KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/JS-108/BOS /Chemistry(UG) /22-23/1138 Date: 11 OCT 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿಗಾಗಿ ಸಿ.ಬಿ.ಸಿ.ಎಸ್. ಅಡಿಯಲ್ಲಿ ಜಾರಿಯಲ್ಲಿರುವ ಸ್ನಾತಕ ಪದವಿಯ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳ ರಸಾಯನಶಾಸ್ತ್ರ ವಿಷಯದ (SEC) ಪರಿಷ್ಕೃತ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 17, ದಿನಾಂಕ: 17.09.2022
2. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 11/10/2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022–23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿಗಾಗಿ **ಸಿ.ಬಿ.ಸಿ.ಎಸ್.** (CBCS) ಅಡಿಯಲ್ಲಿ ಜಾರಿಯಲ್ಲಿರುವ ಸ್ನಾತಕ ಪದವಿಯ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳ **ರಸಾಯನಶಾಸ್ತ್ರದ** SEC Theory ವಿಷಯವನ್ನು Practical ಎಂದು ಪರಿಷ್ಕರಿಸಿದ ಪಠ್ಯಕ್ರಮವನ್ನು 2022–23ನೇ ಸಾಲಿನ **ಸಿ.ಬಿ.ಸಿ.ಎಸ್.** (CBCS) ಪದ್ಧತಿಯಲ್ಲಿ ಜಾರಿಯಲ್ಲಿರುವ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ ಅಳವಡಿಸಿಕೊಳ್ಳಲಾಗಿದೆ ಹಾಗೂ ಸದರ ಪಠ್ಯಕ್ರಮವನ್ನು ಕ.ವಿ.ವಿ. www.kud.ac.in ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಅಡಕ: ಮೇಲಿನಂತೆ

11/10
ಕುಲಸಚಿವರು.

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. Programme

***

Revised SEC Syllabus (V and VI semesters)

CHEMISTRY (OPTIONAL)

AS DISCIPLINE SPECIFIC COURSE (DSC) and

SKILL ENHANCEMENT COURSE (SEC)

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

*****

Effective from 2020-21

B.Sc. Programme structure under CBCS

Semester	*Core			Elective			Ability Enhancement Course						Total Credits
	DSC			**DSE			***SEC			AECC			
	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	Course	L+T+P	Credit	
I	DSC-1A	4+0+4	4+2=6							English-1	2+1+0	2+1=3	26
	DSC-2A	4+0+4	4+2=6							MIL-1	2+1+0	2+1=3	
	DSC-3A	4+0+4	4+2=6							ENVIRONMENTAL SCIENCE	2+0+0	2+0=2	
II	DSC-1B	4+0+4	4+2=6							English-2	2+1+0	2+1=3	26
	DSC-2B	4+0+4	4+2=6							MIL-2	2+1+0	2+1=3	
	DSC-3B	4+0+4	4+2=6							CONSTITUTION OF INDIA	2+0+0	2+0=2	
III	DSC-1C	4+0+4	4+2=6							English-3	2+1+0	2+1=3	24
	DSC-2C	4+0+4	4+2=6							MIL-3	2+1+0	2+1=3	
	DSC-3C	4+0+4	4+2=6										
IV	DSC-1D	4+0+4	4+2=6							English-4	2+1=0	2+1=3	24
	DSC-2D	4+0+4	4+2=6							MIL-4	2+1=0	2+1=3	
	DSC-3D	4+0+4	4+2=6										
V				DSE-1E	4+0+4	4+2=6	SEC-1E	0+0+4	2				22
				DSE-2E	4+0+4	4+2=6	SEC-2E	0+0+4	2				
				DSE-3E	4+0+4	4+2=6							
VI				DSE-1F	4+0+4	4+2=6	SEC-1F	0+0+4	2				22
				DSE-2F	4+0+4	4+2=6	SEC-2F	0+0+4	2				
				DSE-3F	4+0+4	4+2=6							
TOTAL			72			36			08			28	144

L+T+P= Lecturing in Theory + Tutorial + Practical Hours per Week (no tutorial for practical subject).

