/FSA42043

I SEMESTER

DSC-1: Chemistry-1

CLASS DURATION – THEORY: 04 HOURS/WEEK

Theory and Practicals: Total Credits-06 (Theory-04, Practicals-02)

UNIT –I – Analytical chemistry

Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques.Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation.Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range).

Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (R2).

Numerical problems

Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

UNIT-II: Inorganic Chemistry

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance.

Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations-Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules. Variation of effective nuclear charge inPeriodicTable. **[14Hours]**

UNIT-II: Organic Chemistry

Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules, Influence of hybridization on bond properties.

Nature of bonding in Organic molecules

Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance, aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene.

Mechanisms of Organic Reactions

Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic.Types of reagents-Electrophiles, nucleophiles, nucleophilicity and basicity.Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation withexamples.

Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigmabonds

Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity

Carbon-carbon pi bonds

Formation of alkenes and alkynes by elimination reaction.Mechanism of E1, E2, E1cb reaction.Saytzeff and Hofmann eliminations.Addition of HBr to propene, Free radical addition of HBr to propene. Addition of halogens to alkenes-carbocation and halonium ion mechanism.Stereospecificity of halogen addition.Ozonolysis mechanism - ozonolysis of propene.Addition of hydrogen halides to alkenes, mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes. Diels-Alder reaction, Allylic and benzylicbromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.

[14 hours]

UNIT-III: Physical Chemistry

Gaseous State

Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation not required), Molecular velocity, collision frequency, collision diameter, Collision cross section, collision number and mean free path and coefficient of viscosity, calculation of σ and η, variation of viscosity with temperature and pressure.

Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root mean square velocities).Relation between RMS, average and most probable velocity and average kinetic energies. (Mathematical derivation not required), law of equipartition of energy.

Behaviour of real gases: Deviation from ideal gas behaviour. Compressibility factor (Z) and its variation with pressure for different gases. Causes of deviation from ideal behaviour, vander Waals equation of stat (No derivation) and application in explaining real gas behaviour. Critical phenomena - Andrewsisotherms of CO_2, critical constants and their calculation from van der Waals equation, Continuity of states, Law of corresponding states. Numerical problems.

Liquid State

Surface Tension: Definition and its determination using stalagmometer, effect of temperature and solute on surface tension

Viscosity: Definition, Coefficient of viscosity. Determination of viscosity of a liquid using Oswald viscometer.Effect of temperature, size, weight, shape of molecules and intermolecular forces.

Refraction: Specific and molar refraction- definition and advantages. Determination of refractive index by Abbes Refractometer.Additive and constitutive properties.

Parachor: Definition, Atomic and structure parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure.Molar refraction and chemicalconstitution.Numerical Problems. [14Hours]

I Semester Practicals

CHEMISTRY-DSC 1 LAB: 04HOURS/WEEK

Content of Practical Course 1: List of Experiments

PART-A Inorganic Chemistry

1. Preparation of standard sodium carbonate solution and standardization of hydrochloricacid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
2. Determination of carbonate and hydroxide present in amixture.
3. Determination of oxalic acid and sodium oxalate in a given mixture usingstandard$KMnO_4$/NaOHsolution
4. Estimation of ferrous and ferric iron in a given mixture using standard potassiumdichromate solution
5. Preparation of standard oxalic acid solution and standardization of potassiumpermanganate solution. Estimation of hydrogen peroxide present in thesolution.
6. Preparation of standard oxalic acid solution and standardization of potassiumpermanganate solution. Estimation of ferrous ammonium sulphate present in thesolution.

PART-B Organic Chemistry

1. Preparation of acetanilide from aniline using Zn/acetic acid (Greenmethod).
2. Synthesis of p-nitro acetanilide from acetanilide using nitratingmixture.
3. Bromination ofacetanilide
4. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventionalmethod)
5. Synthesis of diazoaminobenzene from aniline (conventionalmethod).
6. Preparation of dibenzalacetone (Greenmethod).

LEARNING OUTCOMES / COURSE OUTCOMES

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester – I

CHEMISTRY:1

- The concepts of chemical analysis, accuracy, precision and statistical datatreatment
- Prepare the solutions after calculating the required quantity of salts in preparing the reagents/solutions and dilution of stocksolution.
- Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their relatedproblems.
- Quantum mechanics. Derivation of Schrodinger's wave equation.Radialand angularOrbital shapes of s, p, d and f atomic orbitals, nodal planes. Electronic configurations of theatoms.
- Pauli's exclusion principle, Hund'srule ,Aufbau's principle and itslimitation.
- The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bondforming
- The Concept of aromaticity, resonance, hyper conjugation,etc.
- Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity ofamines.
- Understand basic concept of organic reaction mechanism, types of organicreactions.
- Understand the preparation and reactions of alkanes.
- Understand the stability and conformational analysis ofcycloalkanes.
- Understand the concept of resonance ,aromaticity andantiaromaticity.
- Describe relative strength of aliphatic and aromatic carboxylicacids.
- Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion
- Understand the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquidstate.
- Understand the properties of liquids in terms of intermolecularattractions.
- Understandtheexistenceofdifferentstatesofmatterintermsofbalancebetween

intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion

- Understand the conditions required for liquefaction of gases. Realize that thereis continuity in gaseous and liquidstate.
- Understand the properties of liquids in terms of intermolecularattractions.

CHEMISTRY LAB (volumetric (inorganic) and Organic preparations):P-1

After studying this course and performing the experiments set in it student will be ableto:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparationof standardsolutions.
2. Explain the principles of acid-base, redox and iodometrictitrations.
3. Work out the stoichiometric relations based on the reactions involved in the titrimetricanalysis.
4. Describe the significance of organic quantitativeanalysis.
5. Understand the preparation of organic compounds involving addition, substitution, hydrolysis, diazotization and condensationreactions.

FSB42031/FSB42037/FSA42038/FSA42043

II SEMESTER

DSC-2: Chemistry-2

CLASS DURATION – THEORY: 04 HOURS/WEEK

Theory and Practicals: Total Credits-06 (Theory-04, Practicals-02)

UNIT-I: Analytical Chemistry

Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions.Normality, Molarity and Mole fraction. Use of N1V1= N2V2 formula, Preparation of ppm level solutions from source materials (salts), conversion factors.

Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base andweak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity,acidity.

Complexometrictitrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application-determination of hardness of water.

Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications.

Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.

Gravimetric Analysis: Requisites of precipitation, mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, reagents used in gravimetry (8-hydroxy quinoline (oxine) and dimethyl glyoxime (DMG).

Numerical problems on all the above aspects. **(14 hours)**

Unit – II Inorganic chemistry

s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements:

(a) Atomic radii (van der Waals)

(b) Ionic and crystalradii.

(c) Covalent radii

(d) Ionization enthalpy, successive ionization enthalpies and factors affectingionization energy. Applications of ionizationenthalpy.

(e) Electron gain enthalpy, trends of electron gainenthalpy.

(f) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partialcharge, hybridization, groupelectronegativity.

Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.

[14 hours]

Unit – III Organic chemistry

Nucleophilic substitution at saturated carbon. Mechanism of SN1 and SN2 reactions with suitable

examples. Energy profile diagrams, Stereochemistry and factors effecting SN1 and SN2 reactions.
Aromatic Electrophilic substitution reactions, Mechanisms, σ and π complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio.
Aromatic nucleophilic substitution reaction: SNAr and Benzyne mechanism with suitable examples

[14 hours]

Unit – IV Physical Chemistry

Liquid Crystals

Explanation, classification with examples- Smetic, nematic, cholesteric, dics shaped and polymeric.Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals.Applications of liquid crystals in LCDs and thermal sensing.

Solids

Forms of solids: Unit cell and space lattice, anisotropy of crystals, size and shape of crystals,
Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes.
Miller indices and its calculation, X–Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals.Numerical problems.

Distribution Law

Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation.Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.

[14 hours]

II Semester Practicals

CHEMISTRY-DSC 2 LAB: 04HOURS/WEEK

Content of Practical Course 2: List of Experiments

PART-A Physical Chemistry

1. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald'sviscometer(Ethylacetate,Toluene,Chloroform,Chlorobenzeneoranyothernon-hazardousliquids)
2. Determinationofthedensityusingspecificgravitybottleandsurfacetensionofliquidsusing Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardousliquids
3. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water &Sucrose)
4. Determination of partition/distribution coefficient - i) Acetic acid in waterandcyclohexane. ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.

5. Determination of rate constant of decomposition of H2O2 catalyzed byFeCl3
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-watersystem.

PART-B Analytical Chemistry

1. Determination of alkali present in soaps/detergents using standardHCl
2. Determination of iron(II) using potassiumdichromate
3. Determination of oxalic acid using standard potassium permanganate solution
4. Determination of hardness of water Standardized EDTAsolution
5. Determination of alkali content in antacids using standard HClsolution.
6. Determination of chlorine in bleeching powder by iodometry (standard solution to begiven)

LEARNING OUTCOMES / COURSE OUTCOMES

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester II

CHEMISTRY:2

- Understand principles of titrimetricanalysis.
- Understand principles of different type's titrations. Titration curves for all types ofacids
  - basetitrations.
- Gain knowledge about balancing redox equations, titration curves, theory ofredox indicators andapplications.
- Understand titration curves, indicators for precipitation titrations involvingsilver nitrate- Volhard'sand Mohr's methods and theirdifferences.
- Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness ofwater.
- Understand periodic table, classification and properties of s p d and f blockelements
- Understand different scales for the measurement of electro-negativity and factors affectingit.
- Understand the chemistry of the hydrides, carbides, oxides and halides of group 13 to17
- Understand nucleophilic substitution at saturated carbon, energy profile diagramstereochemistry and factors affecting S_N^1 and S_N^2 reactions.
- Aromatic electrophilic substitution reactions like nitration sulphonationFriedel-Crafts reactions etc
- Understand liquid crystals, classification withexamples
- Understand the different forms of solids, laws of crystallography , miller indices andits calculation, X-ray diffraction studies. Brags law and itsequation

- Defects in solids , properties of glasses and concept of liquidcrystals

CHEMISTRY LAB (volumetric (inorganic) and Organic preparations): P-1

After studying this course and performing the experiments set in it student will be able to:

1. Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standardsolutions.
2. Explain the principles of acid-base, redox and iodometrictitrations.
3. Describe the significance of inorganic quantitativeanalysis.
4. Determine of density followed by the determination of viscosity and surface tension of different liquidsamples.
5. Determination of partition coefficient of different liquidmixtures
6. Determination of rate constant in the decomposition reaction of hydrogenperoxide

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REFERENCE BOOKS :

1. Organic Chemistry - L. Ferguson, Von Nostrand,1985.
2. Organic Chemistry - M. K. Jain, Nagin& Co.,1987.
3. Organic Chemistry- Mehta and Mehta, PHI Learning Pvt. Ltd, NewDelhi,2005.

