DAVANGERE UNIVERSITY

Shivagangothri Campus, Tolahunase, Davangere -577 007

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Chemistry Major & One Minor Discipline Scheme for the Four Years Chemistry B.Sc. Undergraduate Honors Programme with effect from 2021-22

SEMESTER-I

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	3
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	3
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1C1CHM1L	**CHEMISTRY: CHM T-1**	40	60	100	4	-	-	4	3
	21BSC1C1CHM1P	**CHEMISTRY LAB : CHM P-1**	25	25	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
SEC1	21BSC1SE1CS1	Digital Fluency*	25	25	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education-Yoga	25	-	25	-	-	2	1	-
VBC2	21BSC1V2HW1	Health & Wellness	25	-	25	-	-	2	1	-
OEC1	21BSC1O1CHM1	**OE-1.1:CHEMISTRY IN DAILY LIFE**	40	60	100	3	-	-	3	3
		OE-1.2: General Chemistry-1	40	60	100	3	-	-	3	3
				Total Marks	**700**	**Semester Credits**			**25**	

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*B.Sc (Computer Science) & BCA Students have to opt other Discipline SEC subjects

SEMESTER-II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	3
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	3
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2CHM2L	**CHEMISTRY: CHM T-2**	40	60	100	4	-	-	4	3
	21BSC2C2CHM2P	**CHEMISTRY LAB : CHM P-2**	25	25	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	20	30	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC4	21BSC2V4NC1	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC2	21BSC2O2CHM2	**OE-2.1:** MOLECULES OF LIFE OE- **2.2 General Chemistry-2**	40	60	100	3	-	-	3	3
				Total Marks	**700**	**Semester Credits**			**25**	

Syllabus for III – VIII semesters will be provided later

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SECOND YEAR; SEMESTER-III											
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	3
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	3
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3C3CHM3L	**CHEMISTRY: CHM T-3**	40	60	100	4	-	-	4	3
	21BSC3C3CHM3P	**CHEMISTRY LAB : CHM P-3**	25	25	50	-	-	4	2	3
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
SEC2	21BSC3SE2ES2	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Physical Education-Sports	25	-	25	-	-	2	1	-
VBC6	21BSC3V6NC2	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
OEC3	21BSC3O3CHM3	***	40	60	100	3	-	-	3	3
			Total Marks		**700**	**Semester Credits**			**25**	

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SEMESTER-IV

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	3
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	3
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C4CHM 4L	**CHEMISTRY: CHM T-4**	40	60	100	4	-	-	4	3
	21BSC4C4CHM 4P	**CHEMISTRY LAB : CHM P-4**	25	25	50	-	-	4	2	3
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
AECC2	21BSC4AE1ES2	Constitution of India	25	25	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC8	21BSC4V6NC3	NCC/NSS/R&R(S &G) / Cultural	25	-	25	-	-	2	1	-
OEC4	21BSC4O4CHM 4	***	40	60	100	3	-	-	3	3
			Total Marks		**700**	**Semester Credits**			**25**	

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SEMESTER-V

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
Chemistry as Major Discipline										
DSC5	21BSC5C5CHMMJ1L	**CHEMISTRY: CHM T-5**	40	60	100	3	-	-	3	3
	21BSC5C5CHMMJ1P	**CHEMISTRY LAB : CHM P-5**	25	25	50	-	-	4	2	3
DSC6	21BSC5C5CHMMJ2L	**CHEMISTRY: CHM T-6**	40	60	100	3	-	-	3	3
	21BSC5C5CHMMJ2P	**CHEMISTRY LAB : CHM P-6**	25	25	50	-	-	4	2	3
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	3
			25	25	50	-	-	4	2	3
VC1	21BSC5VC1US	Unix & Shell Programming	40	60	100	3	-	-	3	3
	21BSC5VC1FD	Fundamentals of Data Science								
VBC9	21BSC5V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC10	21BSC5V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC3	21BSC5SE3CS3	Cyber Security	25	25	50	1	-	2	2	2
		Total Marks	**700**			**Semester Credits**			**22**	

