COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

DIT UNIVERSITY
DEHRADUN

DETAILED COURSE STRUCTURE & SYLLABUS
OF
B.SC. (HONS) CHEMISTRY

(FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

INTRODUCTION

The Ministry of Human Resource Development (MHRD), Govt. of India, has initiated development of a New Education Policy (NEP) to bring out comprehensive reforms in the Indian education system.

The University Grants Commission (UGC) has subsequently initiated several steps to foster academic excellence through introduction of paradigm shift in learning and teaching pedagogy, innovation and improvement in course curricula, examination and education system.

While a majority of education institutions have started following the semester-based system of education, it has been observed that this new system is still producing graduates who lack knowledge, values, skills and are not job ready professional. The reason for this lacking could be attributed to the rigidity of our program structures and lack of flexibility to have choices among core subject education, liberal arts, ability enhancement, skill development, etc., that is fundamental to overall development and employability of these graduates.

To make this possible, a fully flexible choice-based credit system (FFCBCS), a well-established internationally known system, is proposed. This fully flexible choice-based credit system allows students the flexibility to learn at their own pace, and register for both core subjects and a variety of courses from other areas, leading to holistic development of an individual. The FFCBCS will facilitate us to bench mark our programs with best international liberal arts based academic programs.

Advantages of the FFCBCS structure:

- Shift in focus from the teacher-centric to student-centric education. Student can curve out their program structure by choosing minimum number of credits from well-defined baskets.
- Student may undertake as many credits as they can cope with.
- FFCBCS allows students to choose courses from various baskets of inter-disciplinary, intra-disciplinary, skill oriented, ability enhancing, and from other disciplines.

Features unique to DIT University FFCBCS structure:

1. A minimum of 141-147 credits has to be earned by a student to be eligible for an Under Graduate Honor degree in Sciences. Each department will decide their total credits for each program, and it can vary across disciplines.
2. Courses are categorized into 9 baskets, and a student will have the option to choose courses in most baskets and earn **minimum number of credits** required in each basket for the award of his/her degree. For each basket, the departments have the flexibility to identify course(s) which will be a core requirement for their program.
3. An Academic Advisory Committee may be formed comprising all HoDs/ Program Coordinator and one representative each from respective departments. Academic Advisory Committee will meet at the end of every semester after the completion of Board of Examination meeting to discuss and finalize course offerings by respective departments in the upcoming semester. Academic Advisory Committee will be chaired by the Dean Academic Affairs/ Deans of respective Schools/ Competent Authority.
4. To provide sufficient flexibility and room during the program for additional **Certificates**, **Specializations, and Minors**, 8-week summer semesters (Summer 1, Summer 2, and Summer 3) may have to run. Summer semesters are critical for implementing a fully flexible system. Each department will decide a priori which courses to offer in the summer semester and get them finalized at the Academic Advisory Committee meeting.

5. Project based learning has to be incorporated as a core component of evaluation in each course, and depending on the level and type of the course, the project can be of several types - Study Oriented Project, Lab Oriented Project, Research Projects or Entrepreneurship and Start Up Projects.
6. Courses under each basket may be updated on an annual basis.
7. Each student will be advised by a faculty advisor of his/her department for registration of courses from each basket in the beginning of semester, depending upon the availability of seats. A student advising centre may be formed where students will have access to department faculty advisers. Faculty advisers should have complete access to view individual student's academic transcript for advising purposes.
8. A student getting an F grade in a core course (departmental or otherwise) at the end of the semester will have to earn those credits by registering for the same course whenever it is offered in subsequent semesters. If the course is not a core course, the student may choose to register for any other course next semester in that basket as advised by the department faculty adviser. Additional fees for those number of credits may apply.
9. Students may opt for summer training/internships/industrial tours as advised by the department. However, these activities will not have credits.

Baskets of FFCBCS

9 baskets of courses have been identified to provide student comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These baskets are as follows:

1. **Language and Literature:** These include courses related to English or other popular languages worldwide, communication skills, and literature. These courses are of 3 credits each.
2. **Generic Elective:** This basket includes courses from other disciplines of Science and Engineering like Mathematics, Chemistry and Computer Science.
3. **Discipline Core:** This basket includes compulsory courses in the discipline in which the student is admitted to the University. These courses are of 4-5 credits each.
4. **Discipline Elective:** This basket provides students courses other than discipline core, and are normally in certain specialized areas. These courses are of 3/5 credits each.
5. **Humanities and Liberal Arts:** This basket includes liberal arts courses in various disciplines like psychology, management, economics, etc., and are of 3 credits each.
6. **Skill Enhancement:** Courses in this basket are primarily hands-on and aims to allow students acquire skills required in certain disciplines that are currently in high demand in the job market. These courses are of 3-4 credits each.
7. **Ability Enhancement:** These courses aim to enhance knowledge and ability of an individual in certain required areas related to national and societal interest. Courses in this basket are of 2 credits each.
8. **Free Electives:** Student can register for any two courses outside their department of his/her choice. These courses can also be taken from MOOCs, and a minimum of 6 credits have to be taken by a student in this basket. These courses are of 3 credits each.
9. **Project:** Students will do two projects in semester 5^{th} and 6^{th}, Minor Research Project and Major Research Project.
10. In addition to courses from above 9 baskets the student will register for any two Non-Credit courses**.**

