DAVANGERE UNIVERSITY, DAVANAGERE

B.Sc. (Hons.) Program

***

DRAFT SYLLABUS

CHEMISTRY

[Effective from 2021-22]

PROGRAM /COURSE STRUCTURE AND SYLLABUS as per the Choice Based Credit System (CBCS) designed in accordance with Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020 for

Bachelor of Science in CHEMISTRY (B.Sc.) (Hons.)

PREAMBLE

The higher education system in India is undergoing a substantial change in the last year with implementation of New Education Policy (NEP) leading to both qualitative and quantitative development of the beneficiaries. Quality higher education involved innovation that can be useful for efficient governance of higher education institutions, systems and society at large. The quality of Chemistry education profoundly impacts not only the academia but also research and innovation of a Country.

The undergraduate programme will prepare the students for both- academia and employability. The curriculum has been prepared with an aim to support a uniform, advanced and effective Chemistry curriculum for undergraduate studies in Chemistry. The concerns, needs and interests of students, teachers as well as societal expectations have been taken into consideration while developing this syllabus. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The programmes also state the attributes that it offers to inculcate at the graduation level. The graduate attributes encompass values related to well-being, emotional stability, critical thinking, social justice and also skills for employability.

The Chemistry Syllabus for B.Sc. Degree covers four academic years consisting of Eight semesters and this curriculum is prepared to give sound knowledge and understanding of Chemistry to undergraduate students. The goal of the syllabus is to make the study of chemistry stimulating, relevant and interesting. The syllabus has been prepared in a participatory manner, after discussions with a number of faculty members in the subject and after referring the existing syllabi, the new syllabi of Pre-University class, UGC model curriculum and the syllabi of other Universities and National level Institutes.

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**	

***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										

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	21BSC4O4CHM4	***	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**	

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

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

PROGRAM OUTCOMES:

After studying the Chemistry for 04 years, students will be able to:

PO 1 Demonstrate, solve and an understanding of major concepts in all the disciplines of chemistry.

PO 2 Provide students with broad and balanced knowledge and understanding of key chemical concepts.

PO 3 Develop in students a range of practical skills so that they can understand and assess risks and work safely and competently in the laboratory.

PO 4 Develop in students the ability to apply standard methodology to the solution of problems in chemistry.

PO 5 Provide students with knowledge and skill towards employment or higher education in chemistry or multi-disciplinary areas involving chemistry.

PO 6 Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO 7 To prepare students effectively for professional employment or research degrees in chemical sciences.

PO 8 To cater to the demands of chemical industries of well-trained graduates.

PO 9 To build confidence in the candidate to be able to work on his own in industry and institution of higher education.

PO 10 To develop an independent and responsible work ethics.

COURSE-WISE SYLLABUS

Semester I

Course Code: 21BSC1C1CHM1L **Course Title:** CHM T-1

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	04	04	56	3	40	60	100
Practical	02	04	52	3	25	25	50

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

(Numerical problems are to be solved wherever applicable**)**

Atomic structure

Review of theories atomic model, limitations of Rutherford's atomic model. Bohr's theory, derivation of radius and energy of an electron in hydrogen atom, limitations of Bohr's theory, Atomic spectra of Hydrogen.

Wave mechanics: Dual behavior of matter and radiation, de Broglie's equation, Heisenberg Uncertainty principle and their related problems.

Quantum mechanics. Quantum theory of radiation (Brief account), Derivation of Schrodinger's wave equation for hydrogen atom and meanings of various terms in it. Significance of ψ and ψ^2. Radial and angular wave functions (atomic orbitals) and their distribution curves for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Quantum numbers and their significance. Orbital shapes of *s, p, d and f* atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms (atomic number up to 30). IUPAC nomenclature of elements with atomic number greater than hundred. Effective nuclear charge, shielding/screening effect, factors affecting screening effect. Slater's rules and its limitations.