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SEMESTER-VI										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
Chemistry as Major Discipline										
DSC7	21BSC6C6CHMMJ1L	**CHEMISTRY: CHM T-7**	40	60	100	3	-	-	3	3
	21BSC6C6CHMMJ1P	**CHEMISTRY LAB : CHM P-7**	25	25	50	-	-	4	2	3
DSC8	21BSC6C6CHMMJ2L	**CHEMISTRY: CHM T-8**	40	60	100	3	-	-	3	3
	21BSC6C6CHMMJ2P	**CHEMISTRY LAB : CHM P-8**	25	25	50	-	-	4	2	3
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	3
			25	25	50	-	-	4	2	3
VC2	21BSC6VC2HT	Health Care Technologies	40	60	100	3	-	-	3	3
	21BSC6VC2DM	Digital Marketing								
INT1	21BSC6 INT1L	Internship	25	25	50	-	-	2	2	2
VBC1	21BSC6V5PE5	Physical Education- Sports	25	-	25	-	-	2	1	-
VBC2	21BSC6V6NC4	NCC/NSS/R&R(S&G) / Cultural	25	-	25	-	-	2	1	-
SEC4	21BSC6SE4CS4	Professional Communication	25	25	50	1	-	2	2	2
Total Marks					**700**	**Semester Credits**			**24**	
Total Marks for BSC Program					**4200**	**Total Credits for BSC Program**			**146**	

Chemistry Subject as a Minor Discipline

SEMESTER-V										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
DSC5 As a Minor Subject	21BSC5C5CHMMN1L	CHEMISTRY: CHM T-5	40	60	100	3	-	-	3	3
	21BSC5C5CHMMN1P	CHEMISTRY LAB :CHMP-5	25	25	50	-	-	4	2	3

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SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC6 As a Minor Subject	21BSC6C6CHMMN1L	CHEMISTRY: CHM T-7	40	60	100	3	-	-	3	3
	21BSC6C6CHMMN1P	CHEMISTRY LAB :CHM P-7	25	25	50	-	-	4	2	3

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B.Sc, III- SEMESTER (SEP Syllabus)

(Effective From 2024-25)

PAPER – III: Selected Topics in Chemistry-I

Total Hours: 56 **4 hrs/week**

UNIT-I : INORGANIC CHEMISTRY **14 hours**

Chapter-1: s and p-block elements **5 hours (8 marks weightage)**

s-block elements (Alkaline earth metals) : Amphoteric and basic nature, elctropositive character, reducing properties, flame colouration and anomalous behavior of Be.

p-block elements : BF_3- Preparation, properties, electron acceptor character and applications.

Hydrides of Boron: Diborane : Preparation, properties, structure and bonding and uses.

Borazine : Preparation, properties, structure and uses.

Fullerenes: Introduction, preparation, properties and uses.

Chapter-2: Solvents **5 hours (8 marks weightage)**

Classification, comparative account of water and liquid ammonia as solvents (striking similarities and factors which make them good polar solvents). Reactions in liquid ammonia and water, acid base neutralisation, oxidation-reduction, complex formation, ionisation of acetic acid. Solvolysis and solvation. Solutions of alkali metals in liquid ammonia, advantages and disadvantages of liquid NH_3 as solvents.

Chapter-3: Industrial Chemistry **4 hours (4 marks weightage)**

Glass : Raw materials, manufacture by tank furnace method, colouring agents, annealing of glass, types of glass – soda glass, potash glass, flint glass, pyrex glass (their composition and uses).

Cement : Raw materials, manufacture by dry process, mechanism of setting. Role of water and gypsum in setting process.

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Paints : Constituents and their functions, manufacture of white lead by chamber's process and electrolytic process

UNIT-II: ORGANIC CHEMISTRY **14 hours**

Chapter-1: Alcohols **7 hours (11 marks weightage)**

Monohydric alcohol : Classification, preparation from alky halides, aldehydes and ketones. Distinguish test between 1^0, 2^0, 3^0 by Victor-Meyer method and Lucas method. Reaction of alcohol: Oxidation by $KMnO_4$ and OsO_4 and esterification with mechanism,

Dihydric alcohol : Preparation of glycol from alkene. Reactions of 1,2 diols: with lead tetra acetate, periodic acid and Pinacol - Pinacolone rearrangement with mechanism. Uses of ethylene glycol.