Physical Chemistry

1. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill,2007.
2. Castellan, G.W. Physical Chemistry, 4th Ed. Narosa,2004.
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning IndiaPvt. Ltd., New Delhi,2009.
4. P.W. Atkins: Physical Chemistry,2002.
5. W.J. Moore: Physical Chemistry,1972.
6. Text Book of Physical Chemistry - P. L. Soni, S. Chand & Co.,1993.
7. Text Book of Physical Chemistry - S. Glasstone, Mackmillan India Ltd.,1982.
8. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma and M. S. Patania, S. L. N. Chand & Co.1987.
9. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons,1992.
10. Physical Chemistry - G. M. Barrow, McGraw Hill,1986.
11. Physical Chemistry (3rd Edition) - Gilbert W. Castilian, Narosa Publishing House,1985.
12. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., NewDelhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York,1981.

Analytical Chemistry

1. Jeffery, G.H., Bassett, J., Mendham, J.& Denney,R.C.
2. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons,1989.
3. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, th
   7 Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
4. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York,2004.
5. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman,2001.
6. Skoog, D. A. Holler F.J. &Nieman, T.A. Principles of Instrumental Analysis,Cengage Learning India Ed,2017.
7. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand,1974.

Open Elective Course - Semester – I
Title of the Course: OE-1: CHEMISTRY IN DAILY LIFE
Unit- I

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter.Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages.
Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate.
Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residuesinfood. [14 hours]

Unit- II

Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1.
Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test.
Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition anduses [14 hours]

Unit- III

Chemical and Renewable Energy Sources:
principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer.
Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials.Problems of plastic waste management.Strategies for the development of environment-friendly polymers.

[14 hours]

COURSE OUTCOMES OEC-1 Chemistry

On completion of the course students will be able to:

1. Understand the chemical constituents in various day to day materials using by a commonman.
2. Understand the chemical constituents in vitamins, soaps and detergents
3. Understand the renewable chemical energy resources
4. Understand different types of polymers and their applications.

Reference Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut(1998)
2. Medicinal Chemistry- AshtoushKar.
3. Analysis of Foods – H.E. Cox:13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4thed. New Age International(1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7thEd. 2002, Oxford UniversityPress.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6th ed. 2001,FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fired (Prentice Hall).

Open Elective Course - Semester – II

Title of the Course: OE-2: Molecules of Life

UNIT I

Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures.Epimers, mutarotation and anomers.

Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

Amino Acids, Peptides and Proteins

Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins.Determination of primary structure of peptides.

UNIT II

Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity),

Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non competitive inhibition including allosteric inhibition).

Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH2 group, double bond and aromatic ring

Lipids

Introduction to lipids, classification.Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

UNIT III

Nucleic Acids

Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Concept of Energy in Biosystems

Calorific value of food.Standard caloric content of carbohydrates, proteins and fats.Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis,
Fermentation, Krebs Cycle. Overview of catabolic
pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates

Course Outcome / Learning Outcome:

After studying this paper the student would be able to

1. Acquire knowledge about different types of sugars and their chemical structures.
2. Identify different types of amino acids and determine the structure ofpeptides.
3. Explain the actions of enzymes in our body and interpret enzymeinhibition.
4. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication. Explain production of energy in ourbody.

Reference Books:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (PearsonEducation).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7thEd.,
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. &Stryer, L. Biochem

FSC42031/FSC42037/FSC42038/FSC42043

SEMESTER III

DSC-3: Chemistry-III

(L:T:P = 4:0:0) Contact Hours: 56 Credits: 4 Workload:4Hours/Week

Course Objectives:

1. Inter relationship among frequency, wavelength and wave number and importance of validation parameters of an instrumental method will be taught.
2. Principle, instrumentation and applications of spectrophotometry, nephelometry and turbidometry will be taught.
3. Inter relationship among frequency, wavelength and wave number and importance of validation parameters of an instrumental method will be taught.
4. The concept of mechanism and its importance will be taught to the student.
5. Concept and importance of intermediates in organic chemistry will be taught taking proper examples.
6. The various techniques for identification of reaction mechanism will be taught to the student taking proper examples.
7. Different types of bonding in molecules/compounds/ions.
8. The theoretical and experimental aspects of chemical kinetics including basic theoriesof reaction rates and methods of determining order.
9. Electrochemistry dealing with electrolytes in solution. Conductance measurementsand applications. Concept of ionic mobility and their determination.

Course Specific Outcomes: After the completion of this course, the student would be able to;

1. Understand the importance of fundamental law and validation parameters in chemical analysis.
2. Apply solvent extraction method for quantitative determination of metal ions indifferent samples.
3. Utilize the ion-exchange chromatography for domestic and industrial applications.
4. Explain mechanism for a given reaction.
5. Predict the probable mechanism for a reaction.
6. Explain the importance of reaction intermediates, its role and techniques of generatingsuch intermediates.
7. Predict the nature of the bond formed between different elements.
8. Identify the possible type of arrangements of ions in ionic compounds.
9. Write Born - Haber cycle for different ionic compounds.
10. Relate different energy parameters like, lattice energy, entropy, enthalpy andsolvation energy in the dissolution of ionic solids.
11. Explain covalent nature in ionic compounds.
12. Understand the concept of rate of a chemical reaction, integrated rate equations, energy of activation and determination of order of a reaction based on experimental data.
13. Know different types of electrolytes, usefulness of conductance and ionic mobility measurements and to determine the transport numbers.

DSE-3: Chemistry III

(L:T:P = 4:0:0) Contact Hours: 56 Credits: 4 Workload:4Hours/Week

Unit-I:

Separation methods:

Fundamentals of chromatography: General description, definition, terms and parameters used in chromatography, classification of chromatographic methods, criteria for selectionof stationary and mobile phase and nature of adsorbents. Principles of paper, thin layer,column chromatography. Column efficiency, factors affecting the column efficiency, vanDeemter's equation and its modern version. **3 Hrs.**

Paper chromatography: Theory and applications

Thin layer chromatography (TLC): Mechanism, Rf value, efficiency of TLC plates, methodology–selection of stationary and mobile phases, development, spray reagents, identification and detection, qualitative applications. **4 Hrs**.

Solvent Extraction: Types- batch, continuous, efficiency, selectivity, distributioncoefficient, Nernst distribution law, derivation, factors affecting the partition, relationshipbetween % extraction and volume fraction, Numerical problems on solvent extraction.Solvent extraction of iron and copper. **4 Hrs**.

Ion exchange chromatography: resins, types with examples- cation exchange and anion exchange resins, mechanism of cation and anion exchange process and applications of ion-exchange chromatography (softening of hard water, separation of lanthanides, industrial applications). **3 Hrs**.

Unit-II:

Structure and Bonding-I: The ionic bond: Structures of ionic solids. Radius ratio rules, Calculation of some limiting radius ratio values, Coordination number 3 (planar triangle), Coordination number 4 (tetrahedral and square planar), Coordination number 6 (octahedral), Close packing. **3 Hrs**.

Classification of ionic structures:

Ionic compounds of the type AX (ZnS, NaCl, CsCI), Ionic compounds of the type AX_2 (Calcium fluoride (fluorite) and Rutile structure Layer structures CdI_2, Cadmium iodide structure. Limitations of radius ratio concept **2 Hrs**.

Lattice energy and Born-Haber cycle, Derivation of Born-Lande equation and its drawbacks, Kapustinskii equation, solvation energy and solubility of ionic solids, polarizing power and polarizability, Fajan's rules with applications. Numerical problems **5 Hrs.**

Covalent bond: Valence bond theory, The Lewis theory, The octet rule, Exceptions to the octet rule, Sidgwick- Powell theory. Valence shell electron pair repulsion (VSEPR) theory, Effect of lone pairs, electronegativity, isoelectronic principle, Examples using VSEPR theory: BF_3 and BF_4^-, NH_3 and NH_4^+, H_2O, PCl_5, CIF_3, SF_4, I_3^- and I_3^+, SF_6, and IF_7. Limitations of VSEPR.

7 Hrs.

Unit-III:

Reaction Intermediates: Generation, structure, stability and reactions involving;

i. **Carbocations**: Dienone-phenol and Pinacol-Pinacolone Rearrangement.
ii. **Carbanions**: Perkin Reaction, Aldol condensation, Claisen-Schmitt condensation.
iii. **Free Radicals**: Chlorination of methane, formation of gammaxene (lindane).
iv. **Carbenes**: Singlet and triplet states, their relative stability. Riemer-Tieman, and Wolff rearrangement.
v. **Nitrenes**: Singlet and triplet states, their relative stability. Hoffman and Curtiusreactions.
vi. **Arynes**: Formation, detection. Bromobenzene to aniline, (4+2) cycloaddition reaction.

8 Hrs.

Methods for Identifying Reaction Mechanism: Product analysis, Isolation and Identification of Intermediates, Stereochemical Evidences, Effect of Catalyst, crossover Experiments, Isotopic studies, Kinetic Studies. **6 Hrs.**

Unit-IV:

Chemical Kinetics: Introduction, rate of reaction, order and molecularity with examples. Rate constant-definition and explanation. Differential and integrated form of rate expressions up to second order reactions, Derivation of expression of rate constant of second order reaction (a=b and a ≠ b), Problems on rate constant (a=b), Methods of determination of order of a reaction (half-life method, isolation method), temperature dependence of reaction rates; Arrhenius equation, activation energy, Numerical problems on Arrhenius equation in calculating energy of activation and rate constants. Collision theory of reaction rates, Lindemann's mechanism, qualitative treatment of the theory of absolute reaction rates. Experimental determination of kinetics of (i) inversion of cane sugar by polarimetric method (ii) spectrophotometric method for the reaction between potassium persulphate and potassium iodide. **7 Hrs.**

Electrochemistry – I: Introduction, strong and weak electrolytes, definition with examples. Arrhenius theory of electrolytic dissociation. Merits and Demerits, Conductance, Specific conductance, equivalent and molar conductivity and their variation with dilution. Molar conductivity at infinite dilution. Numerical problems.

Kohlrausch's law of independent migration of ions and its applications, Debye-Hückel- Onsager equation. Ionic mobilities and their determinations, transference numbers and their relation to ionic mobility's, determination of transference numbers using Hittorf and Moving Boundary methods.

Applications of conductance measurement: (i) Degree of dissociation of weak electrolytes (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts (iv) conductometric titrations (acid base titrations only) and (v) Hydrolysis constants of salts. Numerical problems. **7 Hrs.**

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DSC-3: Chemistry-III Practical

(L:T:P = 0:0:2) Contact Hours: 56 Credits: 2 Workload:4Hours/Week

Course objectives: To attain practical knowledge about:

1. Analytical skills in detecting the constituents present in unknown samples by systematically carrying out the qualitative analysis.
2. The methods of determining rates of chemical reactions.
3. Designing electrochemical cells and making measurements related to it.
4. Determination of physical characteristics of electrolytes using conductivity measurements in solution.
5. Adsorption phenomenon, mechanism and basic models to explain adsorption.
6. Simple techniques like conductometry to obtain physicochemical parameters of electrolytes.

Course Specific outcomes: At the end of the course student would be able to;

1. Understand the chemical reactions involved in the detection of cations and anions.
2. Explain basic principles involved in classification of ions into groups in semi-micro qualitative analysis of salt mixture
3. Carryout the separation of cations into groups and understand the concept of commonion effect.
4. Understand the choice of group reagents used in the analysis.
5. Analyze a simple inorganic salt mixture containing two anions and cations
6. Use instruments like conductivity meter to obtain various physicochemical parameters.
7. Apply the theory about chemical kinetics and determine the velocity constants of various reactions.
8. Learn about the reaction mechanisms.
9. Interpret the behavior of interfaces, the phenomena of physisorption and chemisorption's and their applications in chemical and industrial processes.
10. Learn to fit experimental data with theoretical models and interpret the data

Part A: Inorganic Chemistry Practicals

Qualitative semi-micro analysis of mixtures containing 2 anions and 2 cations. Emphasis should be given to the understanding of different reactions.