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

Fundamentals of organic chemistry

Classification and IUPAC nomenclature of organic compounds, Hybridization (sp, sp^2 and sp^3 types to be discussed by considering acetylene, ethylene, methane and ethane). 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. Electronic displacements: Inductive effect, electromeric effect, resonance and hyper conjugation, cross conjugation explanation with examples. Aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of organic acid and bases: Comparative study with emphasis on factors effecting pKa values. Relative strengths of aliphatic and aromatic carboxylic acids-acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and benzoic acid.

Mechanisms of organic reactions

Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bond breaking- homolytic and heterolytic. Types of reagents-electrophiles, nucleophiles. Nucleophilicity and basicity. Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples.

Chemistry of aliphatic hydrocarbons: 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 reactions. 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, 3-pentene and 2-methyl-2-hexene. 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 benzylic bromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.

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

(Numerical problems are to be solved wherever applicable in SI Units**)**

Gaseous State: **7Hrs**

Recapitulation of characteristics of states of matter, parameter of a gas, gas laws, combined gas equation, (ideal gas equation).

Elementary aspects of kinetic theory of gases (assumption to be mentioned). How does an ideal gases differ from real gases.

Molecular velocity, collision frequency, collision diameter, collision cross section, collision number and mean free path.

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). Problems on calculations of molecular velocities, law of equipartition of energy.

Behavior of real gases: Deviation from ideal gas behavior, compressibility factor (Z) and its variation with pressure for different gases- H_2, He, CH_4. Causes of deviation from ideal behaviour, Vander Waals equation of state (no derivation) and application in explaining real gas behaviour. Critical phenomena- Boyle point and Boyl temperature- PV-isotherms of CO_2 (Andrews isotherms) critical constants (Tc, Pc, and Vc) and their calculation from van der Waals equation, continuity of states, law of corresponding states.

Liquid state: **7Hrs**

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

Viscosity: Definition, Expression, 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, expression, values of atomic and structural parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure. Molar refraction and chemical constitution.

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

(Numerical problems are to be solved wherever applicable in SI units.)

Language of analytical chemistry: Introduction to Analytical Chemistry, definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, determination of accuracy by absolute and comparative methods, distinguish between reproducibility and repeatability, 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 (R^2).

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, good laboratory practices, rules of fire prevention and accidents, first aid. precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

CHEMISTRY LAB: CHM P -1

PART-A: Analytical Chemistry

1. Calibration of glassware: pipette, burette and volumetric flask.
2. Determination of alkali present in soaps/detergents
3. Determination of alkali content in antacids
4. Determination of iron(II) using potassium dichromate
5. Determination of oxalic acid using potassium permanganate solution
6. Standardization of EDTA solution and determination of hardness of water

PART-B: Organic Chemistry

1. Selection of suitable solvents for Purification/Crystallization of organic compounds.
2. Preparation of acetanilide from aniline using Zn/acetic acid (green method).
3. Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
4. Bromination of acetanilide (i) conventional method and/or (ii) with ceric ammonium nitrate and potassium bromide (green method).
5. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (conventional method)
6. Synthesis of diazoaminobenzene from aniline (conventional method).

- Standard solution is to be prepared by students for both in regular and in practical examination.

Examination

Viva questions may be asked on any of the experiments prescribed in the practical syllabus**.** *Manual is not allowed in the examination.*

Distribution of marks in analytical experiments

Accuracy - 15 marks, reactions and calculations – 5 marks, viva-voce-5 marks, total=25 marks.

Deduction of marks for accuracy: : ±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.

Distribution of marks in organic experiments

Accuracy - 15 marks, reactions and calculations – 5 marks, viva-voce-5 marks, total=25 marks.

Deduction of marks for accuracy: : ±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.

Note: Practical coordinator has to prepare the detailed scheme of valuation

LEARNING OUTCOMES / COURSE OUTCOMES: CHMT-1

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester – I; CHEMISTRY: CHM T-1

Students will able to learn

1. Atomic structure, Bohrs theory its limitations and Atomic Spectra of Hydrogen

2.The dual behavior of matter and radiation, de Broglie's equations, Heisenberg Uncertainty principle and their related problems.

