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**	

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**	

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**	

B.SC, III- SEMESTER

CHEMISTRY: PAPER – III

Total Hours: 56

UNIT-I : INORGANIC CHEMISTRY — 14 hours

Chapter-1: S and P-block elements — **6 hours (8 marks weightage)**

Alkaline earth metals: Comparative study of diagonal relationship between Be and Al, hydration of ions, amphoteric and basic nature, elctropositive character, flame colouration, oxidation potential and anomalous behavior of Be.

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

Hydrides of Boron; Diborane - Preparation, properties, structure and bonding and uses. Borazine - Preparation, properties, structure and uses.

Carbon and silicon: Stuctural features of diamond and graphite, CO_2 and SiO^{2-} Correlation of their properties with structure.

Fullerenes: Introduction, preparation, properties and uses. Silicates – Types, structure, ultramarine and zeolites.

Chapter-2: Solvents — **5 hours (7 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, solvation, Solubility of ionic solids – its dependence of lattice energy and solvation energy. Solutions of alkali metals in liquid ammonia, advantages and disadvantages of liquid NH_3 as solvents.

Chapter-3: Glass, Cement and paints — **3 hours (5 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.

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 (10 marks weightage)**

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

Dr. U.S. MAHABALESHWAR
M.Sc., M.Phil., Ph.D
Professor & Dean, Science & Technology
Davangere University, Shivagangotri

Registrar
Davangere University
Shivagangotri, Davangere.

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007

Dihydric alcohol : Nomenclature, preparation of glycerol 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 : Nomenclature, manufacture of glycol from Spent lye and synthesis from propene. Reactions of glycerol with oxalic acid (at different temperatures), PCl_5 and fatty acids. Uses of glycerol, preparation of nitroglycerine, composition and uses of Cordite and dynamite.

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

Classification, nomenclature, methods of preparation from Cumene, Dow process, 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 Reimerr-Tiemann reactions with mechanism.

Chapter-3: Oils and fats **3 hours (4 marks weightage)**

Common fatty acids, glycerides- simple & mixed. Hydrogenation of unsaturated oils. 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, electrolytic conductance. Debye-Huckel theory of strong electrolytes; asymmetry effect and electrophoretic effect. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Transport number, definition and determination by Hittorf's method. Kohlrausch's law; its applications: determination of degree of dissociation, determination of equilibrium constants of weak electrolytes, determination of solubility product of sparingly soluble salt. Conductometric titrations: Strong acid v/s strong base, weak acid v/s strong base, mixture of acid vs. strong base.

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.

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,

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007

types of 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 7 hrs (12 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-})

Chapter 3: Sampling methods 3 hours (04 marks weightage)

Sampling and sample handling, preparation of sample, sample storage, sampling techniques of solid, liquid and gaseous samples. Hazards in sampling.

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^+, Pb^{2+}, 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-}, CH_3COO^-, 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.

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007

B.SC, IV- SEMESTER

CHEMISTRY : PAPER - IV

Total Hours: 56

UNIT-I : INORGANIC CHEMISTRY — 14 hours

Chapter-1: 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.

Chapter-3: 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.

UNIT-II: ORGANIC CHEMISTRY — 14 hours

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

Nomenclature, structure and reactivity of carbonyl groups in aldehydes and ketones. Methods of preparation of aldehydes and ketones by oxidation of alcohols and alkenes. Reactions of aldehydes and ketones with hydroxyl amine, hydrogen cyanide, 2,4-DNP. Reaction and mechanism of Aldol, Perkin's, Benzoin, Cannizaro, Knoevenagel reaction. Clemmenson reduction, Wolff-Kishner reduction.

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

Nomenclature of mono and dicarboxylic acids. 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.

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

Nomenclature, Classification with examples. Synthesis of amines by reduction of nitro compounds. Hoffmann's degradation methods with mechanism. Basicity of amines. Comparative study of (i) Methyl amine, dimethyl amine and trimethyl amine

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007

(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: Polymer Chemistry **2 hours (3 marks weightage)**

Classification of polymers-Types of polymerization, Mechanism of Free radical and ionic polymerization. Examples for addition and condensation polymers. Thermoplastics and thermosetting plastics. Synthesis of Styrene, Teflon, Nylon-6, Nylon-6,6, Backelite, PVC, Polythene and Natural rubber.

UNIT-III : PHYSICAL CHEMISTRY 14 hours

Chapter-1: Electrochemistry-II **6 hours (9 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 ($K_2Cr_2O_7$ vs. FAS).

Chapter-2: Phase Equilibria **7 hours (11 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 stationary and mobile phase and nature of adsorbents. Column efficiency, factors affecting the column efficiency, van Deemter's equation and its modern version.

Chapter-2: Solvent Extraction **4 hrs (6 marks weightage)**

Definition, types, principle and efficiency of extraction, sequence of extraction process, factors affecting extraction- pH, oxidation state, modifiers, synergistic, masking and salting out agents, techniques-batch, continuous extraction and counter current extraction, applications.

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007

Chapter-3: Paper, Thin layer and Ion exchange chromatography **6 hrs (8 marks weightage)**

Paper chromatography: Principal, types & 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).

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. Study of the variation of viscosity of sucrose solution with the concentration of a solute
4. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids
5. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose)
6. Determination of percentage of given electrolyte in phenol water system by miscibility temperature method.
7. Determination of percentage of given binary mixture (Glycerol-water) by viscosity method.
8. Determination of rate constant of Fe3+ catalyzed decomposition of H_2O_2.
9. Determination of rate constant of saponification of ethyl acetate.
10. Determination of critical solution temperature of phenol water system.
11. Determination of transition temperature of given hydrate salt ($Na_2S_2O_3.5H_2O$).
12. Identification of the given amino acid by paper chromatography.

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

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007

B.Sc., Question Paper Pattern (SEP)

CHEMISTRY

PART-A

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

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

(Note: Three questions from each unit.)

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.)

Dr. U.S. MAHABALESHWAR
M.Sc., M.Phil., Ph.D
Professor & Dean, Science & Technolo
Davangere University, Shivagangotri
Davangere-577 007, Karnataka, India

Registrar
Davangere Univer
Shivagangotri, Davang

CHAIRMAN
DOS in Chemistry
Davangere University
Shivagangotri, Davangere-577007