The following cations and anions are suggested.

Cations: NH_4^+, Pb^{2+}, Bi^{3+}, Cu2+, Al^{3+}, Fe^{3+}, Co^{2+}, Cr^{3+}, Ni^{2+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+},

Na^+, K^+ and Li^+.

Anions: CO_3^{2-}, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^- , BO_3^{3-} , SO_4^{2-}, $C_2O_4^{2-}$ and PO_4^{3-}.

Spot tests and flame tests to be carried out wherever possible.

Part B: Physical Chemistry Practicals

1. Determination of the enthalpy of neutralization of a strong acid with strong base.
2. Verification of Freundlich and Langmuir isotherms for adsorption of acetic acid on

activated charcoal.

3. The study of kinetics of potassium persulphate and potassium iodide volumetrically.
4. Determination of velocity constant for acid catalyzed hydrolysis of methyl acetate volumetrically.
5. Determination of velocity constant for the saponification of ethyl acetate (a = b) volumetrically.
6. Determination of equivalent conductivity of strong electrolyte and verification of DHO equation using meter bridge.
7. Determination of dissociation constant of weak acid by conductivity method using meter bridge.
8. Conductometric titration of strong acid and strong base.
9. Conductometric titration of weak acid and strong base.
10. Determination of the hydrolysis constant of aniline hydrochloride by conductometric method.
11. Determination of solubility product of sparingly soluble salt by conductometricmethod.

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SEMESTER IV

DSC-4: Chemistry-IV

(L:T:P = 4:0:0) Contact Hours: 56 Credits: 4 Workload:4Hours/Week

Course Objectives:

1. Principle, instrumentation and applications of spectrophotometry, nephelometryand turbidometry will be taught.
2. Principle, types and applications of solvent extraction will be taught.
3. Concept of stereochemistry and its importance will be taught.
4. The various projection formulae and the techniques of designating the molecules in to R,S, D, L will be taught taking proper examples.
5. The theory and concept of Cis-, Trans- isomerism and its importance and thetechniques to differentiate between them will be taught taking examples.
6. The structures of molecules/compounds/ions based on different models/theories.
7. Properties of compounds based on bonding and structure.
8. The fundamentals of thermodynamics including the laws, the concept of entropy andfree energy functions and their applications.
9. The concepts of surface chemistry, catalysis and their applications.

Course Specific Outcomes: After the completion of this course, the student would be able to;

1. Understand the importance of fundamental law and validation parameters inchemical analysis.

2. Know how different analytes in different matrices (water and real samples) can be determined by spectrophotometric, nephelometric and turbidimetric methods.
3. Explain the importance of Stereochemistry in predicting the structure and propertyof organic molecules.
4. Predict the configuration of an organic molecule and able to designate it.
5. Identify the chiral molecules and predict its actual configuration.
6. Write the M.O. energy diagrams for simple molecules.
7. Differentiate bonding in metals from their compounds.
8. Learn important laws of thermodynamics and their applications to various thermodynamic systems.
9. Understand adsorption processes and their mechanisms and the function andpurpose of a catalyst.
10. Apply adsorption as a versatile method for waste water purification.

Unit-I:

Quantitative analysis-Instrumental methods: Electromagnetic spectrum, absorption of electromagnetic radiation, Definition and units of frequency, wavelength, wave number, Beer's law, Beer-Lambert law derivation, deviations from Beer's law, limitations, construction of calibration graph (Plot of absorbance versus concentration), Evaluation Procedures- standard addition, Internal standard addition, validation parameters- detection limits, sensitivity, dynamic/linearity range, Instrumentation, single beam and double beam spectrophotometers, quantitative applications of colorimetry (determination of Fe, Mo, Cu, Ti and PO_4^{3-}) and numerical problems on application of Beer's law. **10 Hrs**.

Nephelometry and Turbidimetry: Introduction, principle, instrumentations of nephelometry and turbidimetry; effects of concentration, particle size and wavelength on scattering; choice between nephelometry, applications of nephelometry & turbidimetry (determination of $S0_4^{2-}$ and PO_4^{3-}). **4 Hrs.**

Unit-II:

Structure and Bonding -II:

Concept of resonance, resonance energy, hybridization, types of hybridization, sp, sp^2, sp^3 dsp^2, dsp^3, d^2sp^3, sp^3d^2 with one example each, and energetics of hybridization. Bent's rule, Limitations of Valence Bond Theory. **3 Hrs.**

Molecular Orbital theory: LCAO concept: s-s, s-p, p-p, p-d and d-d combinations of orbitals, bonding, nonbonding and antibonding molecular orbitals, non-bonding combinations of orbitals, Rules for linear combination of atomic orbitals.

Examples of molecular orbital treatment for homonuclear diatomic molecules: H_2 molecule, H_2^+ molecule ion, He_2 molecule, He_2^+ molecule ion, Li_2 molecule, Be_2 molecule, B_2 molecule, C_2 molecule, N_2 molecule, N_2^+ molecule ion, O_2 molecule, O_2^- and O_2^{2-} molecule ions.

M.O. Energy diagrams of heteronuclear diatomic molecules with examples (NO, NO^+, CO and HCl). Calculation of bond order, relationship between bond order, bond energy, and bond length, magnetic properties based on MOT. **7 Hrs.**

Metallic Bonding: General properties of metals-conductivity, lustre, malleability and cohesive force. Crystal structures of metals and Bond lengths.

Theories of bonding in metals: Free electron theory, valence bond theory, molecular orbital or band theory of solids. Prediction of conducting properties of conductors, insulators and semiconductors, extrinsic and intrinsic semiconductors using M.O. theory.

4 Hrs.

Unit-III:

Structure and Stereochemistry of Organic Compounds:

Concept of isomerism, types of isomerism. Projection formulae of chiral molecules-Fischer (glyceric acid), Newman (2,3-dibromobutane), Sawhorse (2,3-dibromobutane) and Fly- wedge (glyceric acid) projection formulae. Interconversion of projection formulae: Conversion of; Fisher into Sawhorse projection (tartaric acid), Sawhorse into Fisher projection (2,3-dibromobutane), Sawhorse to Newman to Fisher projection (3-amino-3- bromo-2-chlorobutan-2-ol), Fisher to Newman to Sawhorse (3-chloro-2,4- dihydroxybutanal), Fisher into Fly-wedge formula and vice- versa (2-bromo propanoic acid), **4 Hrs**.

Geometrical isomerism: Cause of geometrical isomerism. Cis-trans isomerism (cinnamic acid, but-2-enedioic acid) and syn-anti isomerism (benzaldoxime, ethyl methyl ketoxime), E/Z notations with examples following C.I.P rules.

Optical Isomerism: Optical activity, conditions for optical activity-Elements of symmetry (plane, centre, C_2-axis, rotation-reflection with examples). Specific rotation, Chirality/Asymmetry, Enantiomers-definition with examples, properties, Molecules with two or more chiral centres, Diasteroisomers-definition with examples (threo and erytho isomers), properties. Meso compounds- definition with examples. optical isomerism in tartaric acid, and biphenyls. Asymmetric synthesis, Walden inversion. Racemic modification- Definition with examples. Resolution-definition with examples, chemical and biochemical methods of resolution, Relative and absolute configuration, D/L convention, limitations, and R/S designations-CIP rules with examples. **10 Hrs**.

Unit-IV:

First Law of Thermodynamics: Introduction, system, surroundings, types of systems. Thermodynamic Processes (isothermal, adiabatic, isochoric, isobaric and cyclic), Nature of Heat and Work, Internal Energy, First Law of Thermodynamics, Enthalpy of a System, Work done in isothermal and adiabatic expansion of an ideal gas, Numerical problems, Joule - Thomson Expansion, Relation between Joule-Thomson coefficient and other thermodynamic parameters.

Second law of Thermodynamics: Limitations of first law of thermodynamics. Reversible and Irreversible Processes, Concept of entropy, thermodynamic scale of temperature, Statements of the Second Law of Thermodynamics, molecular and statistical interpretation of entropy, Calculation of entropy change for reversible and irreversible processes, Free Energy Functions: Gibbs and Helmholtz energy, variation of S, G, A with T, V and P, Numerical problems, Free energy change and spontaneity, Gibbs-Helmholtzequation.

Third Law of Thermodynamics: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. **10 Hrs.**

Surface Chemistry Adsorption: Introduction, types of adsorptions with examples. Types of adsorption isotherms. Freundlich adsorption isotherm (only equation), its limitations. Langmuir adsorption isotherm (derivation to be done) and BET equation (derivation not included).

Catalysis: Types of Catalysis (positive, negative, auto and induced), characteristics of catalysis, and theories with examples (intermediate compound theory and adsorption theory), Theory of acid base catalysis, Michaelis-Menten mechanism. Heterogeneous catalysis: surface reactions, unimolecular, bimolecular surface reactions. Autocatalysis with examples. Applications: Design process to removal of toxic compounds from industrial wastewater and treatment of portable water requirements. **4 Hrs.**

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DSC-4: Chemistry-IV Practical

(L:T:P = 0:0:2) Contact Hours: 56 Credits: 2 Workload:4Hours/Week

Course objectives:

1. To impart skills related to preparation of stock and working solutions and handlingof instrumental methods.
2. To know the principle of colorimetric analysis and construction of calibration plot.
3. To understand the chemistry involved in colorimetric determination of metal ions and anions.
4. To determine Rf values of different metal ions present in a mixture.
5. To impart knowledge on the importance of functional groups in organic compounds.
6. Techniques to identify the functional groups in a compound by performing physicaland chemical tests.
7. To record its melting point/boiling point.
8. To prepare suitable derivative for that compound and to characterize it.

Course Specific outcomes: After the completion of this course, the student be able to

1. Understand the importance of instrumental methods for quantitative applications.
2. Apply colorimetric methods for accurate determination of metal ions and anions inwater or real samples.
3. Understand how functional group in a compound is responsible for its characteristic properties.
4. Learn the importance of qualitative tests in identifying functional groups.
5. Learn how to prepare a derivative for particular functional groups and how to purify it.

PART-A: Analytical Chemistry Practicals

1. Colorimetric determination of copper using ammonia solution.
2. Colorimetric determination of iron using thiocyanate solution.

3. Colorimetric determination of nickel using DMG solution.
4. Colorimetric determination of titanium using hydrogen peroxide.
5. Colorimetric determination of nitrite in a water sample (diazo coupling Reaction/Griess reagent.
6. Colorimetric determination of phosphate as ammonium phosphomolybdate.
7. Determination of Rf values of two or three component systems by TLC.
8. Separation of different metal ions by paper chromatography/ Solvent extraction ofiron using oxine solution (demonstration).