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY APPLICABLE FOR BATCH: 2022-25

STRUCTURE OF THE B.SC. FFCBCS PROGRAM IN CHEMISTRY (TENTATIVE)

Basket/Area	Min Credits To be taken	Credit per course	Courses
Language and Literature (LL) Core: None Elective: Choose any 1 from LL course	3	3	1
Generic Elective (GE) Core: None Elective: Choose any 4 courses as per your Specialization	16-20	4-5	4
Discipline Core (DC) Core: All Elective: None	80	5	16
Discipline Specific Elective (DSE) Core: None Elective: Choose any 5 courses as per your Specialization	17	3-5	5
Humanities and Liberal Arts (HL) Core: None Elective: Choose any 1 HL Courses	3	3	1
Skill Enhancement Courses (SEC)* Core: None Elective: Choose any 3 courses to complete credits	8-10	3-4	3
Ability Enhancement Courses (AEC)* Core: Env. Sc, Elective: Choose any 3 courses to complete the credits	2	2	3
Free Electives (FE) Core: None Elective: Choose any 2 FE courses	6	3	2
Project	6	2-4	2
Total Credits	**141-147**		**37**

* Credits in SEC and AEC courses may vary.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

CATEGORY WISE CLASSIFICATION OF THE CREDIT

Category		Credit	Number of Subjects
DC	Discipline Core	80	16
GE	Generic Elective	16-20	4
DSE	Discipline Specific Elective	17	5
AEC	Ability Enhancement Course	2	3
SEC	Skill Enhancement Course	8-10	3
PRJT	Project	6	2
HL	Humanities and Liberal Arts	3	1
LL	Language and Literature	3	1
FE	Free Elective	6	2
TOTAL		**141-147**	**37**

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY APPLICABLE FOR BATCH: 2022-25

UNIVERSITY FFCBCS BASKETS (OTHER THAN DC/DE) FOR B.SC. (HONS) CHEMISTRY

Course Code	FFCBCS Baskets				
	Language and Literature (min 3 credits to be taken)	Contact Hrs			Credits
	Name of Courses	L	T	P	C
LAF181	Professional Communication	2	0	2	3
LAF182	Indian English Literature	3	0	0	3
LAF183	English Language Teaching	3	0	0	3
LAF184	Corporate Communication and Soft Skills	2	0	2	3
Generic Elective (min 16-20 credits to be taken)					
	Name of Courses	L	T	P	Credits
CSF101	Programming for Problem Solving	3	0	2	4
CSF102	Data Structures	3	0	2	4
MAF108	Calculus -I	3	1	0	4
MAF117	Ordinary Differential Equations	3	1	0	4
PYF359	Physics of Semiconductor Devices	3	1	0	4
MAF206	Computer Based Numerical Techniques	3	1	2	5
PYF378	Nanomaterials and Applications	4	0	0	4
PYF217	Elements of Modern Physics	3	1	2	5
MAF216	Probability Theory and Mathematical Statistics	3	1	2	5
PYF366	Renewable Energy and Energy Harvesting	3	1	0	4

Skill Enhancement (min 8-10 credits to be taken)					
	Name of Courses	L	T	P	C
SET1					
MAF346	Technical Writing with LATEX	0	0	4	2
HS241	Education and Social Change	3	0	0	3
CA102	Programming in ‘C’	3	0	2	4
SWAY	MOOC courses offered through NPTEL/SWAYAM (as advised by the department)	2	0	0	2
SET2					
MAF256	Aptitude and Skill Enhancement-I	3	0	0	3
MAF348	Aptitude and Skill Enhancement-II	3	0	0	3
MAF349	Aptitude and Skill Enhancement-III	3	0	0	3