* If the core course is Mathematics, there shall be two papers of 75 marks each. Then L+T+P = (2x3)+(2x1)+0, but credit shall be 6 only.

** Each DSE shall have at least two papers and student shall choose any one paper from each DSE.

*** SEC shall be from any one DSC and study two each in 5th and 6th semesters (SEC may be practical or theory for 2 credits only).

Note: 1. Each DSC/DSE Shall have 60hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam) and 52 hrs practical/sem for 50 marks(40 Sem. End exam +10 IA Exam).

2. English/MIL Shall have 45 hrs syllabus / semester for 100 marks in theory (80 Sem. End exam +20 IA Exam).

3. Environmental Science/ Constitution of India / SEC shall have 30 hrs syllabus / semester for 50 marks in theory/ Practical (40 Sem. End exams +10 IA Exam).

Karnatak University, Dharwad
CBCS syllabus for Under Graduate Programme in Chemistry (opt.) as
DISCIPLINE SPECIFIC COURSE (DSC)
Effective from 2020-21

Semester	Theory/ Practical	Subject Code	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
I	Theory	DSC (CHT: A)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: A)	04 hrs	52	03 hrs	10	40	50	02
II	Theory	DSC (CHT: B)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: B)	04 hrs	52	03 hrs	10	40	50	02
III	Theory	DSC (CHT: C)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: C)	04 hrs	52	03 hrs	10	40	50	02
IV	Theory	DSC (CHT: D)	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC (CHPr: D)	04 hrs	52	03 hrs	10	40	50	02
V	*Theory P-I /P- II	DSE (CHT: P-I E CHT: P-II E)	04 hrs / 04 hrs	60/60	03 hrs	20	80	100	04
	Practical	DSE (CHPr: E)	04 hrs	52	03 hrs	10	40	50	02
VI	*Theory P-I /P- II	DSE (CHT: P-I F CHT: P-II F)	04 hrs / 04 hrs	60/60	03 hrs	20	80	100	04
	Practical	DSE (CHPr: F)	04 hrs	52	03 hrs	10	40	50	02
Total						180	720	900	36

*Candidate shall choose either paper –I or P-II but not both in DSE theory.

SKILL ENHANCEMENT COURSE (SEC) for Chemistry opted as DSC

Semester	Practical	Subject Code	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam.	Internal Assessment Marks	Sem final Exam. Marks	Total Marks	Credits
V	Practical	(SEC-CH- 1E)	04 hrs	40	3 hrs	10	40	50	02
V	Practical	(SEC-CH- 2E)	04 hrs	40	3 hrs	10	40	50	02
VI	Practical	(SEC-CH- 1F)	04 hrs	40	3 hrs	10	40	50	02
VI	Practical	(SEC-CH- 2F)	04 hrs	40	3 hrs	10	40	50	02
Total						40	160	200	08

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - V

CHEMISTRY: Paper-I (CHT:P-I E)

(Candidate shall choose either Paper-I or paper-II)

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

I. Coordination Chemistry-II and Organometallic Compounds:

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for O_h and T_d complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Organometallic Compounds: Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds), heptacity. Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Structure and bonding of mononuclear and polynuclear carbonyls of 3d metals. π-acceptor behaviour of carbon monoxide. **(15 Lectures)**

II: Analytical Chemistry

Flame Atomic Absorption and Emission Spectrometry*:* Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Thermal methods of analysis: Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Separation techniques: Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions.Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: GLC, and TLC. **(15 Lectures)**

III. Biochemistry:

Carbohydrates: Classification of carbohydrates, reducing and non-reducing sugars, their open chain structure. Epimers, mutarotation and anomers. Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (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. Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups.

Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and their role in biological reactions, Specificity of enzyme action(Including stereospecificity), Drug action-receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group,-NH_2 group, double bond and aromatic ring,

Nucleic Acids: Components of Nucleic acids: Adenine, guanine, thymine, Uracil 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.

Lipids: Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

(15 Lectures)

IV. Quantum Chemistry:

Black body radiation, Spectral distribution of black body radiation, Plank's theory, derivation for Planck's radiation law, photoelectric effect, Compton effect, wave nature of electron,

derivation of Schrödinger's wave equation, wave function and its interpretation, Eigen function and Eigen values, normalization and orthogonality.

Equation of motion for a particle, Newtonian, Lagrangian and Hamiltonian equations of motion, elementary wave motion. Operators, eigen values and expectation values, commuting operators, linear operator and hermitian operators. Solutions of Schrödinger equations of a free particle, particle in a box problem: in one and three dimensions, degeneracy, reflection and penetration of a particle in a one dimensional box of semi-infinite barrier, a particle in a box of finite walls.

Rigid rotator, derivation of selection rules for transitions in rotating molecule, linear harmonic oscillator, Hermite polynomials. Equation for the hydrogen atom in spherical polar coordinates and an indication of the method of its solution, the quantum numbers and their significance**.** **(15 Lectures)**

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - V

CHEMISTRY: Paper-II (CHT:P-II E)

(Candidate shall choose either Paper-I or paper-II)

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs./wk. Total Practical: 52 hrs.**
		40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

I. Coordination Chemistry-II and Organometallic Compounds:

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for O_h and T_d complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Organometallic Compounds: Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds), heptacity. Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Structure and bonding of mononuclear and polynuclear carbonyls of 3d metals. π-acceptor behaviour of carbon monoxide. **(15 Lectures)**

II. Industrial chemistry

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.

Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

Alloys: Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels. **(15 Lectures)**

III. Introduction to Green Chemistry

Meaning of Green Chemistry. Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry Twelve principles of Green Chemistry with their explanations and examples

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)
2. Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction
3. Ultrasound assisted reactions: sonochemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)
4. Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.
5. Designing of Environmentally safe marine antifoulant.
6. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.
7. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
8. Healthier fats and oil by Green Chemistry: Enzymatic interesterification for production of no Trans-Fats and Oils **(15 Lectures)**

IV. Quantum Chemistry:

Black body radiation, Spectral distribution of black body radiation, Plank's theory, derivation for Planck's radiation law, photoelectric effect, Compton effect, wave nature of electron, derivation of Schrödinger's wave equation, wave function and its interpretation, Eigen function and Eigen values, normalization and orthogonality.

Equation of motion for a particle, Newtonian, Lagrangian and Hamiltonian equations of motion, elementary wave motion. Operators, eigen values and expectation values, commuting operators, linear operator and hermitian operators. Solutions of Schrödinger equations of a free particle, particle in a box problem: in one and three dimensions, degeneracy, reflection and penetration of a particle in a one dimensional box of semi-infinite barrier, a particle in a box of finite walls.

Rigid rotator, derivation of selection rules for transitions in rotating molecule, linear harmonic oscillator, Hermite polynomials. Equation for the hydrogen atom in spherical polar coordinates and an indication of the method of its solution, the quantum numbers and their significance**.** **(15 Lectures)**

CHEMISTRY LAB: CHPr: E

(Common for both Paper I and II)

SET –I: INORGANIC EXPERIMENTS

A. Gravimetric Analysis (20 marks)

1. Determination of barium as $BaSO_4$.
2. Determination of Aluminium as Al_2O_3.
3. Determination of iron as Fe_2O_3.

B. Complex Preparation(10 marks)

4. Preparation of trans-potassium diaqua di oxalato chromate (III).
5. Preparation of tris(thiourea) copper (I) sulphate monohydrate.
6. Preparation of sodium tris oxalate ferrate (III).