PART-B: Organic Chemistry Practical

Qualitative analysis of mono and bifunctional Organic compounds: Benzoic acid, Salycilic acid, p-Nitro benzoic acid, Anthranilic acid, p-Chloro benzoic acid, o-Cresol, p-Cresol, Resorcinol, o- Nitrophenol, p-nitophenol, o-Nitro aniline, p-Nitroaniline, p-Toluidine, p-Chloroaniline, p- Bromoaniline, Ethyl Salicylate, Salicylaldehyde, Acetophenone, Urea, Thiourea, Aniline, Benzldehyde, acetanilide, Naphthalene, Chlorobenzene, p-Dichlorobenzene, p-Nitro toluene, Benzamide etc. (At least 6-8 compounds to be analyzed in a semester).

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***REFERENCE BOOKS**:*

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8th Ed., Saunders College Publishing, New York (2005).
2. Analytical Chemistry, G.D. Christian, 6th edition, Wiley-India (2007).
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, PHI Learning Pvt. Ltd. New Delhi (2009).
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint, Pearson Education Pvt. Ltd. (2007).
5. Organic Reaction Mechanism by V.K. Ahluwalia and R.K. Parashar (Narosa Publishers).
6. Organic Chemistry by S.M. Mukherji, S.P. Singh and R.K. Kapoor (Narosa Publishers).
7. Morrison R.N and Boyd R.N, Organic Chemistry, Darling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar I.L, Organic Chemistry (Volume I); Finar I.L (Volume II) Stereochemistry and the Chemistry of Natural Products., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Kalsi P.S. Stereochemistry, conformation and Mechanism, New age International.
10. Eliel E.L and Wilen S.H, Stereochemistry of Organic Compounds, Wiley, (London).
11. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th Ed. Third Indian Reprint,Pearson Education Pvt. Ltd. (2007).
12. Vogel's Text Book of Qualitative Chemical Analysis, ELBS.
13. Peter Atkins & Julio De Paula, Physical Chemistry, 9th Ed., Oxford University Press

(2010).
14. G W Castellan, Physical Chemistry, 4th Ed., Narosa (2004).
15. R G Mortimer, Physical Chemistry 3rd Ed., Elsevier: Noida, UP (2009).
16. B R Puri, L R Sharma and M S Pathania, Principal of Physical Chemistry, Vishal Publishing Co.
17. B S Bahl, G D Tuli and Arun Bahl, Essentials of Physical Chemistry, S Chand & Comp. Ltd.
18. A S Negi and S C Anand, A textbook of Physical Chemistry, New Age International.
19. B N Bajpai, Advanced Physical chemistry, S Chand and Company ltd.
20. R L Madan, Chemistry for Degree Students, Semester I, II, III and IV, S Chand and Company Ltd.
21. P L Soni, O P Dharmarha and U N Dash, Textbook of Physical Chemistry, Sultan Chand and Sons.
22. Vogel's Qualitative analysis, Revised by G. Svehla, Pearson education, 2002
23. J B Yadav, Advanced Physical Chemistry, Krishna Prakashan Media (P) Ltd, Meerut.
24. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, S. Chand &Co.: New Delhi (2011).
25. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
26. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).

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OPEN ELECTIVE COURSE

III SEMESTER

OEC-3: Atomic Structure, Bonding and Concepts in Organic Chemistry

(L:T:P = 3:0:0) Contact Hours: 42 Credits: 3 Workload:3Hours/Week

Course Objectives:

1. To develop an understanding of principles of atomic structure.
2. To know the importance of quantum numbers, writing of electronic configurationsand representation of orbitals.
3. To develop an understanding of the periodic trends.
4. To understand the nature of bonding and to predict the shapes of molecules.
5. To construct MO energy level diagrams and predict the properties of molecules.
6. To understand the formation of sigma and pi bonds and the bond strength.
7. To study the classification of organic reactions.
8. To learn nomenclature preparation and reactions of alkanes, alkenes, alkynes and stability of alicyclic compounds.

Course Specific Outcomes: On completion of the course the student will learn and be able to understand/explain;

1. The concept of atomic structure, significance of quantum numbers, filling of electrons of atoms/ions in various orbitals as per rules.
2. The trends in periodic properties.
3. The structures of ionic solids, applications of B-H cycle, solubility of compounds and consequences of polarization of ions.
4. The shapes of molecules/ions based on VSEPR theory.
5. The construction of MO energy level diagrams and prediction of properties of molecules/ions like bond order, bond energies, bond lengths and magnetic properties.
6. The formation of sigma and pi bonds and the bond strength.
7. The classification of organic reactions.
8. Nomenclature preparation, and reactions of alkanes, alkenes, alkynes and stability of alicyclic compounds.

Unit I: Atomic Structure and Periodic Properties

History of an atom. Idea of de Broglie matter waves. Heisenberg uncertainty principle. Schrödinger wave equation, significance of wave functions, Bohr's model of hydrogen atom and its limitations. Quantum numbers and their importance, atomic orbitals and shapes of s, p, d orbitals, multi-electron atoms, Aufbau and Pauli exclusion principle and Hund's multiplicity rule- Electronic configurations of the elements (atomic no. up to 30), effective nuclear charge and shielding. **8 Hrs.**

Periodic Properties: Atomic radius, Covalent, ionic and van der Waal radii-explanationwith examples. Definition and periodicity of the following properties - ionic radii, ionization potential, electron affinity and electronegativity, methods of determination of electronegativity. Factors affecting the values of ionization energy. **6 Hrs.**

Unit II: Chemical Bonding:

Ionic Solids– Ionic structures (NaCl, CsCl, TiO_2, ZnS), radius ratio rule and coordination number, limitation of radius ratio rule, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule and their consequences. **4 Hrs.**

Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization with examples and shapes of simple inorganic molecules and ions. Shapes of NH_3, I_3^+, I_3^-, SF_4, CIF_3, IF_5, ICl_2^- and H_2O using valence shell electron pair repulsion (VSEPR) theory, linear combination of atomic orbitals (LCAO), bonding, nonbonding and antibonding molecular orbitals, physical picture of bonding and antibonding wave functions. Applications of MO theory to explain the stability of homo dinuclear (He_2, N_2, O_2, F_2, C_2) and hetero dinuclear (NO and CO) molecules. Comparison of M.O. and V.B. Models. **7 Hrs.**

Metallic bond-free electron, Band theory-electrical properties of metals, semiconductors

and insulators. Weak interactions – Hydrogen bonding and its consequences, van der Waals forces. **3 Hrs.**

Unit III: Bonding and molecular structure and hydrocarbons

Bonding and molecular structure: Introduction to organic chemistry, atomic orbitals, sigma and pi bond formation-molecular orbital [MO] method, sp, sp^2 and sp^3 hybridization, bond length, bond dissociation energies and bond angles (open chain and cyclic compounds). Electronegativity and polarity of the bonds. Classification and reactions of organic compounds (with examples). **7 Hrs.**

Alkanes, Alkenes and Alkynes: Definition, Nomenclature, preparations (any two methods). Reactions: Electrophilic, nucleophilic and free radical addition reactions.

Alicyclic compounds: Nomenclature, preparation and stability of cyclopropane, cyclobutane, cyclopentane and cyclohexane. **7 Hrs.**

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REFERENCE BOOKS:

1. Concise Inorganic Chemistry, J. D. Lee, ELBS, 1996.
2. Inorganic Chemistry, A. K. Das.
3. Inorganic Chemistry: Principles of Structure and Reactivity, Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. Pearson Education India, 2006.
4. Inorganic Chemistry, Shriver, D.F. & Atkins, P.W. Oxford University Press.
5. Schaum's Outline Series Theory and Problems of Organic Chemistry.SI (metric) Ed Herbert Meislich, Howard Nechamkin and Jacob Sharefkin.
6. Organic chemistry. Robert T. Morrison Robert N. Boyd, 6^{th} Ed.
7. Organic Chemistry Volume-1, I.L. Finar.

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OPEN ELECTIVE COURSE
IV SEMESTER

OEC-4: Electrochemistry, Corrosion and Metallurgy

(L:T:P = 3:0:0) Contact Hours: 42 Credits: 3 Workload:3Hours/Week

Course Objectives: This course will deal with

1. Types of conductance, concept of electrolytes, electrolysis, redox reactions and EMF.
2. Concept of different types of electrochemical cells, Types of electrodes and electrode potential. Application of electrochemical series.
3. Basic principles and applications of conductometric, potentiometric and pH titrations.
4. Different types of Batteries their principle construction and working - lead-acid storage and lithium ion battery. Study of Fuels cells.
5. Concept of corrosion, types of corrosion and its prevention by different methods. Introduction to electroplating.
6. Introduction to ores and minerals, extraction of metals from their ores, and purification. Eg., Manganese, Titanium and Uranium. Study of alloys, classification, production and uses of alloys.

Unit I: Electrochemistry: Conductance, specific and molar conductance Types of Electrolytes, Conductivity in electrolytic solution, Electrolysis, Kohlrausch's law and its application, Equivalent Conductance of Weak electrolyte at Infinite dilution.

Oxidation -reduction reactions, electrode potential, EMF of an electrochemical cell, cell reaction, Daniel cell, dry Cells - electrolytic and Galvanic cell, Representation of a cell. Standard electrode potential, Nernst equation (No derivation) and its application to chemical cell, Electrochemical series and its importance. Types of Electrodes.

Basic Principles of (i) Conductometric titrations- HCl Vs NaOH, CH_3COOH Vs NaOH

Potentiometric titrations: Acid-base titration HCl Vs NaOH, Redox titration (FAS Vs $K_2Cr_2O_7$)

Determination of PH using glass electrode. **12 Hrs.**

Batteries- Primary and Secondary batteries, Battery components and their role. Working ofthe following Batteries- Lead acid, Lithium Storage, Batteries, Fuel cells. **2 Hrs.**

Unit II: Corrosion: Introduction, definition, Types of Corrosion, Corrosion rate, Factors affecting corrosion rate, Metallic factor-purity, electrode potential of metal, hydrogen over voltage, nature of corrosion product. Environmental Factors-Temperature, pH of the medium, humidity, presence of impurities, electrical conductivity of the medium, velocity of the medium, concentration of the medium.

Prevention of Corrosion: Material selection - Metals and alloys, metal purification, non-metallic, Alteration of environment - Changing media, inhibitors, Design-wall thickness, design rules, Coating-Metallic and other inorganic coatings, organic coating.