Trihydric alcohol : Manufacture of glycerol from spent lye and synthesis from propene. Reactions of glycerol with oxalic acid (at different temperatures) and PCl_5. Uses of glycerol, preparation of nitroglycerine, composition and uses of cordite and dynamite.

Chapter-2: Phenols **4 hours (5 marks weightage)**

Classification, nomenclature, methods of preparation from Cumene, Dow process, and from diazonium salts. Acidity of phenols- resonance, stabilization of phenoxide ion, compare the acidity of alcohol and phenol. Effect of substituent's on acidity of phenols, electron withdrawing groups ($-NO_2$, -Cl, -CN, -CHO, -COOH), electron donating groups ($-CH_3$, $-OCH_3$, $-NH_2$).

Reactions of phenols: Claisen rearrangement, Fries rearrangment and Reimer-Tiemann reactions with mechanism.

Chapter-3: Soaps and Detergents **3 hours (4 marks weightage)**

Introduction, common fatty acids, glycerides- simple & mixed, hydrogenation of unsaturated oils and hydrogenolysis of oils and fats. Determination and significance of saponification value, iodine value and acid value. Manufacture of soap by hot process. Mechanism of cleansing action of soap. Synthetic detergents, superiority of detergents over soaps. Types of detergents (cationic, anionic and non-ionic).

UNIT-III : PHYSICAL CHEMISTRY **14 hours**

Chapter-1: Electrochemistry-I **8 hours (12 marks weightage)**

Electrolytes, specific conductance, equivalent, molar conductivity and molar conductance at infinite dilution. Debye-Huckel theory of strong electrolytes; asymmetry effect, electrophoretic effect and viscous Effect. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number: Definition and determination by

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moving boundary methods. Applications of conductance measurement : i) Determination of degree of dissociation, ii) Determination of equilibrium constants of weak electrolytes. Conductometric titrations: Strong acid v/s strong base and weak acid v/s strong base. Common ionic effect, application of common ionic effect, solubility product, relation between solubilty and solubilty product and application of solubilty product (qualitative analysis of cationic mixture).

Chapter-2: Solid State and Crystallography **6 hours (8 marks weightage)**

Classification of solids – Isotropic and anisotropic crystals. Elements of symmetry – plane, axes and center of symmetry. Definition of unit cell & space lattice. Laws of crystallography: – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry.

Representation of planes – Miller Indices, Weiss indices and its calculations using simple examples (AX and AX_2 types).

X-ray diffraction by crystals, derivation of Bragg's equation. Determination of crystal structure of NaCl. Liquid Crystals: difference between solids, liquids and liquid-crystals, Classification of liquid crystals into Smectic and Nematic. Applications of Liquid Crystals.

(Note: Numerical problems must be solved wherever necessary)

UNIT-IV : ANALYTICAL CHEMISTRY **14 hours**

Chapter-1: Quantitataive analysis- Instrumental methods **10hrs (14 marks weightage)**

Introduction to electromagnetic radiation, 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, Ti and PO_4^{3-}) and numerical problems on application of Beer's law.

Chapter-2: Nephelometry and Turbidimetry **4 hrs (6 marks weightage)**

Introduction, principle, instrumentations of nephelometry and turbidimetry; effects of concentration, particle size and wavelength on scattering; choice between nephelometry, applications of nephelometry and turbidimetry (determination of SO_4^{2-})

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III Semester Chemistry-Practicals (4hrs /week)

Chemistry: Practicals - III

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

The following cations and anions are suggested.