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Ability Enhancement (min 2 credits to be taken)					
	Name of Courses	**L**	**T**	**P**	**C**
CHF201	Environmental Science	2	0	0	2
MAF119	Introduction to MATLAB	0	0	4	2
LAF285	Indian Constitution	2	0	0	2
MEF483	Entrepreneurship and Startups	0	0	4	2
Humanities and Liberal Arts (min 3 credits to be taken)					
	Name of Courses	**L**	**T**	**P**	**C**
LAF281	Introduction to Psychology	3	0	0	3
LAF381	Positive Psychology & Living	3	0	0	3
LAF481	Application of Psychology	3	0	0	3
LAF282	Human Values	3	0	0	3
LAF283	Literature, Language & Society	3	0	0	3
LAF284	Principles of Management	3	0	0	3
LAF482	Intellectual Property Rights	3	0	0	3
LAF382	Engineering Economics	3	0	0	3
LAF287	Sustainable Development	3	0	0	3
LAF286	Youth Psychology	3	0	0	3
LAF383	Introduction to Linguistics	2	0	2	3
Free Electives (min 6 credits to be taken)					
	Name of Courses	**L**	**T**	**P**	**C**
CSF381	Software Project Management	3	0	0	3
PEF381	Carbon Capture and Sequestration	3	0	0	3
PEF491	Polymer Technology	3	0	0	3
PEF492	Health, Safety and Environment in Industry	3	0	0	3
CEF382	Disaster Preparedness Planning & Management	3	0	0	3
CEF481	Environmental Management & Sustainability	3	0	0	3
ECF483	Digital Image Processing	2	0	2	3
CSF345	Introduction to Data Science	3	0	0	3
CSF482	Introduction to Cyber Security	3	0	0	3
MEF481	Total Quality Management	3	0	0	3
CEF483	GIS	3	0	0	3
CEF484	Resource Dynamics and Economic Implications	3	0	0	3
Project (6 credits)					
	Name of Courses	**L**	**T**	**P**	**C**
CHF309	Research Project-I	0	0	4	2
CHF329	Research Project-II	0	0	8	4

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY APPLICABLE FOR BATCH: 2022-25

COURSE BASKETS: B.SC. (HONS) CHEMISTRY FFCBCS DC AND DE BASKETS

Discipline Core (80 credits)						
	Contact Hrs Credits					
	Name of Courses	**Pre- requisite Courses**	**L**	**T**	**P**	**C**
CHF106	Inorganic Chemistry -1	None	3	1	2	5
CHF107	Physical Chemistry-1	None	3	1	2	5
CHF108	Basic Analytical Chemistry	None	3	1	2	5
CHF116	Organic Chemistry-1	None	3	1	2	5
CHF117	Physical Chemistry-II	None	3	1	2	5
CHF118	Inorganic Chemistry II	None	3	1	2	5
CHF207	Organic Chemistry II	None	3	1	2	5
CHF208	Physical Chemistry III	None	3	1	2	5
CHF206	Inorganic Chemistry III	None	3	1	2	5
CHF217	Organic Chemistry III	None	3	1	2	5
CHF218	Physical Chemistry IV	None	3	1	2	5
CHF306	Organic Chemistry - IV	None	3	1	2	5
CHF307	Physical Chemistry - V	CHF 218	3	1	2	5
CHF216	Inorganic Chemistry - IV	None	3	1	2	5
CHF316	Organic Chemistry - V	None	3	1	2	5
CHF317	Inorganic Chemistry -V	None	3	1	2	5
Discipline Specific Electives (min 17 credits to be taken)						
	Name of Courses		**L**	**T**	**P**	**C**
CHF346	Green Methods in Chemistry		3	0	0	3
CHF347	Polymer Chemistry		3	0	0	3
CHF348	Fuel Chemistry		3	1	2	5
CHF349	Fundamentals of Biochemistry		3	1	2	5
CHF356	Business skills for Chemist and IPR		3	0	0	3
CHF357	Pesticide Chemistry		3	0	0	3
CHF358	Medicinal Pharmaceutical Chemistry		3	0	0	3
CHF359	Chemistry of Cosmetics and Perfumes		3	0	0	3
CHF366	Green Chemistry		3	0	0	3
CHF367	Forensic Chemistry		3	0	0	3

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-106	Subject Title	INORGANIC CHEMISTRY-I					
LTP	3 1 2	Credit	5	Subject Category	CC	Year	1st	Semester	I

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development/Knowledge	√	√	√	√	√
Employability					
Entrepreneurship					

Course Objectives: This course unit aims to develop an understanding of the fundamental chemistry of the atomic properties as guided by the electronic configurations of atoms at orbital levels; rules governing the periodicity of properties variance, understanding of VBT and molecular orbital theory to determine the geometry and bonding in polyatomic molecules. The course provides fundamental knowledge and develops skills through performing practicals based on the theoretical concept.

