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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 IV semesters)

wef 2022-2023

SYLLABUS

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Course –Chemistry/ Zoology (CZ)

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No. of credits			Total credits	Total hours		Maximim marks in theory exam	Continuous Assessment							Total
													Theory				Practicals			
													C1		C2		C1	C2		
						L	T	P		Th	Pr		Test	Assignment	Test	Assignment/ Seminar	Test	Test	Record	
I B.Sc	I	DSC-1 Theory	FSA 42038	Chemistry-1	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-1 Practicals	FSA 42038	Chemistry-DSC-1 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-1 (Open Elective)		Chemistry in daily life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100
	II	DSC-2-Theory	FSB 42038	Chemistry-2	04	4	-	-	06	56	56	60	10	10	10	10	-	-		100
		DSC-2 Practicals	FSB 42038	Chemistry-DSC-2 Lab	04			2				25	-	-	-	-	10	10	05	50
		OE-2 (Open Elective)		Molecules of life	03	3	-	-	03	42	-	60	10	10	10	10	-	-		100

B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department(wef 2022-2023)

Physics, Chemistry

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment							Total
													Theory				Practicals			
													C_1		C_2		C_1	C_2		
						L	T	P		Th	Pr		Test	Assessment	Test	Assessment	Test	Test	Record	
I BSc	I	DSC-1 Theory	FSA42031	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab								25								50
		OE-1		Chemistry in daily life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
I BSc	II	DSC-2 Theory	FSB42031	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab								25								50
		OE-2		Molecules of life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	III	DSC-3 Theory	FSC42031	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab								25								50
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	IV	DSC-4 Theory	FSD42031	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab								25								50
		OE-4		Electrochemistry, corrossion and metallurgy	03	3	-	-	03			60	10	10	10	10	-	-	-	100

B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department(wef 2022-2023)

Chemistry, Biotechnology

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment							Total
													Theory				Practicals			
													C_1		C_2		C_1	C_2		
						L	T	P		Th	Pr		Test	Assessment	Test	Assessment	Test	Test	Record	
I BSc	I	DSC-1 Theory	FSA42037	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab								25								50
		OE-1		Chemistry in daily life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
I BSc	II	DSC-2 Theory	FSB42037	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab								25								50
		OE-2		Molecules of life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	III	DSC-3 Theory	FSC42037	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab								25								50
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	IV	DSC-4 Theory	FSD42037	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab								25								50
		OE-4		Electrochemistry, corrossion and metallurgy	03	3	-	-	03			60	10	10	10	10	-	-	-	100

B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department(wef 2022-2023)

Chemistry, Zoology

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment							Total
													Theory				Practicals			
													C_1		C_2		C_1	C_2		
						L	T	P		Th	Pr		Test	Assessment	Test	Assessment	Test	Test	Record	
I BSc	I	DSC-1 Theory	FSA42038	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab								25								50
		OE-1		Chemistry in daily life	03	3	-	-	32			60	10	10	10	10	-	-	-	100
I BSc	II	DSC-2 Theory	FSB42038	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab								25								50
		OE-2		Molecules of life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	III	DSC-3 Theory	FSC42038	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab								25								50
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	IV	DSC-4 Theory	FSD42038	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab								25								50
		OE-4		Electrochemistry, corrossion and metallurgy	03	3	-	-	03			60	10	10	10	10	-	-	-	100

B.Sc Programme Syllabus
Syllabi and guide lines for B.Sc., Programme under NEP Scheme
to be implemented in the Department(WEF 2022-2023)