SET –II: PHYSICAL EXPERIMENTS

1. Determination of concentration of HCl and CH_3COOH or mixture of HCl + CH_3COOH by conductometric titrations using standard NaOH.
2. Determination of equivalent conductance of strong electrolyte (NaCl) and equivalent conductance at infinite dilution (λ_∞).
3. Determination of concentration of strong acid by potentiometric titration against standard solution of 0.1 N NaOH.
4. Determination of K_a of a weak acid potentiometrically.
5. Verification of Beer- Lambert's law by colorimetric method. Calculation of molar extinction coefficient and determination of unknown concentration of tetraammine copper (II) complex / ferric thiocyanate complex.
6. Determination of critical solution temperature of two partially miscible liquids (water and phenol).

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examinations

In a batch of 10 students in the practical examination, 05 students shall be given Set – I experiments: **Inorganic** (one each from A and B) and the other 05 students be Set–II experiments (**PHYSICAL EXPERIMENTS**). Selection of experiments may be done by the students based on the picking up of chits.

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

SET-I: INORGANIC EXPERIMENTS

Note: At least two different experiments from set I (one each from A and B) shall be given in a batch of 05 students. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

A. Gravimetric Determination (20 Marks)

Technique-02 marks, Accuracy-16 marks, calculation - 02marks, Total - 20 marks

Deduction of Marks for accuracy:

±6mg -16 marks, ± 8mg-14 marks, ±10 mg -12 marks, ±12mg-10 marks, ±14mg-08 marks, ±16mg-06 marks, above ±16 mg -zero marks.

B. Complex Preparation(10 marks)

Technique-02 marks, Yield of the complex- 08marks, Total -10 marks

Deduction of Marks for accuracy:

Preparation Error yield- Less than 10%- 08 marks, 11-15% -06 marks, 16-20% -04 marks, 21-25% -03 marks, more than25% -zero marks

SET –II: PHYSICAL EXPERIMENTS

NOTE: In a batch of 05 students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Technique and Presentation-3 Calculation and graph- (5+4) 9 marks, Accuracy-18 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15% 12 marks, 16-20% 6 marks, above 20% zero (0) marks

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - VI

CHEMISTRY: Paper-I (CHT: P-I F)

(Candidate shall choose either Paper-I or II)

Credits: I. Theory	**: 04**	**Theory class 4hrs /wk. Total theory: 60 Lectures**
		80 marks for Sem. end Examination (3 hrs) & 20 marks IA
II. Practical	**: 02**	**Practical: 4 hrs. / wk. Total Practical: 52 hrs.**
		40 marks for Sem. end Examination (3 hrs) & 10 marks IA
Total Credits	**: 06**	**Total Theory marks 100 and Practical marks 50**

I. Metallurgy, Inorganic Polymers and Bio-Inorganic chemistry

Metallurgy: Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy(Ag and Au), Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond's process.

Inorganic Polymers: Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Bio-inorganic chemistry: Role of metal ions present in biological systems with special reference to Na^+, K^+ and Mg^{2+} ions: Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones). **(15 Lectures)**

II. Application of Spectroscopy to Simple Organic Molecules

a)Ultraviolet Spectroscopy:

Electromagnetic radiations, electronic transitions, λ_{max} & ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes- alicyclic homo nuclear and hetero nuclear. cis – trans isomerism, α, β – unsaturated compounds, aldehydes, ketones, carboxylic acids and esters.

b)Infrared Spectroscopy:

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

c) Nuclear Magnetic resonance(NMR):

Basic principles of PMR, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals. Interpretation of PMR structure of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, ethyl acetate, toluene, acetophenone and acetanilide. **(15 Lectures)**

III. Molecular Spectroscopy:

Electromagnetic spectrum, Interaction of electromagnetic radiation with matter.

(a). Rotational spectroscopy:

Rotation of molecules, diatomic: rigid rotator, selection rule: derivation for expression of energy and bond length (HCl), problems on bond length, polyatomic molecules: linear, symmetric top, asymmetric top molecules (qualitative approach).