Unit 1: Atomic Structure

Basic Concept of Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Basic concept of Wave mechanics: de Broglie equation, Heisenberg's uncertainty principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normal and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

Unit 2: Periodicity of Elements:

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following Pauling's/ Mulliken's/Allred Rachow's and Mullikan-Jaffe's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio. properties of the elements, with reference to s & p- block. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. Atomic radii (van der Waals) Ionic and crystal radii. Covalent radii (octahedral and tetrahedral) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. Electron gain enthalpy, trends of electron gain enthalpy. Electronegativity, Pauling's/ Mulliken's / Allred Rachow's and Mullikan-Jaffe's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

Unit 3: Ionic Bonding

Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

Unit 4: Covalent Bonding

Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule,

Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons: H_2O, NH_3, PCl_3, PCl_5, SF_6, ClF_3, I_3^-, BrF_2^+, PCl_6^-, ICl_2^-, ICl_4^- and SO_4^{2-} Multiple bonding (ζ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

Unit 5: Metallic Bond

Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids. (iv) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction. Hydrogen bonding (theories of hydrogen bonding, valence bond treatment). Effects of weak chemical forces, melting and boiling points, solubility, energetics of dissolution process.

Learning outcome: -

At the end of the course, the student will be able to:

CO1: Explain the atomic structure based on quantum mechanics and explain periodic properties of the atoms viz. atomic radii, ionization energy and their interpretations.

CO2: Explain the structure and bonding in molecules and ions and predict the structure and geometry of molecules on the basis of VBT and VSEPR theory.

CO3: Explain electronegativity and dipole moment and its vector in determining ionic characters in covalent compounds.

CO4: Explain the band structure of solids and determine the electrical properties, semi conductivity and packing orders of crystals with defects.

CO5: Explain the relationships between weak forces and physical properties of solid compounds

TEXT BOOKS

1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010
2. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.
3. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
4. Shriver, D.D. & P. Atkins, Inorganic Chemistry 2nd Ed., Oxford University Press, 1994.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Sr. No.	EXPERIMENT NAME
1	Acid-Base Titrations: Principles of acid-base titrations to be discussed. Estimation of sodium carbonate using standardized HCl. Estimation of carbonate and hydroxide present together in a mixture. Estimation of carbonate and bicarbonate present together in a mixture. Estimation of free alkali present in different soaps/detergents
2	Oxidation-Reduction Titrimetry: Principles of oxidation-reduction titrations (electrode potentials) to be discussed. Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ solution Estimation of oxalic acid and sodium oxalate in a given mixture. Estimation of Fe(II) with $K_2Cr_2O_7$ using internal indicator (diphenylamine, N-phenylan thranilic acid) and discussion of external indicator.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-107	Subject Title	PHYSICAL CHEMISTRY-I						
LTP	3 1 2	Credit	5	Subject Category	CC	Year	1st	Semester	I

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development/Knowledge	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

The course covers the gaseous states kinetics and P-V-R relations in the first unit. The second unit is about the properties of liquids. The third unit renders details of the types of crystalline packing and symmetry for prototype crystalline solids. The fourth and fifth unit covers the thermodynamics of gaseous expansions and compressions and changes in intrinsic parameters, like, enthalpy, internal energy during gaseous phase reactions.

Course Objective:

The objectives of this course involve learning the basics of thermodynamics and to be able to identify and describe energy exchange processes of reactions.

Course Pre/Co- requisite (if any): The student must have basic knowledge of gaseous laws and equations regarding the Pressure-Volume-Temperature dependency of gaseous molecules. Students should also have a prior understanding of the crystalline nature of well-known salts (NaCl) to be further explained and the basis of homogenous solutions and colloidal suspensions.

Detailed Syllabus

Unit 1: Gaseous state:

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity.

Unit 2: Liquid State

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapor pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of the structure of water.

Unit 3: Solid State:

Definition of space lattice, unit cell, Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of the rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. Lattice sites and coordination number in the unit cell, X-ray diffraction by crystals, Derivation of

Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

UNIT 4: Thermodynamics and Thermochemistry:

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Second Law: Concept of entropy; the thermodynamic scale of temperature, statement of the second law of Thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of the third law, the concept of residual entropy, calculation of absolute entropy of molecules.

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy, and resonance energy from thermochemical data, the effect of temperature (Kirchhoff's equations) and pressure on the enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

UNIT 5: Free Energy functions and Systems of Variable Composition:

Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Learning Outcome: -

At the end of the course, the student will be able to:

CO1: Explain the kinetics of gaseous diffusion and viscosity based on various parameters; understand gaseous mixture separation based on partial pressures.

CO2: Determine of Physical properties of pure Liquids and mixtures (solutions).

CO3: Elucidate the structure of crystals using X-ray crystallography

CO4: State and apply the laws of thermodynamics in macroscopy systems and thermochemistry of chemical reactions.

CO5: Predict the spontaneity of reactions by using thermodynamic principles.