3. Quantum mechanics. Derivation of Schrodinger's wave equation. Orbital shapes of s, p, d and f atomic orbitals, nodal planes. Electronic configurations of the atoms slaters rules and its limitations.

4.Classification and IUPAC nomenclature of Organic compounds nature of bonding in organic molecules, bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). Aromaticity, Huckel rule ,relative strengths of aliphatic and aromatic carboxylic acids.

5. Understand basic concept of organic reaction mechanism, types of organic reactions, structure, stability and reactivity of reactive intermediates.

6. Formation of alkenes and alkynes by elimination reaction. Diels-Alder reaction with examples.

7.Gaseous State, Molecular velocity , Maxwell s Boltzmann distribution law of moleculat velocities.Behaviour of real gases. Critical phenomena.

8.liquid state, Surface Tension, Viscosity, Refraction. Additive and Constitutive properties.

9.Basics of Analytical Chemistry,Classification of Analytical techniques, accuracy,precision,LOD, and LOQ.

10. Errors , determinate and indeterminate errors,minimization of errors,Stastical treatment of finite samples.

11. Basic Laboratory Practices.

CHEMISTRY LAB (Analytical and Organic Analyses): CHM:P1

1. Calibration of glassware, pipette, burette and volumetric flask.
2. Determination of alkali present in soaps/detergents
3. Determination of alkali content in antacids
4. Determination of iron(II) using potassium dichromate
5. Determination of oxalic acid using potassium permanganate solution
6. Standardization of EDTA solution and determination of hardness of water
7. Selection of suitable solvents for Purification/Crystallization of organic compounds.
8. Preparation of acetanilide from aniline using Zn/acetic acid (green method).

9. Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
10. Bromination of acetanilide (i) conventional method and/or (ii) with ceric ammonium nitrate and potassium bromide (green method).
11. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (conventional method)
12. Synthesis of diazoaminobenzene from aniline (conventional method).

B.Sc. Semester - II

CHEMISTRY: CHM T-2

Course Code: 21BSC1C1CHM2L **Course Title:** CHM T-2

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	04	04	56	3	40	60	100
Practical	02	04	52	3	25	25	50

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

Periodic properties

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 crystal radii.

(c) Covalent radii

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

(e) Electron gain enthalpy; trends of electron gain enthalpy.

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

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

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

Nucleophilic substitution at saturated carbon. Mechanism of S_N^1 and S_N^2 reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting S_N^1 and S_N^2 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: S_N^{Ar} and Benzyne mechanism with suitable examples

UNIT-III: PHYSICAL CHEMISTRY

(Numerical problems are to be solved wherever applicable in SI units)

Solids: **7Hrs**

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 (centre, plane, rotation axis of symmetry), 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-vacancy-(Schottky defect) interstitial(Frenkel defect) & impurity defects.

Liquid Crystals: **3Hrs**

Explanation, classification with examples- Smetic, nematic, cholesteric, disc 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

Distribution Law: **4Hrs**

Nernst Distribution Law - Statement and its derivation. Modification of distribution law when molecules undergo a) association b) dissociation. Mentioning of application of Distribution law in solvent extraction, partition chromatography, determination of solubility, determination of dissociation, determination of association, distribution indicators, confirmatory test for bromide and iodide, and explanation of desilverization of lead by Parke's process.

UNIT-IV: ANALYTICAL CHEMISTRY 14 Hrs

(Numerical problems are to be solved wherever applicable in SI units)

TITRIMETRIC ANALYSIS

Basic principle of titrimetric analysis: Classification, preparation and dilution of reagents/solutions. Normality, molarity and mole fraction. Use of $N_1V_1 = N_2V_2$ 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 and weak base vs strong acid titrations. Titration curves, quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity.

Complexometric titrimetry: 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).