(b). Vibrational spectroscopy:

Vibrating diatomic molecules - energy of diatomic molecules, Hooks law and force constant, Vibrational spectra: harmonically vibrating diatomic molecules (HCl) and anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies, and problems on force constants. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectra: Classical theory, Rotational Raman spectroscopy (Linear and symmetric top molecules for S and R branch), Vibrational Raman spectroscopy; vibration - rotational Raman spectra(Rotational fine structures), complementary of Raman and IR.

(c). Electronic spectroscopy:

Diatomic molecules: Born- Oppenheimer approximation, Vibrational course structure of electronic transition and intensity, Franck – Condon principle, pre-dissociation, ‘g’ and ‘u’ transitions and their applications in organic molecules. **(15 Lectures)**

IV. Photochemistry and Chemical Kinetics-II

Photochemistry: Characteristics of electromagnetic radiation, Beer –Lambert's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield and its determination using thermopile and actinometer, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, quenching. Role of photochemical reactions in biochemical processes, photo stationary states, chemiluminescence, Fluorescence and phosphorescence. (numerical problems). **(10 Lectures)**

Chemical Kinetics-II : Reversible, Parallel, Consecutive and Chain reactions. Derivations of rate constant for first order parallel, reversible and consecutive reactions. Reaction kinetics of thermal and photochemical Hydrogen – Bromine Reactions. **(05 Lectures)**

Discipline Specific Elective (DSE) under CBCS

B.Sc. Semester - VI

CHEMISTRY: Paper-II (CHT:P-II F)

(Candidate shall choose either Paper-I or paper-II)

Credits: I. Theory : 04 **Theory class 4hrs /wk. Total theory: 60 Lectures**
80 marks for Sem end Examination(3 hrs) & 20 marks IA
II. Practical : 02 **Practical: 4 hrs./wk. Total Practical: 52 hrs.**
40 marks for Sem end Examination(3 hrs) & 10 marks IA
Total Credits : 06 **Total Theory marks 100 and Practical marks 50**

I. Environment Chemistry

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Methods of estimation of CO, NO_X, SO_X and control procedures.

Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens.

Water Pollution: Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.

Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal.

Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water. **(15 Lectures)**

II. Application of Spectroscopy to Simple Organic Molecules

a)Ultraviolet Spectroscopy:

Electromagnetic radiations, electronic transitions, λ_{max} & ε_{max}, chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes- alicyclic homo nuclear and hetero nuclear. cis – trans isomerism, α, β – unsaturated compounds, aldehydes, ketones, carboxylic acids and esters.

b) Infrared Spectroscopy:

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

c) Nuclear Magnetic Resonance (NMR):

Basic principles of PMR, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals. Interpretation of PMR structure of simple organic molecules such as ethylbromide, ethanol, acetaldehyde, ethyl acetate, toluene, acetophenone and acetanilide. (15 **Lectures)**

III. Molecular Spectroscopy:

Interaction of electromagnetic radiation with matter, electromagnetic spectrum.

(a). Rotational Spectroscopy:

Rotation of molecules, diatomic: rigid rotator, selection rule : derivation for expression of energy and bond length (HCl), problems on bond length, polyatomic molecules: linear, symmetric top, asymmetric top molecules(qualitative approach).

(b). Vibrational Spectroscopy:

Vibrating diatomic molecules - energy of diatomic molecules, force constant, vibrational spectra: harmonically vibrating diatomic molecules (HCl) and anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies, and problems on force constants. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectra: Classical theory, Rotational Raman spectroscopy (Linear and symmetric top molecules for S and R branch), Vibrational Raman spectroscopy; vibration - rotational Raman spectra(Rotational fine structures), complementary of Raman and IR.