TEXT BOOKS

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004)
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Sr. No.	EXPERIMENT NAME
1	To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
2	To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber Cycle.
3	Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution of sulphuric acid or enthalpy of neutralization), and (ii) heat gained equal to heat lost by cold water and hot water respectively
4	Determination of heat capacity of a calorimeter for different volumes using heat gained equal to heat lost by cold water and hot water respectively
5	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
6	Study of the solubility of benzoic acid in water and determination of ΔH.
7	Determination of integral enthalpy (endothermic and exothermic) solution of salts.
8	Calculation of enthalpy of ionization.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF108	Subject Title	BASIC ANALYTICAL CHEMISTRY						
LTP	3 1 2	Credit	5	Subject Category	CC	Year	1st	Semester	I

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓		✓		
Employability		✓		✓	✓
Entrepreneurship					

Course Outline:

The course briefly covers the quantitative aspects of statistics for data interpretations for accuracy and distributions and then the next unit covers the instrumentation and basics methods utilized in UV-VIS and IR spectroscopy. An introductory third and fourth unit would cover the instrumentation, principles and data interpretations for thermos gravimetric analysis and electro-analytical titration methods. Finally, the unit-5 touches upon the basic principles and methods for different chromatographic techniques

Course Objective:

The objectives of this course is to teach basics Analytical techniques with instrumentation working and principles methods of data acquisitions for major instruments like; UV-VIS, IR spectroscopic methods, TGA based sample analysis and electro-analytical titration methods. The course intends to impart basic knowledge of the principles and methods for different chromatographic techniques and separation criteria for advanced chromatographic instruments. The course introduces the basic learning for calculating data sampling and distribution analysis. This course imparts skills to the student so that they have complete knowledge of operating analytical instruments which is much required for employability in R & D labs and pharmaceutical companies.

Detailed Syllabus

Unit I: Qualitative and Quantitative aspects of analysis:

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q, and T test, rejection of data, and confidence intervals

Unit 2: Optical methods of analysis:

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principle of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enoltautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

Unit 3: Thermal method of analysis:
Theory of thermosgravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Unit 4: Electro analytical methods:
Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conduct metric titrations. Techniques used for the determination of equivalence point. Techniques used for the determination of pKa values.

Unit 5: Separation Techniques:
Solvent extraction: Classification and principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.
Technique of extraction: batch, continuous and counter current extractions.
Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media. Chromatography: Classification and principle and efficiency of the technique. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Learning Outcome: -
At the end of the course, the student will be able to:
CO1: Perform data sampling, identification of patterns through estimation of analytical errors and precision, statistical test of data and confidence intervals.
CO2: Explain the principles of the origin of spectroscopy, selection rules in UV-Vis and IR-spectrometry, instrumentation and various domains of applications.
CO3: Interpret the IR spectra in the determination of functional group changes during reactions and UV-Vis spectroscopy in the quantitative estimation of metal-ligands stoichiometry in the solutions and basis of bioanalytical methods.
CO4: Develop insight of the practical methods for performing thermos gravimetric analysis, potentiometric and conduct metric titrations and their graph analysis.
CO5: Gain practical understanding of solvent extraction; implications in metallic and organic compound extractions. Students will develop a basic knowledge of various chromatographic techniques and corresponding stationary phases and mobile phases.

TEXT BOOKS

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by GH Jeffery and others) 5th Ed. The English Language Book Society of Longman
2. Willard, Hobert H. et. al: Instrumental Methods of Analysis, 7th Ed. Wards worth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. New York- John Willy, 2004.
4. Khopkar, S.M. Basic Concepts of Analytical Chemistry New Age, International Publisher, 2009.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

SR.NO.	EXPERIMENT NAME
1	Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}
2	Separate and identify the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography.
3	Chromatographic separation of the active ingredients of plants, flowers and juices by TLC
4	Determine the pH of given aerated drinks fruit juices, shampoos and soaps.
5	Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.
6	Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Department of Chemistry**
Course Code	CHF116
Course Title	Organic Chemistry I
Credits	5
Contact Hours (L: T: P)	3:1:2
Prerequisites (if any)	None
Course Basket	Core

Course Mapping

	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
Skill Development	✓	✓	✓	✓	✓
Employability					
Entrepreneurship					

Course Objectives:

This course aims to develop an understanding of the basic principles of organic chemistry which include organic skeleton build-up, hybridization states, their stereo-electronic properties and different mechanisms involved in organic transformations. The course will develop an insight on the stereochemistry and mechanism of different classes of organic compounds. The course develops skill to the learners for designing of various chemical processes and synthetic reactions.

Course Outcomes

At the end of the course, the student can:

CO1: Identify the name of the functional groups and different class of organic compounds

CO2: Develop an insight of organic reactions classes and their mechanism

CO3: Draw various models of chiral compounds, basis of chiralty and determination of absolute configurations

CO4: Understand the physico-chemical properties and forces in the organic molecules which govern their reactivities.

CO5: Understand the basis of aromaticity of organic compounds, and differences in the reactivity of aromatic vs aliphatic and alicyclic compounds.