Note: The syllabus for III-VIII Semesters will be provided later

CHEMISTRY LAB CHMP- 2

PART-A: Inorganic Chemistry (TITRIMETRY and GRAVIMETRY)

1. Determination of carbonate and hydroxide present in a mixture.
2. Determination of oxalic acid and sodium oxalate in a given mixture using standard $KMnO_4$/NaOH solution
3. Determination of sodium carbonate and sodium bicarbonate in a mixture.
4. Standardization of potassium permanganate solution and determination of nitrite in a water sample.
5. Determination of chlorine in bleaching powder using iodometric method.
6. Standardization of silver nitrate and determination of chloride in a water sample (demonstration)
7. Determination of Ba^{2+} as $BaSO_4$ (demonstration)

PART-B: Physical Chemistry

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. Study of variation of surface tension of detergent solution with concentration.
6. Determination of the composition of liquid mixture by refractometry.(Toluene & Alcohol, Water & Sucrose)

Viva questions may be asked on any of the experiments prescribed in the practical syllabus. *Manual is not allowed in the examination.*

Distribution of marks in inorganic experiments

Accuracy - 15 marks, reactions and calculations – 5 marks, viva-voce-5 marks, total=25 marks.

Deduction of marks for accuracy: ±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.

Distribution of marks in physical experiments:

Accuracy-15 marks, calculation: 5 marks, viva-voce-5 marks, total=25 marks.

Deduction of marks for accuracy: Error up to 5% - 15 marks, 6 - 10% 12 marks, 11-15% 9 marks, 16-20% 6 marks, above 20% zero (0) marks

LEARNING OUTCOMES / COURSE OUTCOMES CHMT-2

Chemistry as Discipline Specific Course (DSC)

B.Sc. Semester – II

CHEMISTRY: CHM T-2

Students will able to learn

1. Periodicity, cause of periodicity in properties, and classify the elements into four categories according to their electronic configuration.

2. Definition of atomic radii, ionisation energy, electron affinity and electronegativity,

the factors affecting atomic radii, the relationship of atomic radii with ionisation energy and

electron affinity, the periodicity in atomic radii,ionization energy, electron affinity and electronegativity.

3. Nucleophilic substitution at saturated carbon. Mechanism of S N 1 and S N 2 reaction with suitable examples. Stereochemistry and factors effecting S N 1 and S N 2 reactions.

4. 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: S N Ar and Benzyne mechanism with suitable

examples

5.. Expected to learn symmetry elements, unit cells, crystal systems..

6. laws of crystallography - law of constancy of interfacial angles, law of rational

indices. Learn Bravais lattice, types and identification of lattice planes.

7.Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and

CsCl (qualitative treatment only). defects in crystals. Learn the applications of liquid

crystals.

8.. Liquid crystals, types, theories and applications Distribution Laws-Nernst distribution

law, applications including desilverization of lead by Parke's process.

9.. Learn principles of titrimetry and gravimetric analysis

10.. Learn the precipitation, mechanism of precipitation, factors influencing precipitation,

co-precipitation and post-precipitation.

11. Types of titrimetry, including acidimetry, alkalimetry, redox and complexometry

CHEMISTRY LAB (Inorganic and Physical experiments): CHM P: 2

Students will able to learn

1. Determination of carbonate and hydroxide present in a mixture.

2. Determination of oxalic acid and sodium oxalate in a given mixture using standard $KMnO_4$/NaOH solution
3. Determination of sodium carbonate and sodium bicarbonate in a mixture.
4. Standardization of potassium permanganate solution and determination of nitrite in a water sample.
5. Determination of chlorine in bleaching powder using iodometric method.
6. Standardization of silver nitrate and determination of chloride in a water sample
7. Determination of Ba^{2+} as $BaSO_4$ by gravimetric technique.
8. Safety practices in the chemistry laboratory, knowledge about common toxic chemicals and safety measures in their handling, cleaning and drying of glassware's
9. 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)
10. Study of the variation of viscosity of sucrose solution with the concentration of a solute
11. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardou liquids
12. Study of variation of surface tension of detergent solution with concentration.
13. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose)