Electroplating: Introduction, Electroplating of chromium (hard and decorative). Electro less plating: Introduction, distinction between electroplating and electroless plating processes. Electroless plating of copper. **14 Hrs.**

Unit III: Metallurgy: Introduction: Ore, minerals, important ores of some common elements in India, General Principles of pyrometallurgy, roasting, Calcination, Gangue, Smelting, Flux, Gravity separation, Froth flotation process, leaching. Techniques employed for Purification of metal (Distillation process, Bessemerization, Electro-refining, Van Arkel and De Boer's Filament. **7 Hrs.**

Extraction of metals: Extraction of Manganese (Pyrolusite), Titanium (Ilmanite) and Uranium. **4 Hrs.**

Alloys: Introduction, Classification of alloys, commercially important alloys, gold karats, **Production of Ferro alloys**; Ferrochrome, Ferro Manganese, Uses of alloys. **4 Hrs.**

REFERENCE BOOKS:

1. Barrow. G.M, Physical Chemistry, Tata McGraw-Hill, (2007).
2. An introduction to electrochemistry, Samuel Glasstone, East-West edition New Delhi, (1942).
3. Text book of physical chemistry, Samuel Glasstone, 2ndEdition, Mac Millan India Ltd, (1991).
4. Principles and applications of Electrochemistry, D. R. Crow, 3rd edition, Chapman Hall London, (1988).
5. Fundamentals of electrochemical deposition, Milan Paunovic and Mordechay Schlesinger, Wiley Interscience Publications, New York, (1998).
6. Engineering Chemistry, V R Kulkarni and K Ramakrishna Reddy, New Age International, (2015).
7. Electrochemistry and Corrosion Science, Nestor Perez, Springer (india) Pvt. Ltd.,(2004).
8. Principles and Prevention of Corrosion, D. A. Jones, Macmillan Publ. Co., (1996).
9. Essential of Materials Science and Engineering, Donald R. Askeland, Thomson Learning, 5th Edition, (2006).
10. Introduction to Engineering Materials, B. K. Agarwal, Tata McGraw Hill, 1st Edition.
11. Material Science and Engineering, V. Raghavan, PHI Learning, 5th Edition.
12. Engineering Materials and Metallurgy, R. K. Rajput, S. Chand - 1st Edition, (2011).

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Scheme of valuation: Practical

III Semester: Inorganic and Physical Chemistry Practical

Part-A: Semimicro Qualitative Inorganic Analysis **13 Marks**

(Two acid radicals and two basic radicals be given, two radicals in a group be avoided)

DISTRIBUTION OF MARKS		
Preliminary tests: State, color, solubility		1 Mark
Identification of 2 anions:	Group Identification: 1 + 1 Mark	2 Mark
	Confirmatory tests: 1 + 1 Mark	2 Mark
Group Separation of cations	Group Identification: 1 + 1 Mark	2 Mark
Identification of 2 cations:	Confirmatory tests: 2 + 2 Mark	4 Mark
	Ionic equations for CT tests: 1 + 1 Mark	2 Mark

Part-B: Physical Chemistry Practical **12 Marks**

The following experiments be given, but not more than two candidates be given the same experiment.

1. The study of kinetics of potassium persulphate and potassium iodide volumetrically.
2. Determination of velocity constant for acid catalyzed hydrolysis of methyl acetate.
3. Determination of velocity constant for the saponification of ethyl acetate(a = b) volumetrically.
4. Determination of equivalent conductivity of strong electrolyte and verificationof DHO equation.
5. Determination of dissociation constant of weak acid by conductivity method.
6. Conductometric titration of strong acid and strong base.
7. Conductometric titration of weak acid and strong base.

DISTRIBUTION OF MARKS (For Experiments **1, 2** and **3**)		
k values	5 Constant values	7 Marks
	4 Constant values	6 Marks
	3 Constant values	5 Marks
	Any other values	3 Marks
Graph (straight line)		2 Marks
Unit of k		1 Mark
Calculation		2 Marks

DISTRIBUTION OF MARKS (For Experiments **4** and **5**)	
Determination of cell constant	3 Marks
Determination of specific conductance	2 Marks
Determination of equivalent conductance	3 Marks
SI unit of k and λ (1 + 1 Mark)	2 Marks
Verification of DHO **or** k_a Calculations	2 Marks

DISTRIBUTION OF MARKS (For Experiments **6** and **7**)		
Deviation	± 0.2 cm^3	8 Marks
	± 0.3 cm^3	6 Marks
	± 0.4 cm^3	4 Marks
	Any other value	3 Marks
Graph		2 Marks
Calculation of Normality		1 Mark
Calculation of weight/dm^3		1 Mark

IV Semester: Analytical and Organic Chemistry Practical

Part-A: Analytical Chemistry Experiments **13 Marks** Any one of the Colorimetric determination experiments be given, but not more than twocandidates be given the same experiment.

- Colorimetric determination of copper using ammonia solution.
- Colorimetric determination of iron using thiocyanate solution.
- Colorimetric determination of nickel using DMG solution.
- Colorimetric determination of titanium using hydrogen peroxide.
- Colorimetric determination of nitrite in a water sample (diazo coupling Reaction/Griess reagent.
- Colorimetric determination of phosphate as ammonium phosphomolybdate.

DISTRIBUTION OF MARKS (For all colorimetric determinations)		
Preparation of solutions		4 Marks
Determination of λmax		2 Marks
Accuracy	± 5%	5 Marks
	± 10%	3 Marks
	Any other value	2 Marks
Graph		2 Marks

Part-B: Qualitative Organic Analysis ***12 Marks***

DISTRIBUTION OF MARKS	
Preliminary tests	2 Marks
Physical constant	1 Mark
Detection of elements (one each)	3 Marks
Solubility (complete chart/table)	2 Marks
Functional group tests (minimum two important tests)	3 Marks
Naming and structure	1 Mark

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FSE42031/FSE42037/FSE42038/FSE42043

V SEMESTER

CHDSC-5: ChemistryV

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week

Unit-I: Inorganic Chemistry 15 Hrs.

Coordination compounds: Ligands, classification of ligands, and chelation, physical methods in the study of complexes–change in conductance, color and pH. Nomenclature ofco-ordination compounds, Inner metallic polynuclear and bridged complexes, Preparationof complexes-by simple addition reactions, substitution reactions and oxidation-reduction reactions. Geometries of complexes with coordination number 3 to 8. **05 Hrs.**

Metal-Ligand equilibria in solution: Stability of complexes- kinetic and thermodynamic stability of metal complexes, step-wise and overall formation constant and their relationship, trends in step-wise constant. Factors affecting the stability of metal complexeswith reference to the nature of the metal ion and ligand, chelate effect, macrocyclic effectand their thermodynamic origin. Determination of formation constant by pH metric, and spectrophotometric methods. **06 Hrs.**

Isomerism in co-ordination complexes: Structural isomerism- Ionization, Hydrate, linkage, Ligand isomerism. Stereoisomerism – Geometrical and optical isomerism exhibited by co-ordination compounds of co-ordination number 4 and 6. **04 Hrs.**

Unit-II: Organic Chemistry 15 Hrs.

Aromaticity, Homo-aromaticity of azulene, tropone, tropolone, annulenes, benzenoids, meso-ionic compounds. Alternant and non-alternant hydrocarbons, Energy levels in odd and even-alternant hydrocarbons. **02 Hrs.**

Stereochemistry: Chirality in allenes, alkylidene cycloalkanes and spiranes (with a stereogenic axis). Cram's and Prelog's rules. Conformational analysis of substituted cycloalkanes (Methyl, iso-propyl, tert-butyl, dialkyl, dihalo, diols), and cycloheptane. Nomenclature and conformations of fused rings and bridged ring systems. Prochirality: Enantiotopic and diastereotopic atoms, groups and faces. **06 Hrs**.

Vitamins: Definition, classification. Structure elucidation, synthesis and biological importance of Vitamin A, and Vitamin C. Structural formulae and biological importance of thiamine, pyridoxine, folic acid, pantothenic acid, riboflavin, α-tocopherol, biotin, vitamin K_1 and vitamin K_2. **07 Hrs**.

Unit-III: Physical Chemistry 15 Hrs.

Photochemistry: Laws of photochemistry: Grothus-Draper's law, Stark-Einstein law of photochemical equivalence. Quantum efficiency: definition, reasons for low quantum yield and high quantum yield with examples (formation of HBr and formation of HCl). Actinometers: Uranyl oxalate actinometer, Potassium ferrioxalate actinometer (Qualitative study). (Numerical problems).

Photophysical processes: Jabolonski diagram, photosensitization (mercury as an example), photoinhibition, fluorescence and phosphorescence, chemiluminescence and bioluminescence (explanation with examples), mechanism (qualitative).

Radiation Chemistry: Definition, primary and secondary stages in radiochemical reactions, ionic yield, energy yield, comparison with photochemistry. Units of radiation-rad, gray, Roentgen. Dosimeters-Frick-dosimeter, ceric sulphate dosimeter (qualitative study)

theories of radiolysis – Lind's and EHT theories. Radiolysis of water (qualitative study) and acetic acid. **10 Hrs.**

Phase equilibria: Definition of the terms-phase, component and degree of freedom with examples. Statement of Gibb's phase rule and thermodynamic derivation. Applications: (a) one component system (water system); (b) reduced phase rule and reduced system, two component system (Silver-lead system, eutectic type), desilverization of lead and $FeCl_3$-H_2O system (congruent melting point). Freezing mixtures: Definition and examples, explanationbased on KI-water system.

Unit-IV: Molecular Spectroscopy 15 Hrs.

Electromagnetic radiation: Regions of electromagnetic radiations (spectra), molecularenergy levels, absorption and emission spectra, Born- Oppenheimer approximation.

Rotation spectroscopy: Selection rules, expression for rotational spectra of diatomicmolecules for rigid rotator model, moment of inertia (expression to be derived) rotationalenergy rotational spectral lines, determination of bond lengths of diatomic molecules,isotopic substitution effect on rotational lines. **05 Hrs.**

Vibrational spectroscopy: Selection rules, classical equation of vibration, computation of force constant, expression for vibrational energy levels and potential energy of simple harmonic oscillator, zero-point energy, determination of force constant bond dissociation energies, fundamental frequencies, overtones. The number of degrees of freedom ofvibrations polyatomic molecules, modes of vibration ($CO_2$and H_2O). **05 Hrs.**

Raman spectroscopy- Selection rules, origin of Raman spectrum, quantum mechanicaltheory, stokes and anti-stokes lines. Pure rotational Raman spectra of diatomic molecule(derivation),and vibrational rotational Raman spectra for diatomic molecule(explanation with equation) .

Electronic spectra: Concepts of potential energy curves for bonding and anti-bonding molecular orbitals, Franck-Condon principle. **05 Hrs.**

FSE42131P/FSE42137P/FSE42138P/FSE42143P

CHDSCP-5: Chemistry-V Practical

(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week

PART-A: Organic Preparations (Multistep synthesis):

1. Preparation of *p*-bromo aniline from acetanilide.
2. Preparation of anthranilic acid from phthalic acid.
3. Preparation of benzanilide from benzophenone.
4. Preparation of 2,4-dinitrophenylhydrazine from chlorobenzene.
5. Preparation of acridone from 2-chlorobenzoic acid.
6. Preparation of benzocaine from p-nitrobenzoic acid
7. Pechmann Reaction: Preparation of coumarin from resorcinol and ethyl acetoacetate.
8. Sandmeyer reaction: Preparation of 4-chlorotoluene from 4-toluidine.

PART-B: Organic Estimations:

1. Estimation of glucose by colorimetric method.
2. Estimation of aspirin by colorimetric method.
3. Estimation of ascorbic acid by iodometric method.
4. Estimation of amino acids by formylation method.
5. Estimation of carboxylic acid.
6. Estimation of amino group.
7. Determination of saponification value of oil.

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FSE42231/FSE42237/FSE42238/FSE42243

CHDSC-6: Chemistry-VI

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week

Unit-I: Inorganic Chemistry 15 Hrs.