Curriculum Content

Unit I: Basics of Organic Chemistry **9Hrs**

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

Unit 2: Stereochemistry of Organic compounds: 8 Hrs

Newman projection, Sawhorse, Fischer projection and Flying-Wedge formulae, Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, meso compounds, resolution of racemic mixtures; relative and absolute configurations – D&L and R&S systems of nomenclature, sequence rules; geometrical isomerism – cis-trans isomerism, E&Z system of nomenclature of alkenes

Unit 3: Chemistry of Aliphatic Hydrocarbons: 9 Hrs

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz- Fittig Reactions, Free radical substitutions: Halogenation - relative reactivity and selectivity. Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration. oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2- and 1, 4- addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes. Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

Unit 4: Aromatic Hydrocarbons 7Hrs

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Aromatic electrophilic substitution – general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio, Side chain reactions of benzene derivatives, Birch reduction; Methods of formation and chemical reactions of alkyl benzenes, alkynyl benzenes and biphenyl, naphthalene and Anthracene;

Unit 5: Alkyl and Aryl Halides 6Hrs

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions, Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams; Polyhalogen compounds : Chloroform, carbon tetrachloride; Methods of formation of aryl halides, nuclear and side chain reactions; The addition-elimination and the elimination-addition mechanisms of nucleophilc aromatic substitution reactions; Relative reactivities of alkyl halides vsallyl, vingl and aryl halides, Synthesis and uses of DDT and BHC.

TEXTBOOK(S)

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Finar, I. L. Organic Chemistry (Volume 1), 6th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education) (2002).

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

REFERENCE BOOKS

1. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
3. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).

Sr.No.	Experiment name
1	**Purification of organic solids by** i) Sublimation (Naphthalene, camphor etc.) ii) Hot water (Benzoic acid, acetanilide etc.) Checking purity of organic solids by melting point/mixed melting point.
2	**Identification of Organic Compounds** The preliminary examination of physical and chemical characteristics (physical state, colour, odor and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions. Functional group tests of following classes of compounds – phenols, carboxylic acids – carbonyl compounds – ketones, aldehydes – carbohydrates – aromatic amines – amides, ureas and anilides – aromatic hydrocarbons and their halo- derivatives
3	**Preparations** i) Acetylation of salicylic acid, aniline ii) Benzoylation of salicylic acid, aniline iii) Preparation of iodoform from ethanol and acetone iv) Preparation of 4-nitroacetanilide from acetanilide v) Preparation of 4-bromoacetanilide from acetanilide

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-117	Subject Title	PHYSICAL CHEMISTRY -II						
LTP	3 1 2	Credit	5	Subject Category	CC	Year	1st	Semester	II

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development/Knowledge	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

The First unit covers the equilibrium chemistry of solution phase reactions and calculations of quantitative determination of concentration changes with reaction progression. The second unitcovers the colligative properties of real solutions. The Colloidal state is been discussed in unit three whilein unit four covers the Conductance of ionic solutions and in unit five ionic equilibrium is discussed in detail.

Course Objective:

In this module, students will be learned about chemical equilibrium, its types and the factors affecting the state of equilibrium, Conductance of ionic solutions to determine pH and degree of dissociation.

Detailed Syllabus

Unit 1: Chemical Equilibrium

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Thermodynamic derivation of relation between Gibbs free energy of reaction andreaction quotient. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration (Le Chatelier Principle, Quantitatively)).

Systems of Variable Composition: Partial molar quantities, the dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, the chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases. Free energy of mixing and spontaneity of equilibrium between ideal gases and a pure condensed phase.

Unit 2: Solutions and Colligative Properties

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Thermodynamic derivation using the chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar massesof normal dissociated and associated solutes in solution.

Unit 3: Colloidal State:

Definition of colloids, classification of colloids; Solids in liquids (sols): properties – kinetic, opticaland electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels): classification, preparation and properties, inhibition, the general application of colloids, colloidalelectrolytes.

Unit 4: Conductance

Electrical transport: -Conduction in metals and in electrolyte solutions, specific conductance molaand equivalent conductance, measurement of equivalent conductance, variation of molar equivalent and specific conductance with dilution. Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations.

Unit 5: Ionic Equilibrium

Strong, moderate weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale,common ion effect; dissociation constants mono- di-and triprotic acids (exact treatment).

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its application; buffer capacity, buffer range, buffer action and applications buffers in analytical chemistry and biochemical processes in the human body.

Learning Outcome: -

At the end of the course, the student will be able to:

CO1: Apply thermodynamics to chemical equilibria for ideal gases

CO2: Apply thermodynamics to determine colligative properties of solutions

CO3: Explain and apply the properties of colloids.