Chemistry, Botany

Year	Sem	Core course	Course code	Title of the paper	Lecture + Practical hours per week	No of credits			Total credits	Total hours		Maximum marks in final exam	Continuous assesment							Total
													Theory				Practicals			
													C_1		C_2		C_1	C_2		
						L	T	P		Th	Pr		Test	Assessment	Test	Assessment	Test	Test	Record	
I BSc	I	DSC-1 Theory	FSA42043	Chemistry-1	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-1 Practicals		Chemistry-DSC-1 Lab								25								50
		OE-1		Chemistry in daily life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
I BSc	II	DSC-2 Theory	FSB42043	Chemistry-2	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-2 Practicals		Chemistry-DSC-2 Lab								25								50
		OE-2		Molecules of life	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	III	DSC-3 Theory	FSC42043	Chemistry-3	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-3 Practicals		Chemistry-DSC-3 Lab								25								50
		OE-3		Atomic Structure, Bonding and Concepts in Organic Chemistry	03	3	-	-	03			60	10	10	10	10	-	-	-	100
II BSc	IV	DSC-4 Theory	FSD42043	Chemistry-4	08	4	-	2	06	56	48	60	10	10	10	10	10	10	05	100
		DSC-4 Practicals		Chemistry-DSC-4 Lab								25								50
		OE-4		Electrochemistry, corrossion and metallurgy	03	3	-	-	03			60	10	10	10	10	-	-	-	100

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 ProgrammeStructure:**

   The credit pattern for the course is L:P

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

   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 beEnglish/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. **PassingCriteria**

    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 particularcourse

    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 2
(I and II Semester)

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 hours	4 hours	
		100	**50**	**150**

Examination and Evaluation

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

Duration: 2 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)		

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

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

Duration: 2 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)		

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. Biochemistry,2002.

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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FSD42031/FSD42037/FSD42038/FSA42043

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 property of 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 and purpose 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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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).
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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).
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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
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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, 6th 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.

Course Specific Outcomes: Upon completion of the course students will be able to;

1. Understand the concept of conductance in electrolytic solutions, electrolysis andredox reactions involved in electrode reactions.
2. Learn the different types of electrochemical cells, their symbolical representationand application of electrochemical series.
3. Apply conductometric, potentiometric and pH titrations.
4. Know the principle, construction and working of batteries.
5. Understand different types of corrosion and its prevention by different methods.
6. Learn the methods of extraction of metals from their ores and purification.

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.**

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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).
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9. Essential of Materials Science and Engineering, Donald R. Askeland, Thomson Learning, 5th Edition, (2006).
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12. Engineering Materials and Metallurgy, R. K. Rajput, S. Chand - 1st Edition, (2011).

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Scheme of Examination for DSC-3 and DSC-4 (III and IV Semesters): Credits (4:0:0)

Continuous Internal Assessment	Marks		
	Assignment	Test	Total
C1	10	10	20
C2	10	10	20
Semester End Examination	**Duration: 02 Hours**		
C3			60
		Total Marks	100

Question Paper pattern for DSC-3 and DSC-4 (III and IV Semesters)

Duration: 02 Hours	**Max. Marks: 60**	
Part-A	Answer any six out of eight questions (Two questions from each unit)	6 x 2 =12
Part-B (Analytical Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-C (Inorganic Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-D (Organic Chemistry)	Answer any two out of three questions	2 x 6 = 12
Part-E (Physical Chemistry)	Answer any two out of three questions	2 x 6 = 12
Sub-questions Pattern: (3 + 3)/(4 + 2)/(2 + 2 + 2)		

Scheme of Examination for DSC-3 and DSC-4 practical (III and IV Semesters) Credits (0:0:2)

Continuous Internal Assessment	Marks			
	Test	Continuous a ssessment/ Attendance	Record	Total
C1	10	-	--	10
C2	--	10	05	15
Semester End Examination	Duration: 04 Hours			
C3				25
			Total Marks	50

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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** ka Calculations	2 Marks

DISTRIBUTION OF MARKS (For Experiments **6** and **7**)		
Deviation	$\pm$ 0.2 cm^3	8 Marks
	$\pm$ 0.3 cm^3	6 Marks
	$\pm$ 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 couplingReaction/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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Examination and Evaluation

Question paper pattern for DSC I & II Semester
(I & II Semester)