(c). Electronic Spectroscopy:

Diatomic molecules: Born- Oppenheimer approximation, vibrational course structure of electronic transition and intensity, Franck – Condon principle, pre-dissociation, ‘g’ and ‘u’ transitions and their applications in organic molecules. **(15 Lectures)**

IV. Polymer Chemistry and Micelle:

Polymer Chemistry: Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Crystallization and Crystallinity: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. Nature and structure of polymers-Structure Property relationships.

Determination of molecular weight of polymers (M_n, M_w, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Properties of Polymers: (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, polyamides. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

(12 Lectures)

Micelle: Emulsions, micro emulsions or micellar emulsions, and its Stability, Properties of Micro emulsions**:** electro kinetic effects. Colloidal electrolytes or association colloids, types of Colloidal electrolytes. **Micelles:** surface-active agents or surfactants. (**03 Hours**)

CHEMISTRY LAB: CHPr-F

(Common for both Paper I and II)

SET – I: PHYSICAL EXPERIMENTS

1. Determination of dissociation constant of acetic acid conductometrically.
2. Determination of solubility of sparingly soluble salt ($BaSO_4$/$PbSO_4$) conductometrically.
3. Determination of redox potentials of Fe^{3+}/Fe^{2+} using of $FeSO_4.7H_2O$ solution (0.1N) by potentiometric titration against the standard solution of $K_2Cr_2O_7$ (0.1N)
4. Determination of solubility and solubility product of sparingly soluble salts (AgCl) potentiometrically.
5. Preparation of standard acidic buffer solutions using 0.1M acetic acid & 0.1M sodium acetate using Henderson-Hasselbatch and determination of mole ratio of buffer solutions of unknown pH.
6. Determination of percentage composition of unknown mixture of A and B liquids using Abbe's refractometer (formula and graphical method).

SET-II: INORGANIC / ORGANIC

A. Ore / Alloy Analysis (20 marks)

1. Extraction of Iron (III) from haematite ore or solid Fe_2O_3 and determination of percentage of iron in the solution using standard $K_2Cr_2O_7$ solution (internal indicator method).
2. Extraction of Cu and Zn from brass and determination of percentage of copper in the solution using standard $Na_2S_2O_3$ solution.
3. Extraction of calcium from limestone and determination of percentage of calcium in the solution by oxalate method.

B. Organic analysis (10 marks)

4. Separation of amino acids by paper chromatography, measuring R_f value and determination of glycine present in the solution volumetrically.
5. Saponification value of oil or fat.
6. Determination of Iodine number of an oil/ fat.

Note: There shall be instructions / training for the students about laboratory etiquettes, handling of reagents, laboratory safety measures, use of apparatus / instruments pertaining to the semester before commencement of the regular practicals. The same shall be recorded in the Journal.

Examinations

A batch of 10 students in the practical examination, 05 students may be given Set – I experiments (**PHYSICAL EXPERIMENTS**) and the other 05 students may be given Set – II experiments **(SET-II: INORGANIC / ORGANIC)**. Selection of experiments may be done by the students based on the picking up of chits.

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

SET – I : PHYSICAL EXPERIMENTS

NOTE: In a batch of 05 students, not more than two students should get the same experiment in the practical examination. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

Distribution of Marks:

Technique and Presentation-3 Calculation and graph- (5+4) 9 marks, Accuracy-18 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15% 12 marks, 16-20% 6 marks, above 20% zero (0) marks

SET-II: INORGANIC / ORGANIC

Note: At least two different experiments from set II (one each from A and B) shall be given in a batch of 05 students. Selection of experiments may be done by the students based on the picking up of chits. Viva questions may be asked on any of the experiments prescribed in the practical syllabus.

A. Ore / Alloy Analysis(20 marks)

Technique-02 marks, Accuracy- 14 marks, calculation -4 marks, Total 20 marks.

Deduction of Marks for accuracy:

Determination ±0.2 CC -14marks, ± 0.4 CC- 12marks, ±0.6 CC- 10 marks, ±0.8 CC- 06 marks, above ±0.9 - zero marks.