Modern concept of acids and bases: Lux-Flood and Usanovich concepts, solvent systemand leveling effect. Hard-Soft Acids and Bases, Classification and Theoretical backgrounds.**Non-aqueous solvents**: Classification of solvents, Properties of solvents (dielectricconstant, donor and acceptor properties) protic solvents (anhydrous H_2SO_4, HF and glacialacetic acid) aprotic solvents (liquid SO_2, BrF_3 and N_2O_4). Solutions of metals in liquidammonia, hydrated electron. Super acids and super bases. **07 Hrs.**

Chemistry of main group elements: Structure and bonding in boranes (B_2H_6, B_4H_{10}, B_5H_9), carboranes ($C_2B_{10}H_{12}$, $C_2B_9H_{13}$, $C_2B_6H_{12}$), Wades rules, borazines, phosphazines, S, N-compounds.

M-M bond and metal atom clusters: Halide clusters, bonding in $[ReCl_8]^{2-}$. Metal carbonyl clusters- LNCC's and HNCC's. Electron counting in carbonyl clusters, Wades-Mingos and Lauher rule. **08 Hrs.**

Unit-II: Organic Chemistry 15 Hrs.

Carbohydrates: Introduction. Monosaccharides-Open and ring structure of glucose, mutarotation, epimerization. Interconversion reactions (aldose to ketose, ketose to aldose, chain elongation-Killiani-Fischer method, and chain degradation-Ruff's method), Determination ring size of glucose (methylation). Determination of configuration and conformational analysis of monosaccharides (glucose, galactose). Amino sugars: Structural formulae and conformations of α- and β- (glucosamine, galactosamine). Disaccharides- Structure elucidation of sucrose. Polysaccharides-partial structural formulae of starch and cellulose. Application of starch in titrimetric analysis. **08 Hrs.**

Heterocyclic compounds: Definition, classification and nomenclature.

Furan-synthesis (from pentasan), reactions (nitration, acylation). Thiophene-synthesis (from sodium succinate), reactions (sulphonation, chlorination). Pyrrole-synthesis (from furan), reactions (diazotization, Riemer-Tiemann). Pyridine-synthesis (from acetylene), reactions (bromination, with $NaNH_2$). Aromaticity and basicity of pyrrole and pyrimidine. Indole: Synthesis (Fischer), reactions (Br_2/HOAc, $CHCl_3$/NaOH). Quinoline: Synthesis (Skraup), reactions (nitration, with $NaNH_2$, with $KMnO_4$/NaOH). Pyrazole: Synthesis (From acetyl acetone and hydrazine), reactions (nitration, bromination). **07 Hrs.**

Unit-III: Physical Chemistry 15 Hrs.

Quantum Mechanics: Introduction, black body radiation, plank radiation law, photo electric effect, Compton effect, de Broglie concept and uncertainty principle.

Concepts of Operators: Laplacian, Hamiltonian, Linear and Hermitian operators. Commutative and non-commutative of operators. Eigen function and eigen values. Postulates of quantum mechanics. Solutions of Schrödinger wave equation for a free particle, particle in a one-dimensional box. **05 Hrs.**

Colligative properties: Definition and examples.

Lowering of vapour pressure: Raoult's law (to be derived), relationship between relative lowering of vapour pressure and molar mass (to be derived). Experimental determination of molar mass of the solute by Dynamic method (Numerical problems).

Elevation in boiling point: Definition, its relation to lowering of vapour pressure and molar

mass (to be derived). Ebullioscopic constant of the solvent and its relation to the boiling point (only equation). Experimental determination of molar mass of the solute by

Walker–Lumsden method (Numerical problems).

Depression in freezing point: Definition, its relation to lowering of vapour pressure and molar mass (to be derived). Cryoscopic constant and its relation to melting point (only equation), Determination of molar mass of non-volatile solute by Rast method (Numerical problems).

Semipermeable membrane: Definition, types with examples. Preparation of artificial semipermeable membrane (copper ferrocyanide) by Morse-Frazer method.

Osmotic pressure: Definition of osmosis, reverse osmosis and osmotic pressure. Determination of osmotic pressure by Berkely-Hartley's method (Numerical problems). Applications of osmotic pressure (mention only).

Osmotic laws and analogy with gas laws: Relationship between molar mass and osmotic pressure (to be derived). Isotonic solutions, plasmolysis and haemolysis. Abnormal molecular mass, causes, vant Hoff's factor (Numerical problems). **10 Hrs.**

Unit-IV: UV-Visible Spectroscopy **15 Hrs.**

Introduction, measurement of absorption intensities, absorption maxima (λmax), instrumentation, types of electronic transitions, concept of chromophores and auxochromes. Absorption and intensity shifts (bathochromic, hypsochromic, hyperchromicand hypochromic). Types of absorption bands (K, R, B and E-bands). The effect of solvents temperature and conjugation on absorption. **05 Hrs.**

Woodward-Fieser rules for calculation of absorption maxima for: Conjugated dienes(aliphatic, alicyclic, exocyclic, homoannular, heteroannular, with and/or without extendedconjugation, and polyenes), α,β-Unsaturated carbonyl compounds (aldehydes, ketones,carboxylic acids, esters with and/or without extended conjugation) and Acyl benzenederivatives. Absorption in compounds with N-O bonds, quinones, α-diketones, α-ketoaldehydes, benzene and its derivatives. Absorption spectra of heterocyclic and condensedring systems (cata-condensed and peri-condensed). Effect of steric hindrance andcoplanarity (cis, trans isomers) on absorption. The electronic transitions in charge transfercomplexes, and keto-enol tautomers.

10 Hrs.

FSE42331P/FSE42337P/FSE42338P/FSE42343P

CHDSCP-6: Chemistry-VI Practical

(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week

PART-A:

1. Conductometric titration of weak acid (CH_3COOH/HCOOH) versus weak base (Ammonium hydroxide).
2. Conductometric titration of a mixture of HCl and CH_3COOH versus NaOH.
3. Conductometric titration of strong acid (HCl) with salt ($CuSO_4$) versus NaOH.
4. Potentiometric titration of FAS versus $K_2Cr_2O_7$.
5. Potentiometric method of determination of dissociation constant of Formic acid.
6. Potentiometric titration of weak acid CH_3COOH against a strong base NaOH using quinhydrone electrode and calculation of pKa and Ka of the weak acid.
7. Colorimetric estimation of Fe^{2+} ions concentration in the given solution by titrationof FAS versus $KMnO_4$.
8. Colorimetric estimation of Fe^{2+} ions concentration using 1,10- phenanthroline.

PART-B:

1. Determination of the isoelectric point of an amino acid by pH metry.
2. Determination of pH of acetic acid with sodium acetate buffer by pH metry
3. Potentiometric determination of pH of a buffer by using quinhydrone electrode and comparison of the pH values obtained with glass electrode.
4. Colorimetric determination of dissociation constant of a given indicator.
5. Potentiometric titration of $AgNO_3$ versus KCl (demonstration).
6. Conductometric titration of weak acid (CH_3COOH) with salt ($CuSO_4$) versus NaOH.
7. Determination of pKa value of phosphoric acid by pH meter.

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FSF42031/FSF42037/FSF42038/FSF42043

VI SEMESTER
CHDSC-7: Chemistry-VII

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week

Unit-I: Inorganic Chemistry 15 Hrs.

Metal-ligand bonding: Valence bond theory: Salient features, formation and magnetic properties of octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN_6)]^{3-}$, $[Co(CN)_6]^{3-}$, $[CoF_6]^{3-}$ $[Cr(H_2O)_6]^{3+}$ and $[Fe(H_2O)_6]^{2+}$. Formation and magnetic properties of tetrahedral and square planar complexes $[Ni(CO)4]$, $[Cu(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$ and $[Pt(Cl_4)]^{2-}$, limitations of VBT. **04 Hrs.**

Crystal field theory: Salient features, splitting of d-orbitals in octahedral, tetrahedral, and square planar geometry. Applications - colors of transition metal complexes, magnetic properties of octahedral complex, CFSE and their uses. Factors affecting CFSE: Geometry of complexes, nature of the central metal ion, nature of ligand, and spectrochemical series. Limitations of CFT. Experimental evidence for metal-ligand covalent bonding in complexes, nephelauxetic effect. MO theory: tetrahedral and octahedral complexes (including p-bonding). **08 Hrs.**

Magnetic properties of coordination compounds: Introduction, magnetic susceptibilityand its determination- Gouy and Faraday method, the effects of temperature on μeff, ferromagnetism, anti-ferromagnetism and ferrimagnetism. **03 Hrs.**

Unit-II: Organic Chemistry 15 Hrs.

Aromatic Electrophilic Substitution Reactions: Quantitative treatment of reactivity in substrates and electrophiles. Amination, sulfonylation, diazonium coupling, Vilsmeier-Haack reaction, Gatterman reaction, Gatterman-Koch reaction and Hoesch reaction.

Aromatic Nucleophilic substitution reactions: The Goldberg reaction, Bucherer reaction, Schiemann reaction, von Richter reaction, and Sommelet-Hauser reactions. **07 Hrs.**

Addition Reactions: Addition reactions of cyclopropane ring. Addition reactions of carbon-heteroatom multiple bonds: Mechanism of metal hydride reduction (NaH, LiH, $LiAlH_4$, $NaBH_4$), Grignard reagent (CH_3MgBr) and organolithium (CH_3Li) of saturated andunsaturated carbonyl compounds. Hydrolysis of nitriles with mechanism. Wittig, Mannichand Stobbe reactions.

Elimination Reactions: Effects of substrate structure, attacking base, the leaving group andthe medium on elimination reactions. Chugaev reaction. **08 Hrs.**

Unit-III: Physical Chemistry 15 Hrs.

Ionic equilibria: Ionic equilibria in aqueous solutions, strong and weak electrolytes- definition and examples. Ostwald's dilution law (to be derived) and its limitations. Debye- Huckel theory of strong electrolytes (relaxation time, electrophoretic effect and viscous effect). Activity and activity coefficient–definition and their relation. Hydrolysis of salts- Derivation of hydrolysis constant and degree of hydrolysis of the salt of weak acid and weak base (ammonium acetate as an example), effect of temperature on degree of hydrolysis. (Numerical problems). **05 Hrs**.

Electrochemistry-II: Electrolytic and Electro chemical cells (galvanic cells)-Daniel cell (construction, working and cell reaction). Reversible and irreversible cells, rules for representation of a cell, single electrode potential, Standard electrode potential, sign convention for electrode potential, Nernst equation for single electrode potential (Derivation).

Reference electrodes: Calomel electrode, Ag-AgCl electrode**.** Weston standard cell

(Construction, working, reaction and standard emf). Equilibrium constant and free energy of a cell reaction, Concentration cell with transport (example) concentration cell without transport, EMF of concentration cell (derivation). Liquid junction potential. Salt bridge. Application of concentration cell: Valency of ions and solubility product of sparingly solublesalt.

Applications of EMF measurements in (a) Determination of pH of a solution using - (i) quinhydrone electrode, (ii) glass electrode. (b) Potentiometric titration-principle and location of end point in (i) Oxidation - reduction reaction, (ii) Precipitation reaction, iii) acid-base reaction. **10 Hrs**.

Unit-IV: Infrared Spectroscopy 15 Hrs.