Duration: 2 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 III & IV Semester
(III & IV Semester)

Duration: 2 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 (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 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)		

PANEL OF EXAMINERS :

INTERNAL MEMBERS:

1. Smt J S Vidya
   Head,Chairperson, JSS College,
   Ooty Road, Mysore

2. D S Prabhakar
   JSS College, Ooty Road,
   Mysore

EXTERNAL MEMBERS:

1. Dr B K Kendagannaswamy, JSS College, Nanjanagudu
2. Dr. Girija Nagendraswamy . Maharani's Science College for Women, Mysuru
3. Dr. Jayaroopa .Maharani.s Science College for Women, Mysuru
4. Dr Kempegowda,. Maharani's Science College for Women, Mysuru
5. Dr. Jamunarani. Maharani's Science College for Women Mysuru
6. Dr Lakshmi Hebbar,.Maharani's Science College for Women ,Mysuru
7. Dr Madhusudana Reddy , Maharani's Science College for Women, Mysuru
8. Dr. K K Padmanabha,.Maharani's Science College for Women,. Mysuru
9. Prof. Tara, Maharani's Science College for Women, Mysuru
10. Smt. Kavitha ,Maharani's Science College for Women ,Mysuru
11. Smt. Radhika ,Maharani's Science College for Women, Mysuru
12. Dr. T S Yamuna ,Maharani's Science College for Women,Mysuru
13. Smt. Ayesha, Kuvempu Nagar first Grade College., Mysuru
14. Dr. Mousinabegam Maharani's Science College for Women Mysuru
15. Dr. K Ajay Kumar, Yuvaraja's College, Mysuru
16. Dr. Chandrashekar, Yuvaraja's College, Mysuru
17. Dr. DevaRaj, Yuvaraja's College, Mysuru
18. Dr. Sudha B S ,Yuvaraja college ,Mysuru
19. Dr. Shaukatharakhanum ,Yuvaraja'sCollege,Mysuru
20. Dr. Ahamadi bibi khatoon, Yuvaraja's College ,Mysuru
21. Dr . P Jayadevappa ,Yuvaraja's College,Mysuru
22. Dr. Shivaprakash,Vijayanagar first Grade college Mysuru
23. Dr. AlphonsusDsouza, St. PhilominasCollege,Mysuru
24. Smt. Agnes Dsouza St. Philominas College Mysuru
25. Prof. Britto Dominik Rayan,,St Philomenas College, Mysore
26. Smt. Pushpa ,JSS CW, Sarswathipuram, Mysuru
27. Smt Lokeswari ,JSSCW Sarswathipuram, Mysuru
28. Rajeshwari P R, JSSCW Sarswathipuram, Mysuru
29. Poornima , JSSCW,Saraswathipuram, Mysore
30. Praveenkumar H S , JSS College, Nanjanagudu
31. Sri Siddaraju, JSS College, Chamarajanagar
32. Shwetha ,YCM, Mysore
33. Archana P Mendora, St. Philominas College,Mysore
34. Bindu Noronha, St. Philominas College,Mysore
35. Sudeep P, YCM, Mysore
36. Vageesh, YCM, Mysore

37. Dileep P, YCM, Mysore
38. Prakash , YCM, Mysore
39. Pallavi H M, YCM, Mysore
40. Sumana, YCM, Mysore
41. Dr. Nandeesh, YCM, Mysore
42. Guruprasad, YCM, Mysore
43. Jagadeesh, YCM, Mysore
44. Mahima, YCM, Mysore
45. Rekha G R, YCM, Mysore
46. Kemparaje Gowda, YCM, Mysore
47. Gangadhar, YCM, Mysore
48. Vivek, YCM, Mysore
49. Sindhushree, YCM, Mysore
50. Mamatha M, MSCW, Mysore
51. Noor Fatima, MSCW, Mysore
52. Bindushree, MSCW, Mysore
53. Mamatha , JSS College, Chamarajnagar
54. Sowmya, JSS College, Chamarajnagar