Reference Books for Discipline Specific Course

Inorganic Chemistry

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J. J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
4. Huheey, J. E., Keiter, E.A., Keiter, R.L. & Medhi, O. K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.
5. Shriver, D.F. & Atkins, P.W. *Inorganic Chemistry*, Oxford University Press.
6. Wulfsberg, G. *Inorganic Chemistry,* Viva Books Pvt. Ltd.
7. Rodgers, G. E. *Inorganic & Solid State Chemistry,* Cengage Learning India Ltd.,2008.
8. Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012) Adam, D.M. *Inorganic Solids: An introduction to concepts in solid-state structural chemistry*. John Wiley & Sons, 1974.
9. G.L. Miessler & Donald A. Tarr: *Inorganic Chemistry,* Pearson Publication.
10. Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
11. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).

Organic Chemistry

1. Organic Chemistry-P. Y. Bruice, 7th Edition, Pearson Education Pvt. Ltd., New Delhi (2013).
2. Heterocyclic Chemistry- R. K. Bansal, 3rd Edition, New- Age International, New Delhi,2004
3. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry,* Orient Longman, New Delhi (1988).
5. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd, New Delhi.
6. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
7. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.
8. Graham Solomons, T. W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
9. Organic Chemistry Volume-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
10. Organic Chemistry-F.A. Carey, 4th Edition, McGraw Hill (2000).
11. Modern Organic Chemistry - R.O.C. Norman and D.J. Waddington, ELBS, 1983
12. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press, 1998
13. Organic Chemistry - L. Ferguson, Von Nostrand, 1985
14. Organic Chemistry - M. K. Jain, Nagin & Co., 1987
15. Organic Chemistry- Mehta and Mehta.

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 India Pvt. Ltd., New Delhi (2009).
4. P.W. Atkins: Physical Chemistry.
5. W.J. Moore: Physical Chemistry
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, Mc Graw 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., New Delhi.
13. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York.

Analytical Chemistry

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

Chemistry: CHMOEC-1.1

OPEN ELECTIVE COURSE

BSc Semester 1 **Course code:** 21BSC1O1CHM1

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	3	40	60	100

Title of the Course: OE-1.1: CHEMISTRY IN DAILY LIFE

Content of Theory Course 1.1	**42 Hrs**
Unit – 1	14
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 residues in food.	
Unit - 2	14
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 and uses	
Unit - 3	14
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.	

Text Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry- Ashtoush Kar.
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 University Press.
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).

COURSE OUTCOMES: OEC-1.1 Chemistry

On completion of the course students will be able to:

- Understand the dairy products, food additives, adulterants and contaminants in food products
- Understand about the vitamins, composition of oils and fats, soaps and detergents
- Understand the chemical and renewable energy source

Chemistry: CHMOEC-1.2

OPEN ELECTIVE COURSE

BSc Semester 1 **Course code:** 21BSC1O1CHM1

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	3	40	60	100

Title of the Course: OE-1.2: General chemistry-1

Content of Theory Course 1.2	**42 Hrs**
Unit – 1	14
Fuels: Introduction, classification of fuels, calorific value, characteristics of a good fuel, comparison between solid, liquid and gaseous fuels, classification coal by rank, selection of coal, LPG as a fuel, non-petroleum fuels: Natural gas, coal gas, water gas. Non-conventional sources of energy: Biomass, Biogas, pollution due to burning of fossil fuels. **Water treatment.** Introduction, characteristics imparted by impurities in water, hardness of water, equivalents of calcium carbonate, units of hardness, disadvantages of hard water, scale and sludge formation in boilers, boiler corrosion, softening methods, drinking water and municipal water. **Pollution and its control:** Introduction, Environment, Air pollution, Air pollutants, control of air pollution, water pollution, sewage treatment, soil or land pollution, Radioactive pollution, Noise pollution.	
Unit - 2	14
Lubricants: Friction and wear, Lubricants, mechanism of lubrication, classification of Lubricants, lubricating oils, greases or semi solid Lubricants, synthetic Lubricants, properties of lubricating oils, properties of greases, cutting fluids, selection of Lubricants. **Adhesives:** Introduction, adhesive action, development of adhesive strength, physical factors	