CO4: Determine the conductance of metals and electrolytes

CO5: Determine various parameters of ionization and hydrolysis (degree of ionization, pH, buffering capacity)

TEXT BOOKS

1. Khosla, B. D.; Garg, V. C. &Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. Athawale, V. D. &Mathur, P. Experimental Physical Chemistry New Age International: NewDelhi (2001).

REFERENCE BOOKS

1. Atkins, P. W. & Paula, J. de Atkin’s Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

SR.NO.	EXPERIMENT NAME
1	Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H_2O$).
2	To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.
3	To construct the phase diagram of two component (e.g. diphenylamine – benzophenone) system by cooling curve method.
4	**Surface tension measurements** (use of organic solvents excluded). (a)Determine the surface tension by (i) drop number (ii) drop weight method. (b)Study the variation of surface tension of detergent solutions with concentration
5	**Viscosity measurement using Ostwald's viscometer:** Study the effect of variation of viscosity of an aqueous solution with the concentration of solute.
6	**pH measurements** (a)Measurement of pH of different solutions using pH-meter. (b)Preparation of buffer solutions (i) Sodium acetate-acetic acid Ammonium chloride-ammonium hydroxide
7	**pH metric titrations of** (i)strong acid and strong base (ii)weak acid and strong base

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-118	Subject Title	INORGANIC CHEMISTRY-II						
LTP	3 1 2	Credit	5	Subject Category	CC	Year	2nd	Semester	III

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

This course covers the chemistry of s- and p-block elements with extensive understanding. This course also covers the chemistry of Boranes, Silanes, oxo and peroxo acids, and interhalogen compounds along with the reactivity of noble gases, theories of acids and bases and also covers a brief understanding of inorganic Polymers.

Course Objective:

This is an advance course in chemistry that develops skill and provides an extensive understanding of the chemical properties of s- and p-block elements and comprehension of their structure-reactivity in terms of acid-base nature; Course builds up an insight to understand the complex nature of higher-order boranes and interhalogen compounds and their reactions.

Detailed Syllabus

Unit I: Chemistry of s and p block elements: 9 Hrs

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behavior of the first member of each group. Allotropy and catenation, Complex formation tendency of s- and p-block elements. Hydrides and their classification: ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

Unit II: Chemistry of Boranes, Silanes, oxo and peroxo acids and interhalogen compounds 10 Hrs

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses: Boric acid and borates, boron nitrides, borohydrides (diborane), silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur; Interhalogen compounds, polyhalide ions, pseudohalogens.

Unit III: Noble gases: 6 Hrs

Occurrence & uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF_2 and XeF_4, XeF_6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2). Molecular shapes of noble gas compounds (VSEPR theory).

Unit IV: Acids and Bases: 7 Hrs

Brönsted-Lowry concept of acid-base reactions, solvated proton, the relative strength of acids, types of acid-base reactions, leveling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.

Unit V: Inorganic Polymers: 7 Hrs

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and poly sulphates.

Learning Outcome: -

At the end of the course, the student will be able to:

CO1: Explain the concepts of Acid-Base reactivity and theorize the nature of super acids and bases

CO2: Gain an insight into the reactivity of various p-block compounds, their oxo- and peroxo-acids forming ability and reactions.

CO3: Explain the hybridization and geometry of compounds of Nobel gases and their applications

CO4: Classify and understand the complex structures of various boranes, silanes and Interhalogen compounds and also their implications for modern-day catalysts design and applications in medical sciences.

CO5: Gain an understanding of the various inorganic polymers, their chemical properties and applications in modern days.

TEXT BOOKS

1. N.N. Greenwood, and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
2. J. D. Lee, Concise Inorganic Chemistry, ELBS (1991).
3. Canham, G.R. and Overton, T., Descriptive Inorganic Chemistry, Freeman & Co.2006
4. F. A. Cotton andG. Wilkinson; Advanced Inorganic Chemistry, Wiley, VCH, 1999.

REFERENCE BOOKS

1. T. H. Dunning and D. E. Woon; p-Block Elements-Inorganic chemistry, Magnum Publishing, 2016
2. W. N. Lipscomb; Boron Hydrides, Dover Publications.inc, 2012

Sr. No.	EXPERIMENT NAME
1	**(a) Iodo/Iodimetric Titrations** (i) Estimation of Cu (II) and $K_2Cr_2O_7$ Using sodium thiosulphate solution (Iodimetrically). (ii) Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically (iii) Estimation of available chlorine in bleaching powder iodometrically.
2	Inorganic preparations of Cuprous Chloride, Cu_2Cl_2
3	Inorganic Preparation of Manganese (III) phosphate, $MnPO_4.H_2O$
4	Inorganic Preparation of Aluminium Potassium sulphate $K_2Al(SO4)_2.12H_2O$ (Potash alum) or Chrome alum.
5	Inorganic Preparation of salicylaldehyde and ethylene diamine ligands based Cu-schiff base complexes.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Department of Chemistry**
Course Code	CHF207
Course Title	Organic Chemistry II
Credits	5
Contact Hours (L:T:P)	3:1:2
Prerequisites (if any)	None
Course Basket	Core

Course Mapping

	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
Skill Development	✓	✓	✓	✓	✓
Employability					
Entrepreneurship					

Course Summary

This course covers reactivity, preparation and important reactions of halogenated compounds. Course also covers preparation properties and reactivity of alcohols, Phenols, Ethers and epoxide, carbonyl, carboxylic acid and sulphur containing compounds.