B. Organic analysis (10 marks)

Technique-02 marks Accuracy – 08 marks, Total 10 marks.

Deduction of Marks for accuracy:

Determination ±0.2 CC -08marks, ± 0.4 CC- 06marks, ±0.6 CC- 04 marks, ±0.8 CC- 03 marks, above ±0.9 - zero marks.

GENERAL PATTERN OF THEORY QUESTION PAPER FOR ALL THE SEMESTERS

1. **Question number 1-12 carries 2marks to answer any 10 questions : 20 marks**
2. **Question number 13-21 carries 5marks to answer any 6 questions : 30 marks**
3. **Question number 22-26 carries 10marks to answer any 3 questions : 30 marks**
   (10 marks questions may be 6+4 or 7+3 or 10) Total: 80 marks

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Revised SECs

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - V

CHEMISTRY (Practicals) : SEC- I (SEC-CH- 1E)

Soil and Water Analysis

No. of Credits: 02 **Total Syllabus: 40 hrs / Sem** **Teaching hrs / week: 04 hrs**

Practical Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)
Duration of Exam: 3 hrs

1	Determination of pH of different types of soil samples
2	Determination of electrical conductivity of different types of soil samples.
3	Determination of total alkalinity of soil.
4	Determination of total organic matter in the given soil Sample.
5	Determination of available nitrogen of the soil sample
6	Determination of total Phosphorous of the soil sample
7	Determination of Ca (II) and Mg(II) ions from soil sample.
8	Determination of Fe (II) and Fe (III) ions from soil sample.
9	Determination of K from soil sample by flame photometry
10	Determination of Na from soil sample by flame photometry
11	Determination of available sulphur in soils
12	Determination sulfate by Turbidity method / TDS of water

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - V

CHEMISTRY (Practicals) : SEC- 2 (SEC-CH- 2E)

Real sample Analysis

No. of Credits: 02 **Total Syllabus: 40 hrs / Sem** **Teaching hrs / week: 04 hrs**

Practical Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)
Duration of Exam: 3 hrs

1. Determination of total alkalinity in antacids.
2. Determination of vitamin 'C' in fruits juice/ formulations
3. Determination of free alkali present in different soaps / detergents
4. Determination of formaldehyde by sodium sulphite method
5. Determination of acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.
6. Determination of aspirin present in aspirin tablet conductometrically.
7. Determination cholesterol colorimetrically
8. Determination of proteins colorometrically using biuret reagent
9. Determination of amino acids colorimetrically using ninhydrin
10. Determination of Glucose /Sucrose colourimetrically using Fehling's Solution.
11. Determination of CMC of soap by surface tension method

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - VI

CHEMISTRY (Practicals) : SEC- 3 (SEC-CH- 1F)

Preparation and separation techniques

No. of Credits: 02 **Total Syllabus: 40 hrs / Sem** **Teaching hrs / week: 04 hrs**

Practical Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)
Duration of Exam: 3 hrs

1. Preparation of **magnesium** bisilicate from sodium silicate and magnesium chloride.
2. Preparation of organophosphate by esterification of phosphorous oxychloride.
3. Preparation of Organophosphonates by Michaelis-Arbuzov reaction.
4. Preparation of thiophosphate by diethyl phosphate.
5. Preparation of aspirin from salicylic acid.

6. Separation of Sudan yellow and Sudan red in the mixture by Thin Layer Chromatographic technique
7. Separation of Cu^{2+}, Co^{2+} and Ni^{2+} by Paper chromatographic method
8. Separation of Al^{3+}, Fe^{3+} and Zn^{2+} by Paper chromatographic method
9. Separation of o - and p - nitro anilines in a mixture by column chromatographic method
10. Separation of leaf pigments by column chromatography.
11. IR peak analysis for Functional groups using recoded IR Spectra.