Cations: NH_4^+, Bi^{3+}, Cu^{2+}, 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-}, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, SO_4^{2-}, $C_2O_4^{2-}$ and PO_4^{3-}

Note: A minimum of EIGHT experiments must be performed and recorded

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For III Sem, Students

Course/Paper code: Elective

Title of the paper: 3.1 Environmental Chemistry

Courses	Credits	No. of Classes per week	Total No. of Lectures	Duration of Exam in hrs	Internal Assessment Marks	Semester end Exam Marks	Total Marks
Theory	02	02	32	02	10	40	50

Unit –I **16 Hours**

Environmental Chemistry

Vertical temperature and vertical structure of atmosphere, Heat/ radiation budget of the earth: Energy balance of earth, Bio Geo Chemical Cycles in environment: Oxygen, Carbon, Nitrogen, Phosphorous, Sulphur Cycle, Bio distribution of elements

Ozone layer

Ozone layer- Earth's protective umbrella: Formation & depletion, Ozone hole over Antarctica, harmful effects of Chlorofluoro Carbons (CFC).

Acid Rain: Introduction, Theories of acid rain, adverse effects of acid rain, control of acid rain

Unit II **16 Hours**

Environmental Pollution

Air pollution dealing with Particles, ions and radicals. Important photochemical reactions in atmosphere, Major sources of Air pollution, Aerosols and their effects, Effects of particulate matter, indoor and occupational pollutants, Air Quality standards

Vehicular pollution

Automobile emissions, Fuels: Diesel v/s CNG, biofuels, prevention and control of vehicular pollution, gobal efforts in reducing vehicular pollution

Smog: Definition, mechanism of smog formation, examples of London Smog, Los Angeles Smog

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For III Sem Students

Course/Paper code: Elective

Title of the paper: 3.2 Effects of Radioactivity

Courses	Credits	No. of Classes per week	Total No. of Lectures	Duration of Exam in hrs	Internal Assessment Marks	Semester end Exam Marks	Total Marks
Theory	02	02	32	02	10	40	50

Unit-I **16 Hours**

Introduction, Radiation, Natural and manmade sources of radioactive pollution, effects of radioactive pollution, biological effects of radiation, radiation effects on plants. Precautions to be taken in the event of nuclear war, preventive measures and control of radiation from nuclear power plants, atom bomb disaster in Hiroshima, three mile island disaster, Chernobyl : world's worst nuclear disaster.

Unit-II **16 Hours**

Disposal of hazardous radioactive waste. Radioactive waste, environmental problems and management of nuclear waste, disposal methods of radioactive waste, recent methods to dispose critically dangerous radioactive waste. Classification of hazardous waste, management of hazardous waste, treatment and disposal of hazardous chemical

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B.Sc, IV- SEMESTER (SEP Syllabus)

(Effective From 2024-25)

PAPER – IV: Selected Topics in Chemistry-II

Total Hours: 54 **4 hrs/Week**

UNIT-I : INORGANIC CHEMISTRY **14 hours**

Chapter-1: d-block and f-block elements **5 hours (7 marks weightage)**

d-Block elements: Electronic configuration, general characteristics of transition elements, oxidation states, atomic size, ionization potential, colour, complex formation, magnetic properties and acidic & basic properties of oxides- explanation with reference to 3d-series.

f-Block elements: Lanthanide series - Definition, electronic configuration, oxidation states, colour, complex formation and magnetic properties, lanthanide contraction, its causes and consequences, separation of lanthanides by ion-exchange method, applications of lanthanides.

Chapter-2: Metallurgy **9 hours (13 marks weightage)**

Thermodynamics of metallurgy, Ellingham's diagrams- features, applications and limitations, extraction of lead - self-reduction process and nickel from pentalendite, extraction of manganese from pyrolusite from allumino thermite process extraction of gold by hydrometallurgical process, refining of gold by quartation process, beryllium from beryl via sodium beryllium fluoride, Thorium from Monazite sand and Uranium from Pitch blende by aid digestion process.

UNIT-II: ORGANIC CHEMISTRY **14hours**

Chapter-1: Aldehydes and Ketones **5 hours (7 marks weightage)**

Structure and reactivity of carbonyl groups, preparation by oxidation of alcohols and alkenes. Reactions of aldehydes and ketones with hydroxyl amine, hydrogen cyanide, 2, 4-DNP. Reaction and mechanism of Benzoin, Cannizaro, Knoevenagel reaction. Clemmenson reduction, Wolff-Kishner reduction.