influencing adhesive action, bonding process by adhesives, classification of adhesives, preparation of adhesives, animal glue, protein adhesives, starch adhesives, synthetic resin adhesives, rubber based adhesives, uses of adhesives. **Detergents:** Introduction, principal groups of synthetic detergents, classification of surface active detergents, anionic detergents, soaps, alkyl sulphates, alkyl aryl sulphonates, non-ionic detergents, amphoteric detergents, bio degradability of surfactants, detergents containing enzymes, ecofriendly detergents- zeolites, manufacture of detergents- Hot process, manufacture of soaps, cleansing action of soap, manufacture of shampoos.	
Unit - 3	14
Green Synthesis 1. Green synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to strecker synthesis). 2. Microwave assisted reactions in water: Hoffman 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 production and ozone depleting solvents with carbon dioxide for precision cleaning and dry cleaning of garments. **Medicinal Chemistry** Introduction to chemotherapy, different types of drugs with examples (analgesics antiseptics antimalarials antibiotics tranquilizers). Synthesis and uses of aspirin, paracetamol and sulphanilamide. Antibiotics: definition examples and importance. Synthesis of antiviral and chloramine-T. Pesticides types with examples. Synthesis and uses of gammexane. **Electrochemical Energy Sources** Primary cell (dry cells), secondary cell (nickel cadmium cell), fuel cells construction and working of hydrogen oxygen fuel cell and its importance.	

References: 1. Industrial chemistry by B.K.Sharma
2. Engineering chemistry by Jain and Jain
3. Inorganic chemistry by Anilkumar De

COURSE OUTCOMES: OEC-1.2 Chemistry

On completion of the course students will be able to:

- Understand fuels, water treatment and pollution and its control
- Understand lubricants, adhesives and detergents
- Understand about green synthesis, medicinal chemistry and electrochemical energy sources

Chemistry: CHMOEC-2.1

OPEN ELECTIVE COURSE

BSc Semester 2 **Course code:** 21BSC1O1CHM1

Title of the Course: OE – 2.1: Molecules of Life

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	3	40	60	100

Content of Theory Course 2.1	**42 Hrs**
Unit – 1	14
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 - 2	14
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, -NH_2 group, double bond and aromatic ring **Lipids** Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).	
Unit - 3	14
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 OUTCOMES: OEC-2.1 Chemistry

On completion of the course students will 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 of peptides.
3. Explain the actions of enzymes in our body and interpret enzyme inhibition.
4. Know RNA and DNA and their replication.
5. The concept of Energy in Biosystems

Chemistry: CHMOEC-2.2

OPEN ELECTIVE COURSE

BSc Semester 2 **Course code:** 21BSC2O2CHM2

Title of the Course: OE – 2.2: General Chemistry -2

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	3	40	60	100

Content of Theory Course 2.2	**42 Hrs**
Unit – 1	14
Atomic structure Review of theories atomic model, limitations of Rutherford's atomic model. Bohr's theory, expression for radius and energy of an electron in hydrogen atom(no derivation), limitations of Bohr's theory. Dual behavior of matter and radiation, de Broglie's equation, Heisenberg Uncertainty principle. Quantum mechanics. Quantum theory of radiation (Brief account). Wave function, Significance of ψ and ψ^2 . Orbital shapes of *s, p, d and f* atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, Electronic configurations of the atoms (atomic number up to 30). **Periodic properties**: Modern periodic law, arrangement of elements in the groups of periodic table, s,p d and f block elements, Introduction to bonding: types with examples (Ionic, covalent (polar and nonpolar), coordinate, Vandeer Waals etc.) **Language of analytical chemistry:** Introduction to Analytical Chemistry, definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques	
Unit – 2	14
Fundamentals of organic chemistry Basics of organic chemistry, classification and IUPAC nomenclature of organic compounds, hydrocarbons- definition and classification with examples.	