Introduction, principle, modes of vibrations, vibrational frequency. Factors influencing vibration frequencies (coupled vibration, electronic effects, and bond angles). Finger print region and its significance. Effects of H-bonding, conjugation, resonance, and ring size on IR absorptions. **04 Hrs.**

IR absorption frequency positions in; Hydrocarbons (alkanes, alkenes, alkynes, cycloalkanes, aromatic), halogen compounds, alcohols and phenols, ethers, aldehydes and ketones (aliphatic, alicyclic, and aromatic), esters and lactones, carboxylic acids, acid halides, acid anhydrides, amides, lactams, amines, amino acids, nitro compounds, anilides, nitriles, thiols, thiophenols, sulphonic acids, sulphonamides, and hetero aromatic compounds. **07 Hrs.**

Coordination compounds: Changes in infrared spectra of donor molecules uponcoordination (*N*,*N*-dimethylacetamide, urea, DMSO, pyridine N-oxide, ammine, cyano, cyanato and thiocyanato complexes), mono and multinuclear carbonyl complexes, nitrosyls, and phosphine complexes. **04 Hrs.**

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FSF42131P/FSF42137P/FSF42137P /FSF42143P

CHDSCP-7: Chemistry-VII Practical

(L:T:P = 0:0:2) Contact Hours: 60 Credits: 2 Workload: 4Hours/Week

PART-A: Gravimetric and Volumetric Analysis

1. Gravimetric determination of Fe in iron ore as Fe_2O_3.
2. Gravimetric estimation of calcium as calcium oxide.
3. Gravimetric estimation of aluminum as aluminum oxide.
4. Gravimetric estimation of magnesium as magnesium 8-hydroxy oxinate.
5. Gravimetric estimation of lead as lead chromate.
6. Gravimetric determination of Ni using DMG in Cu and Ni solution.
7. Gravimetric determination of Fe using NH_4OH in Fe and Cr solution.
8. Gravimetric estimation of Cu using NH_4SCN in Cu and Zn solution.
9. Volumetric estimation of Ca and Mg in dolomite solution.
10. Volumetric estimation of Fe in Cu and Fe solution.
11. Volumetric estimation of Zn in Cu and Zn solution.
12. Volumetric estimation of Ni in Ni and Zn solution.

PART-B: Preparation of co-ordination complexes

1. Preparation of hexamminenickel(III) chloride.
2. Preparation of chloropentaminecobalt(III)chloride.
3. Preparation of tris(oxalato)ferrate(III) and estimate the iron.
4. Preparation of hexamminecobalt(III)chloride(demonstration).
5. Preparation of mercury tetrathiocyantocobaltate(II) (demonstration).

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FSF42231/FSF42237/FSF42238/FSF42243

CHDSC-8: Chemistry-VIII

(L:T:P = 4:0:0) Contact Hours: 60 Credits: 4 Workload: 4Hours/Week

Unit-I: Inorganic Chemistry 15 Hrs.

Paints: Constituents and their functions, manufacture of lithopone and titanium dioxide.

Propellants: Definition, characteristics, classification and applications.

Abrasives: Definition, classification with examples, hardness, manufacture and applicationsof carborundum, alundum and tungsten carbide.

Refractories: Definition, properties, classification with examples. Different steps involvedin the manufacture of refractories. Applications of refractories. **05 Hrs.**

Ceramics: Introduction, types, manufacturing process, applications.

Explosives: Origin of explosive and classification. preparation and explosive propertiesof leadazide, PETN, cyclonite (RDX).

Fertilizers: Economic importance and synthesis of nitrogenous fertilizers- CAN, ammonium sulfate, ammonium nitrate and urea. Phosphate fertilizers- calcium dihydrogenphosphate, super phosphate. **05 Hrs.**

Silicates: Structure, classification - silicates with discrete anions, silicates containing chainanion, silicates with layer structure, silicones with three dimensional net-work and applications. **02 Hrs.**

Nanotechnology: Definition, uses and nature of nanotechnology. Nanomaterials: Definition, properties and applications. Carbon nanotubes: Definition, types, methods of preparation (mention), properties and industrial applications of carbon nanotubes, Nanowires: Definition, types, production of crystalline nanowires by vapour-liquid-solid synthesis method, application of nanowires. **03 Hrs.**

Unit-II: Organic Chemistry 15 Hrs.

Rearrangements: Reaction and mechanism of Wagner-Meerwein, Fries, Beckmann, Hofmann, Benzil-benzilic acid, Favorskii, Dienone-phenol, and Benzidine rearrangement. Baeyer-Villiger oxidation, Arndt-Eistert reaction. **07 Hrs.**

Amino acids and Peptides: Amino acids: Synthesis (from α-halogen acids, Gabriel phthalimide, malonic ester), reactions (alkyl halides, nitrous acid, acid halide, NH_3, $LiAlH_4$). Classification and nomenclature of peptides. Sanger and Edman methods of sequencing. Cleavage of peptide bond by chemical and enzymatic methods. Peptide synthesis- Protection of amino group (Boc-) and carboxyl group as alkyl esters. Use of DCC, and HOBt in peptide bond formation reactions. Deprotection and racemization in peptide synthesis. Solution andsolid phase techniques. Synthesis of oxytocin. Introduction to peptidomimetics. **08 Hrs.**

Unit-III: Physical Chemistry 15 Hrs.

Chemical Dynamics: Arrhenius equation-characteristics, Significance of energy of activation, Temperature coefficient and its evaluation. Thermodynamical formulation of reaction rates (Thermodynamic parameters).

Reaction between ions in solutions - Influence of ionic strength on reaction rates - primary and secondary salt effects, Effect of dielectric constant (single sphere model).

Complex reactions: Kinetics of parallel reactions, consecutive reaction, reversible reactions (qualitative treatment). **07 Hrs.**

Kinetics of homogeneous catalysis- kinetics of acid-base catalyzed reactions-specific acid and specific base catalysis, general acid base catalysis. Enzyme catalyzed reactions, Mechanism

(Lock and Key theory), Kinetics of enzyme catalyzed reactions - Henri- Michaelis- Menten mechanism, Significance of Michaelis-Menten constant, Lineweaver-

Burk plot. Effects of enzyme concentration, pH, Temperature, catalysts and Inhibitors on enzyme activity.

Kinetics of fast reactions: Introduction, Study of reactions by relaxation method (Temperature and pressure jump), flow method (continuous flow method and stopped flow method), Flash photolysis and Shock tube method. **08 Hrs.**

Unit-IV: Nuclear Magnetic Resonance Spectroscopy **15 Hrs.**

^{1}H NMR spectroscopy: Introduction (including magnetic properties of nuclei, spin population), relaxation process (spin-spin, spin-lattice, quadrupole), number of signals. Instrumentation, chemical shifts, internal standards, shielding and deshielding effects. Factors affecting chemical shift (inductive, Van der Waals, anisotropic, H-bonding). Solvents used. Peak area and proton counting, splitting of the signals, spin-spin coupling, equivalent and non-equivalent protons. Chemical exchange (proton exchange reactions). Calculation of atoms ratio from the height of signals. coupling constant (geminal, vicinal, long-range coupling). Restricted rotation. Double resonance (spin decoupling), nuclear overhauser effect. **09 Hrs.**

Structure determinations/interpretation of spectra of; ethane, propane, 1-bromopropane, 2-bromopropane, ethylene, propene, acetylene, propionamide, methylamine, dimethylamine, trimethylamine, ethyl acetate, methyl cyanide, ethylbenzene, o-cresol, p-cresol, benzoic acid, anisole, benzaldehyde, acetaldehyde, benzophenone, acetophenone, thiophenol. **06 Hrs.**

FSF42331P/FSF42337P/FSF42338P/FSF42343P

CHDSCP-8: Chemistry-VIII Practical

(L:T:P = 0:0:2) **Contact Hours: 60** **Credits: 2** **Workload: 4Hours/Week**

PART-A:

1. Hydrolysis of methyl acetate in presence of two different concentrations of HCl and determination of the relative strength.
2. Determination of energy of activation for the reaction between $K_2S_2O_8$ versus KI (first order) in two different temperatures.
3. Determination of rate constant for the reaction between chloramine-T and indigocaramine dye in pH 10 buffer medium spectrophotometrically.
4. Conductometric determination of strength of HCl, CH_3COOH and $CuSO_4$ versus NaOH.
5. Conductometric titration of sodium sulphate versus $BaCl_2$.
6. Conductometric determination second order rate constant for the saponification of ethyl acetate.
7. Determination of partial molar volume of NaCl-H_2O system by apparent molar volume method.
8. Potentiometric titration of acid mixture (CH_3COOH and $ClCH_2COOH$) versus NaOH.

PART-B: Organic Preparations:

1. Cannizarro reaction of benzaldehyde.
2. Friedel-Crafts reaction of benzene and acetyl chloride.
3. Oxidation of cyclohexanol.
4. Preparation of p-iodonitrobenzene
5. Preparation of *N*-phenyl-2,4-dinitroaniline.
6. Preparation of 2,4,6-tribromoaniline.
7. Preparation of 2,4-dichlorophenoxyacetic acid.

Recommended Books/References:

1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Gaus; John Wiley, 6th Ed. (1999).
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, 6th Ed.
3. Inorganic Chemistry, J. E. Huheey, E. A. Keiter and R. L. Keiter, Addison; Wesley, 4th Ed. (1993).
4. Inorganic Chemistry, D. F. Shriver, P. W. Atkins, C. H. Langford, Oxford University Press, 2nd Ed. 1994.,
5. Concise Inorganic Chemistry, J. D. Lee, 5th Ed. (1996).
6. Essentials of nuclear chemistry, H. J. Arniker, NAIL publishers, 4th Ed. (1995).
7. Vogel's Qualitative Chemical Analysis, J. Bassett, G. H. Jeffery and J. Mendham, ELBS (1986).
8. Advanced Organic Chemistry, Jerry March, John Wiley (2008).
9. Advanced Organic Chemistry, F A Carey and R J Sundberg, Plenum, (1990).
10. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall, (1998).
11. Stereochemistry of Organic Compounds, D Nasipuri, New-Age International, (1999).
12. Stereochemistry of Carbon Compounds, E L Eliel, S H Wilen and L N Mander, John Wiley, (1994).
13. Stereochemistry, Potapov, MIR, Moscow, 1984.
14. Organic Chemistry, Vol. I and II, I L Finar, Longman, (1999).
15. Laboratory Manual of Organic Chemistry, B.B. Dey, M V Sitaraman, T R Govindachari, Allied Publishers, New Delhi, (1996).
16. Practical Organic Chemistry - Mann and Saunders, (1980).
17. Textbook of Practical Organic Chemistry- A. I. Vogel, (1996).
18. Textbook of Quantitative Organic Analysis- A. I. Vogel, (1996).
19. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia, R. Aggarwal, Uni. Press, (2000).
20. Practical Organic Chemistry (Quantitative analysis), B. B. Dey, M. V. Sitaraman, T. R. Govindachari, Allied Publishers, New Delhi, (1992).
21. Physical Chemistry, P. W. Atkins, Julio de Paula, ELBS, 7th Ed., (2002).
22. Physical Chemistry: A Molecular Approach, McQuarie and Simon, Viva, New Delhi, (2001).
23. Introduction to Quantum Chemistry, A. K. Chandra, Tata McGraw Hill, (1988).
24. Quantum Chemistry, R. K. Prasad, New Age International, 2nd Ed. (2000).
25. Chemical Kinetics, K. J. Laidler, McGraw Hill. Inc. New York (1988).
26. Principles of Chemical Kinetics, House J. E. Wm C Brown Publisher, Boston, (1997).
27. Kinetics and Mechanism, A. A. Frost and R. G. Pearson, John-Wiley, New York, (1961).
28. Chemical Kinetic Methods, C. Kalidas, New Age International Publisher, New Delhi (1995)
29. Physical Chemistry, P. Atkins and J. D. Paula, 9th Ed., Oxford University Press (2010).
30. Biochemistry, Geoffrey Zubay, 2nd Ed., Macmillan Publishing Co. New York (1981).
31. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publications Meerut (1988)
32. Senior Practical Physical Chemistry by B. C. Kosla, Simla Printers New Delhi (1987)
33. Experimental Physical Chemistry by Daniel et al., McGraw Hill, New York (1962).
34. Experimental Physical Chemistry by Wilson, Newcombe & others, Pergamon Press, (1962)
35. Experimental Physical Chemistry by R. C. Behra and B Behra, Tata McGraw, New Delhi (1983)
36. Practicals in Physical Chemistry A. Modern Approach, P.S Sindhu, Mac. Millan Publishers Delhi (1986).
37. Surface Chemistry: Theory and Applications, J. J. Bikerman, Academic Press. New York (1972).
38. Physical Chemistry, Laideler K. J. and Meiser J. M. 3rd Ed. McGraw-Hill, (1999).
39. Physical Chemistry, Levine I. N., Physical Chemistry, 4th Ed. McGraw-Hill, (1995).
40. Fundamentals of Molecular Spectroscopy, Banwell, C. N. & McCash E. M. 4th Ed. Tata McGraw-Hill, (2006).
41. Organic Spectroscopy, Kemp, W.
42. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, and Stanley Crouch 6th Ed.
43. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus; John Wiley, 6th Ed. (1999).
44. Chemistry of elements, N. N. Greenwood & A. E. Earnshaw, Butterworth Heinemann (1997).
45. Inorganic Chemistry, J. E. Huheey, E. A. Keiter & R. L. Keiter, Addison; 4th Ed. Wesley (1993).