Chapter-2: Carboxylic acids **4 hours (6 marks weightage)**

Methods of preparation from alcohols and Grignard reagent, acidity of carboxylic acids, effect of substituents on acidity. Comparative study of (i) Acetic acid and formic acid (ii) Acetic acid and benzoic acid (iii) Acetic acid and monochloro acetic acid (iv) 2-Chloro butanoic acid and 1-chlorobutanoic acid.

Hydroxy acid: Effect of heat on α, β and γ – hydroxy acids.

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Chapter-3: Amines **3 hours (4 marks weightage)**

Classification with examples, synthesis of amines by reduction of nitro compounds and Hoffmann's degradation methods with mechanism. Basicity of amines. Comparative study of (i) Methyl amine, dimethyl amine and trimethyl amine (ii) Methyl amine and aniline (iii) Aniline and p-nitroaniline and p-toluidine (iv) Aniline, N-methyl aniline and N, N-dimethyl aniline. Separation of amines by nitrous acid method and Heinsberg's method

Chapter-4: Drugs **2 hours (3 marks weightage)**

Definition, classification of drugs based on the chemical and synthesis of sulfanilamide sulfacetamide, aspirin, phenacetin and paracetamol.

UNIT-III : PHYSICAL CHEMISTRY **14 hours**

Chapter-1: Electrochemistry-II **8 hours (11 marks weightage)**

Definition of EMF of a cell, standard electrode potential, IUPAC sign convention; Types of reversible electrodes with examples: gas-metal ion, metal-ion, metal insoluble salt-anion electrode, Redox electrode with examples – Quinhydrone electrode (To be mentioned).

Reference electrodes: Construction and working of SHE and calomel electrode. Concentration cell: Derivation of EMF using Nernst equation for electrolytic concentration cell without transference. Liquid junction potentials, elimination of liquid junction potential. Potentiometric titration involving only redox systems ($K_2Cr_2O_7$ v/s FAS).

Chapter-2: Phase Equilibria **6 hours (9 marks weightage)**

Introduction to the terms: phase, component, degrees of freedom. Statement and derivation of Gibbs phase rule, phase equilibria of one component system, water and Sulphur system. Two component systems: KI-water system. Freezing mixture- definition, examples. Explanation for congruent melting maximum, congruent melting minimum. Solid solutions – compound formation with congruent melting point (Mg-Zn) and incongruent melting point, ($FeCl_3$-H_2O) system.

(Note: Numerical problems must be solved wherever necessary)

UNIT-IV: ANALYTICAL CHEMISTRY **14 hours**

Chapter-1: Fundamentals of chromatography **4 hours (6 marks weightage)**

General description of chromatography- classification, chromatograms, retention time, retention factor, capacity factor, selectivity factor, band broadening, criteria for selection of

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IV Semester Chemistry-Practicals (4Hrs /Week)

Chemistry : Practicals – IV

1. Safety Practices in the Chemistry Laboratory, Knowledge about common toxic chemicals and safety measures in their handling, cleaning and drying of glassware's
2. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald's viscometer (Ethyl acetate, Toluene, Chloroform, Chlorobenzene or any other non-hazardous liquids)
3. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids)
4. Determination of molecular weight of non volatile solute by Walker-Lumsden method.
5. Determination of percentage of given electrolyte in phenol water system by miscibility temperature method.
6. Determination of percentage of given binary mixture (Glycerol-water) by viscosity method.
7. Determination of rate constant of Fe^{3+} catalyzed decomposition of H_2O_2.
8. Determination of rate constant of saponification of ethyl acetate.
9. Determination of critical solution temperature of phenol water system.
10. Determination of transition temperature of given hydrate salt ($Na_2S_2O_3.5H_2O$, CH_3COONa, and $SrCl_2\,6H_2O$).
11. Identification of the given amino acid (Glycine) by paper chromatography.
12. Determination of R_f values of two or three component systems by TLC

Note: A minimum of EIGHT experiments must be performed and recorded

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stationary and mobile phase. Column efficiency, factors affecting the column efficiency, van Deemter's equation and its modern version.