Hybridization (sp, sp^2 and sp^3 types to be mentioned). Inductive (+I and –I) effect, Resonance (+R and –R) effect, Electromeric effect. Hyperconjugation – definition with ethyl carbocation and propene as examples. **Mechanisms of organic reactions** Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bond breaking- homolytic and heterolytic. Types of reagents-electrophiles, nucleophiles with examples. Types of organic reactions-substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples.	
Unit – 3	14
Basic laboratory practices: Calibration of glassware (pipette, burette and volumetric flask), safety in Chemical laboratory, good laboratory practices, rules of fire prevention and accidents, first aid. precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents. **Stoichiometry** Mole concept, definition of mole, concentration terms, Normality(N), Molarity (M), Molality (m), Mole fraction and parts per million (ppm). Calculation of equivalent and molar mass of acids, bases, salts. **States of matter:** **Gaseous state:** Characteristics of Gases, Parameters of a Gas, Gas Laws, Boyle's Law, Charles's Law. The Combined Gas Law. **Liquid state:** Intermolecular Forces in Liquids, Dipole-dipole Attractions**,** London Forces, Hydrogen Bonding, Vapor Pressure, Effect of Temperature on Vapour Pressure. Surface Tension, Units of Surface Tension, Viscosity, Units of Viscosity, Measurement of Viscosity (Ostwald Method). **Solid state:** Types of Solids, Isotropy and Anisotropy, The Habit of a Crystal, Symmetry of Crystals, Crystal Structure, Parameters of the Unit Cells, Cubic Unit Cells, Three Types of Cubic Unit Cells.	

Reference Books:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
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 7th Ed.,*
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. *Biochemistry*, 2002.

COURSE OUTCOMES: OEC-2.2 Chemistry

On completion of the course students will be able to:

- Understand atomic structures, periodic properties and basics of analytical chemistry
- Understand fundamentals of organic chemistry including reaction mechanism
- Understand about basics of good laboratory practices and states of matter.

SCOPE / LEARNING OUT COME of B Sc -HONORS

The students after B. Sc. has one of the more exciting and rewarding turning time of life. Course is designed as a new non-conventional alternative for the future. The course can be completed either as full time or as part time along withthe graduation. The certificate obtained will be helpful for obtaining jobs in various fields. The student can start his own business /laboratory or can associate with any kind of laboratory or associated jobs with confidence. There are opportunities in the field of analysis, analytical research, fundamental research, quality control departments, governmental and non-governmental organizations etc. for the technical laboratory personnel.

Books Recommended:

1. Laboratory manual for Environmental Chemistry: Sunita Hooda and Sumanjeet Kaur by S. Chand & Company 1999.
2. Soils and soil fertility, Troch, F.R. And Thompson, L.M. Oxford Press.
3. Fundamentals of soil science, Foth, H.D. Wiley Books.
4. Soil Science and Management, Plaster, Edward J., Delmar Publishers.
5. Principles of Soil Chemistry (2Wed.) Marcel Dekker Inc., New York.
6. Handbook of Agricultural Sciences, S.S. Singh, P. Gupta, A. K. Gupta, Kalyani Publication.
7. Introduction to soil laboratory manual -J. J. Harsett Stipes.
8. XIntroduction to soil science laboratory manual, Palmer and troch – Iowa state.

Evaluation Scheme for Lab Examination

Assessment Criteria	**Marks**
Practical Proper	20
Viva Voice	05
Total	**25**

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment: Theory:

Assessment Criteria	**40 marks**
1st Internal Assessment Test for 30 marks 1 hr 30 min after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr 30 min after 15 weeks. Average of two tests should be considered.	30
Attendance >75%	05
Assignment	05
Total	**40**

Evaluation Scheme for Internal Assessment: Practical

Assessment Criteria	**25 marks**
Semester End Internal Assessment Test for 15 marks 2 hrs	15
Attendance >75%	05
Journal (Practical Record)	05
Total	**25**

BSc Question Paper Pattern

Time: 3 Hrs **PART-A** **Max Marks. 60**

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

1.

2.

3.

4

5

6

7

8

Note: Two questions from each unit.

PART-B

Answer any Five of the following questions. **5X4=20**

1

2

3

4

5

6

7

8

Note: Two questions from each unit.