46. Inorganic Electronic spectroscopy, A. B. P. Lever, Elsevier. (1968).
47. Electronic Absorption Spectroscopy & Related Techniques, D. N. Sathyanarayana, University Press (2001).
48. Textbook of Inorganic Chemistry, G. S. Sodhi, Viva books Pvt. Ltd (2011).
49. Vogel's text book of Quantitative Chemical Analysis, J. Bassett, G. H. Jeffery and J. Mendham, and R. C. Denny, 5th Ed. Longman Scientific and Technical (1999).
50. Advanced Organic Chemistry, Jerry March, John Wiley (2008).
51. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum (1990).
52. A Guide Book to Mechanism of Organic Chemistry, Peter Sykes, Longman (2000).
53. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall (1998).
54. Modern Organic Reactions, H. O. House, Benjamin (1972).
55. Stereochemistry of Organic Compounds, D. Nasipuri, New-Age International (1999).
56. Stereochemistry of Carbon Compounds, E. L. Eliel, S. H. Wilen & L. N. Mander, John Wiley (1994).
57. Organic Chemistry, Volumes I and II, I L Finar, Longman. (1999).
58. Medicinal Chemistry, A Kar, Wiley (2000).
59. Peptides: Chemistry and Biology, N Selwad and H.-D. Jakubke, Wiley-VCH, (2002).
60. Practical Organic Chemistry, Mann and Saunders, (1980).
61. Text Book of Practical Organic Chemistry, A. I. Vogel, (1996).
62. Test Book of Quantitative Organic Analysis, A. I. Vogel, (1996).
63. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, R. Aggarwal, Universities Press (India), (2000).
64. Advanced Practical Organic Chemistry, J. Mohan, Vol. I and II, Himalaya Publishing House, (1992).
65. Molecular Thermodynamics, Donald A. Mc Quarrie, John D. Simon University Science Books California, (1999).
66. Thermodynamics for Chemists, S. Glasstone, East-West Press, New Delhi, (1960).
67. Thermodynamics, Rajaraman and Kuriacose, East-West Press, (1986).
68. Statistical Thermodynamics, M. C. Gupta, Wiley Eastern Ltd. (1993).
69. Thermodynamics, Thomas Engel & Philip Reid, Pearson Education inc. (2007).
70. Modern Electrochemistry, Vol-1, 2, J.O.M Bockris and A.K.N. Raddy, Plenum New York (1978).
71. Principles and Applications of Electrochemistry, D.R. Crow, 3rd Ed. Chapmanhall London (1988).
72. Experiments in Physical Chemistry, Shoemaker & Garland, McGraw Hill Int. Edn. (1966).
73. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publications Meerut (1988).
74. Experimental Physical Chemistry, R. C. Behra and B Behra, Tata McGraw, New Delhi (1983).
75. Experimental Physical Chemistry, V.D. Atavale & Parul Mathur, New Age Int. NY. (2001).
76. Introduction to Molecular Spectroscopy, C. N. Banwell, TMH Edition (1994).
77. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw Hill, (1988).
78. Molecular Spectroscopy, J. D. Graybeal, McGraw Hill (Int. Students Ed.) (1990).
79. Spectroscopy, Vols. 1-3, B. P. Straughan and W. Walker, Chapman Hall (1976).
80. Spectroscopic Identification of organic compounds, R. M. Silverstein and F. X. Webster, 6th Ed. Wiley and Sons, India Ltd. (2006).
81. Practicals in Physical Chemistry, by P.S Sindhu, Mac. Millan Publishers Delhi (2006).

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Scheme of Evaluation:VSemester

CHDSCP-5: Chemistry-V Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Note: If experiments from Part-A were given, procedure writingbe from Part-B experiments, and vice-versa).
- Experimental: (Experiments be given from Part-A or Part-B) 20 Marks

Part-A: Organic Preparations

Skill	04 Marks
Reaction and mechanism	04 Marks
Yield	03 + 03 Marks
Recrystallisation products	02 + 02 Marks
Physical constants	01 + 01 Marks

Part-B: Organic estimations

Colorimetric estimation of glucose and aspirin		
Preparation of standard solution		05 Marks
Discrepancy	100 µg	10 Marks
	200 µg	08 Marks
	300 µg	06 Marks
	Any other value	04 Marks
Graph		05 Marks

Estimation of ascorbic acid		
Preparation of standard $K_2Cr_2O_7$ solutionand calculation of its normality		03 Marks
Standardization of $Na_2S_2O_3$ solution and calculation of its normality		03 Marks
Discrepancy	10 mg	12 Marks
	15 mg	10 Marks
	20 mg	08 Marks
	Any other value	05 Marks
Calculation		02 Marks

Estimation of amino acid/carboxylic acid/amino group		
Preparation of standard potassium hydrogen phthalate solution and calculation of its normality		03 Marks
Standardization of NaOH solution and calculation of its normality		03 Marks
Discrepancy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Calculation		02 Marks

Saponification value of an oil		
Preparation of standard Na_2CO_3 solutionand calculation of normality		03 Marks
Standardization of HCl solution and calculation of its normality		03 Marks
Discrepancy	± 10%	12 Marks
	± 15%	10 Marks
	± 20%	08 Marks
	Any other value	05 Marks
Calculation		02 Marks

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Scheme of Evaluation, V Semester
CHDSCP-6: Chemistry-VI Practical

Duration: 03 Hours **Max. Marks:**

25DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

Colorimetric Determinations/Estimations		
Preparation of solutions		04 Marks
Determination of λmax		02 Marks
Accuracy	± 4%	09 Marks
	± 6%	07 Marks
	± 8%	05 Marks
	Any other value	03 Marks
Graph, Calculation		05 Marks

Conductometric titrations		
Accuracy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Graph		05 Marks
Calculation of Normality, weight/dm^3		03 Marks

Potentiometric/pH metric/colorimetric titrations		
Accuracy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Graph		05 Marks
Calculation of Normality, weight/dm^3		03 Marks

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Scheme of Evaluation VI Semester

CHDSCP-7: Chemistry-VII Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

Gravimetric Determination		
Skill		05 Marks
Accuracy	± 3%	12 Marks
	± 5%	10 Marks
	± 8%	08 Marks
	Any other value	05 Marks
Calculation		03 Marks

Volumetric Estimations		
Preparation of standard solution and calculation of normality		01 + 01 Marks
Deviation	Standardization	Estimation
± 0.3 cm^3	05 Marks	07 Marks
± 0.4 cm^3	04 Marks	06 Marks
± 0.5 cm^3	03 Marks	05 Marks
Any other value	02 Marks	04 Marks
Calculation of normality of link solution		02 Marks
Calculation of normality of test solution and wight/dm^3		02 + 02 Marks

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Scheme of Evaluation VI Semester

CHDSCP-8: Chemistry-VIII Practical

Duration: 03 Hours **Max. Marks: 25**

DISTRIBUTION OF MARKS

- Procedure writing: 05 Marks
  (Any one of the experiments from Part-B):
- Experimental: (Experiments be given from Part-A) 20 Marks

Conductometric titrations		
Accuracy	± 0.2 cm^3	12 Marks
	± 0.3 cm^3	10 Marks
	± 0.4 cm^3	08 Marks
	Any other value	05 Marks
Graph		05 Marks
Calculation of normality, weight/dm^3		03 Marks

Kinetics Expts: Determination rate constant(k)	
6 constant values of k	12 Marks
5 constant values of k	10 Marks
4 constant values of k	08 Marks
Any other values of k	06 Marks
Graph	03 Marks
k from graph	02 Marks
Calculation and unit	03 Marks

Note: For experiments i) Hydrolysis of methyl acetate in presence of two different concentrations of HCl and determination of the relative strength, and ii) Determination of energy of activation for the reaction between $K_2S_2O_8$ versus KI (first order) in two different temperatures; only determination of rate constant for one concentration of acid and one temperature.

Determination of partial molar volume		
Accuracy	± 4%	12 Marks
	± 6%	10 Marks
	± 8%	08 Marks
	Any other value	06 Marks
Graph		05 Marks
Calculation		03 Marks

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EXAMINATION AND EVALUATION

Question paper pattern for DSC 1 to 2
(I and II Semester)

Duration: 2.30 hours		**Max. Marks**: 60
The question paper contains 3 parts		
Part-A	Answer any 6 out of 8questions **(two questions from eachunit)**	6 X 2 = 12
Part-B (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

Question paper pattern for DSC 3,4,5,6,7 & 8
(III to VI Semester)

Duration: 2.30 hours		**Max. Marks**: 60
The question paper contains 3 parts		
Part-A	Answer any 6 out of 8questions **(two questions from each unit)**	6 X 2 = 12
Part-B (Analytical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-C (Inorganic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-D (Organic Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Part-E (Physical Chemistry)	Answer any 2 out of 3 questions	2 x 6 = 12
Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

Question paper pattern for Open elective
(I to IV Semester)

Duration: 2.30 hours		**Max. Marks**: 60
The question paper contains 2 parts		
Part-A	Answer any 6 out of 8 questions	6 X 2 = 12
Part-B	Answer any 8 out of 10 questions	8 x 6 = 48
Pattern: Pattern: (3 + 3) / (4 + 2)/(2+2+2)		

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3. Smt Pushpa C S
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