SKILL ENHANCEMENT COURSES (SEC) in Chemistry

B.Sc. Semester - VI

CHEMISTRY (Practicals) : SEC- 4 (SEC-CH- 2F)

Industrial Chemistry

No. of Credits: 02 **Total Syllabus: 40 hrs / Sem** **Teaching hrs / week: 04 hrs**

Practical Examination: Maximum Marks- 50 (40 Semester End exam + 10 IA Exam)
Duration of Exam: 3 hrs

1. Analysis of Cement.
2. Determination of calcium in CAN fertilizer.
3. Determination of viscosity index of lubricants.
4. Determination of composition of dolomite by complexometric method
5. Determination of available chlorine in bleaching Powder.
6. Determination of molecular weight of polymer by viscosity method.
7. Preparation of Nylon6,6.
8. Preparation of phenol formaldehyde Resin.
9. Preparation of urea formaldehyde resin.
10. Nitration of salicylic acid by green method(Using calcium nitrate and acetic acid).
11. Study of food adulteration in Tea Powder, Coffee Powder, turmeric powder, Chilli Powder, oil / fat, milk, etc.

B.Sc. V and VI semesters

DISTRIBUTION OF MARKS FOR SEC EXPERIMENTS

A) QUANTITATIVE ESTIMATION EXPERIMENTS

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

i. Gravimetric Determination (30 Marks)

Reactions: -04 marks, Technique-04 marks, Accuracy-16 marks, calculation - 06marks, Total - 30 marks

Deduction of Marks for accuracy:

±6mg -16 marks, ± 8mg-14 marks, ±10 mg -12 marks, ±12mg-10 marks, ±14mg-08 marks, ±16mg-06 marks, above ±16 mg -zero marks.

Volumetric Analysis:

ii. Volumetric Analysis:

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

Distribution of Marks(30):

Accuracy for Standardization/blank titration - 09 marks , Accuracy for main titration 15 marks, Reactions and calculations – 4 marks, Technique and Presentation-2 marks, Total=30 marks.

Deduction of Marks for accuracy:

Standardization /blank titration: ±0.2 CC -09 marks, ± 0.4 CC- 07 marks, ±0.6 CC- 06marks, ±0.8 CC- 04 marks, above ±0.8 CC- zero marks.

Main titration: ±0.2 CC -15 marks, ± 0.4 CC- 12 marks, ±0.6 CC- 09 marks, ±0.8 CC- 06 marks, ±0.9 CC- 03 marks, above ±0.9 – zero marks.

B) PHYSICAL EXPERIMENTS

Distribution of Marks:

Journal-5 marks and Viva-Voce-5 marks

Distribution of Marks (30):

Technique and Presentation-3 Calculation and graph- (5+4) 9 marks, Accuracy-18 marks, Journal-5 marks, Viva-Voce-5 marks, Total=40 marks.

Deduction of Marks for accuracy:

Error up to 5% - 18 marks, 6 - 10% 15 marks, 11-15% 12 marks, 16-20% 6 marks, above 20% zero (0) marks

C) Preparation Experiments (40 Marks):

Distribution of Marks:

Journal – 05 marks , Viva-Voce-5 marks+ 10 marks

Reaction and calculation of theoretical yield – 3 mark, technique and presentation-3 marks , observed yield -20marks, M.P- 04 marks. Total – 30 marks.

Deduction of Marks:

Error yield- less than 10%- 20 marks, 11-15% 15 marks, 16-20% 10 marks, 21-25% 05 marks, more than 25% Zero marks

D) Chromatographic Techniques

Distribution of Marks:

Journal – 05 marks, Viva-Voce-5 marks= 10 marks

For main experiment: 30 marks

a. Preparation of paper / Column for Chromatography: 15 marks
b. Spotting of TLC: 05 marks
c. Identification of Spots: 05 Marks
d. R_f Calculation: 05 marks

   Marks for Accuracy: Error up to 10% -30 marks, 11-15%- 25marks, 16-20%- 20 marks, 21-25% - 15 marks, 26 – 30 % - 10 marks and above 30% nil.