PART-C

Answer any Three of the following questions. **3X10=30M**

1 **(5+5) M**

2 **(5+5) M**

3 **(5+5) M**

4 **(5+5) M**

5 **(5+5) M**

Note: Minimum One question from each unit.

Exit Option

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

Sl. No	Years	After completion of	Exit Option
1.	First	I and II **Semesters**	UG Certificate Course in Chemistry
2.	Second	III and IV **Semesters**	UG Diploma in Chemistry
3.	Third	V and VI **Semesters**	B.Sc. in Chemistry
4.	Fourth	VII and VIII **Semesters**	B.Sc. (Hons.) in Chemistry

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of **B.Sc**. **Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).**
5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. **OEC: For non- computer science students. Computer Science students have to opt for OEC from departments other than major and minor disciplines.**

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course.
7. VC: Vocational Course.
8. IC: Internship Course.
9. L1: Language One.
10. L2: MIL .
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu.

Program Coding:

1. Code 21: Year of Implementation.
2. Code BSC: BSC Program under the faculty of Applied Science of the University.
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters).
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC).
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses.
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit, &Language Urdu.
7. Code 1: Course in that semester.
8. CHM: Chemistry.

DAVANGERE UNIVERSITY
Department of Studies in Chemistry

Proceedings of PG BoS Meeting in Chemistry

Proceedings of the meeting of Board of Studies in Chemistry (UG) held on **05-10-2021** at 11.00am in the Department of Chemistry, Davangere University, Shivagangothri, Davangere, The following members were present.

MEMBERS:

1. Prof. Mamatha G P — -- Chairperson BoS
   Department of Chemistry,
   Davangere University Davangere.
2. Dr..I. Mallikarjuna — -- External Member — Attended-online
   Assistant Professor
   Mysore University Mysore
3. Dr..K C Ramesh — -- Member — 5.10.21
   Associate Professor,
   SJM College Chitradurga
4. G Umesh — -- Member — 05/10/21
   Associate Professor,
   ADB first Grade College
   Harapanahalli
5. Dr. K V Basavarajappa — -- Member
   Associate Professor
   GFGC College Davangere .
6. S. Nagaraja — -- Special Invitee
   Associate Professor
   Govt Science College Chitradurga

The chairperson welcomed the members of the Board to the meeting and placed the agenda before them for discussion.

Agenda:

1. **Curriculum Structure of NEP 2020 For 1st and 2nd Semester of B.Sc Honors in Chemistry.**

The BoS Resolved the following

The Board approved to implement the curriculum structure of NEP-2020 for 1st and 2nd Semester of B.Sc. Honors in chemistry.

1. The Board decided to introduce one unit from all the four branches of Chemistry for both I and II Sem.
   Inorganic Chemistry
   Organic Chemistry
   Physical Chemistry
   Analytical Chemistry

2. Distribution of IA Marks for Theory DSC [40M]

3. Distribution of IA Marks for practical's DSC [25M]

Minimum EIGHT Experiments should be Performed for each I & II Semester

4. Sem End Exam Theory DSC [60M]
5. Sem End Practical Exam DSC [25M]

6. Sem End Exam Open Elective Course (OEC) [60M]

7. Distribution of IA Marks for OEC [40M]

8. Question Paper Pattern for DSC, OEC, for Both I and II Semester.

The Committee followed the guidelines given by the HEC state level and decided the distribution of Marks,Question paper pattern for Sem End Exam for both theory and practical's also IA for DSC and OEC.

The Meeting ended with vote of thanks to all the Members by Chairman BoS.

Signature of the Committee Members:

1. Prof. Mamatha G P, Chairman BoS
2. Dr. I Mallikarjuna., External Member — Attended throug online
3. Dr. K C Ramesh., Member
4. G Umesh., Member
5. Dr. Basavarajappa K V, Member
6. S. Nagaraja, (Special Invitee)

Prof. Mamatha G P
Chairperson BoS
Department of Chemistry,
Davangere University.Davangere.