Chapter-2: Paper, Thin layer and Ion exchange chromatography

6 hrs (8 marks weightage)

Paper chromatography: Principle, types and applications.

Thin layer chromatography: Principle, R_f value, efficiency of TLC plates, methodology– selection of stationary and mobile phases, preparation of plates, spotting, development, identification & detection and qualitative applications.

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).

Chapter-3: Solvent Extraction **4 hrs (6 marks weightage)**

Types- batch, continous, efficiency, selectivity, distribution coefficient, Nernst distribution law, derivation, factors affecting the partition, relationship between % extraction and volume fraction, Numerical problems on solvent extraction. Solvent extraction of iron and copper.

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For IV Sem Students

Course/Paper code: Elective

Title of the paper: 4.1 Green Chemistry and Clean Energy Sources

Courses	Credits	No. of Classes per week	Total No. of Lectures	Duration of Exam in hrs	Internal Assessment Marks	Semester end Exam Marks	Total Marks
Theory	02	02	32	02	10	40	50

Unit-I **16 Hours**

Principles and goals of Green Chemistry, Green chemicals, Green reagents, Green catalysts, Green solvents. Emerging Green technologies, Microwave chemistry, Sono chemistry, Photo chemistry and Electro chemistry. Use of pesticides synthesized by Green chemistry route

Unit-II **16 Hours**

Growing energy demands, Resources of energy, Conventional sources of energy with example of hydroelectric power/ thermal power plants, nonconventional sources of energy: solar, wind, geothermal energy, ocean energy and tidal power. Fossil fuel based energy: coal, methanol, petroleum, natural gas, biomass energy, biogas. Hydrogen as an alternate source of energy. Energy consumption and conservation. Environmental impact assessment and environmental laws in India

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For IV Sem Students

Course/Paper code: Elective

Title of the paper: 4.2 Water

Courses	Credits	No. of Classes per week	Total No. of Lectures	Duration of Exam in hrs	Internal Assessment Marks	Semester end Exam Marks	Total Marks
Theory	02	02	32	02	10	40	50

Unit-I **16 Hours**

Introduction: Water quality parameters, standards and laws, Hard and Soft water, softening of water, demineralisation of waste water, purification of water for municipal purposes, chlorination and dechlorination, fluoridation and deflouridation, potability of water. Control of water pollution-minimisation, functions of central and state pollution control boards, recycling of waste water

Unit-II **16 Hours**

Analysis of water pollutants, objectives of water analysis, chemical substances affecting water quality: colour, odour, turbidity, conductivity, pH, acidity, alkalinity, etc, chemicals substances in water affecting health.

Definitions of following terms: Dissolved oxygen, COD (Chemical Oxygen Demand), BOD (Biological Oxygen Demand), and Total organic carbon content.

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(Science & Technology)

B.Sc., Question Paper Pattern (SEP)

CHEMISTRY

Time: 3hrs Total Marks :80

PART-A

I Answer all question questions **10X2=20**

1. **a.**
   b.
   c.
   d.
   e.
   f.
   g.
   h.
   i.
   j.

PART-B

II. Answer any SIX of the following questions **6X5=30**

2.
3.
4.
5.
6.
7.
8.
9.

(Note: Two questions from each unit)

PART-C

III. Answer any THREE of the following questions **3X10=30**

10. **(4+6 or 5+5)**
11. **(4+6 or 5+5)**
12. **(4+6 or 5+5)**
13. **(4+6 or 5+5)**

(Note: One question from each unit)

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B.Sc., Question Paper Pattern (SEP) for Chemistry OE

Time: 2hrs | Total Marks : 50

PART-A

I Answer any Five questions **5X2=10**

1. a.
   b.
   c.
   d.
   e.
   f.

(Note: Three questions from each unit)

PART-B

II. Answer any Four of the following questions **4X5=20**

2.
3.
4.
5.
6.
7.

(Note: Three questions from each unit)

PART-C

III. Answer any Two of the following questions **2X10=20**

10. **(4+6 or 5+5)**
11. **(4+6 or 5+5)**
12. **(4+6 or 5+5)**

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