Course Objectives:

The objective of this course is to learn basics concepts of reaction mechanism and electronic flow present in the molecules which help to drive arrow pushing mechanism. This course recalls the fundamental principles of organic chemistry that include chemical bonding, nomenclature, structural isomerism, stereochemistry, chemical reactions and mechanism.

Curriculum Content

Unit 1: Chemistry of Halogenated hydrocarbons **8 Hrs**

Alkyl halides: Methods of preparation, nucleophilic substitution reactions-S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvents etc; nucleophilic substitution vs. elimination.

Aryl halides: Preparation, including preparation from diazoniumsalts. Nucleophilic aromatic substitution; S_NAr and Benzyne mechanism. Relative reactivity of Alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg and Li metals and use in synthesis of organic compounds.

Unit 2: Alcohols, Phenols, Ethers and epoxide **9Hrs**

Alcohols: Preparation, properties and relative reactivity of 1^o, 2^o, 3^o alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols; Oxidation by periodic acid and Lead tetra acetate, Pinacol-Pinacolone rearrangement.

Phenols: Preparation and properties; Acidity of substituted phenols; Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions, Fries and Claisen rearrangements.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$

Unit 3: Carbonyl Compounds **8 Hrs**

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol condensation, Claisen-Schmidt condensation, Perkin and Cannizzaro reactions; Benzoin condensation, Beckmann and Benzil-Benzilic acid rearrangements and Wittig reaction, Baeyer-Villiger Oxidation and Clemmensen, Wolff-Kishner and borohydride reductions, .Addition reactions of α, β-unsaturated carbonyl compounds: Michael additions. Active methylene compounds, Keto-enol, tautomerism.

Unit 4: Carboxylic Acids and their Derivatives **8 Hrs**

Preparation, physical properties and reactions of monocarboxylic acids, typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids, viz; succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids, Preparation and reactions of acid chlorides, anhydrides, esters and amides; Mechanism of acidic and alkaline hydrolysis of esters. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann-bromamide degradation and Curtius rearrangement

Unit 5: Sulphur containing compounds **6 Hrs**

Preparation and reactions of thiols, thioethers and sulphonic acids;
Thiophene: reactions and properties.

Course Outcome:

Having successfully completed this course, the student will be able to:
CO1: Predict the reactivity of an organic compound from its structure.
CO2: Develop basic skills for the multi-step synthesis of organic compounds.
CO3: Justify a reasonable mechanism for a chemical reaction.
CO4: Identify the name of the functional groups and different classes of organic compounds
CO5: Predict electronic flow and arrow-pushing mechanism in a chemical reaction.

TEXT BOOK:

1. Organic Chemistry, Morrison, R. T. & Boyd, R. N., Pearson Education, 7 Ed., (2010)
2. Organic Chemistry (Volume 1), Finar, I. L., Pearson Education 6 Ed., (2002)
3. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure

REFERENCE BOOKS:

1. J. Cleyden and S. Warren, Organic Chemistry, Oxford University Press; Second edition (2012)
2. F.A. Carey & R. Sundberg, Advanced Organic Chemistry-(Part-A & B), Springer; 5thedition
3. R. B. Grossmann, The Art of Writing Reasonable Organic Reaction Mechanisms, Springer;

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

SR.NO.	LIST OF EXPERIMENTS
1	Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
2	Organic preparations: Acetylation of one of the following compounds: amines (aniline, o-, m-, p-toluidines and o-, m-, p-anisidine)
3	Acetylation of Salicylic acid by any one method: a. Using conventional method b. Using green approach
4	Benzolyation of one of the following amines (aniline,β-naphthol, resorcinol, p-cresol) by Schotten-Baumann reaction.
5	Nitration of acetanilide/nitrobenzene by conventional method.
6	Preparation of Warfarin
7	Semicarbazone of any one of the following compounds: acetone, ethyl methyl Ketone, cyclohexanone, benzaldehyde.
8	Nitration of salicylic acid by green approach (using ceric ammonium nitrate.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-208	Subject Title	PHYSICAL CHEMISTRY III						
LTP	3 1 2	Credit	5	Subject Category	CC	Year	2nd	Semester	III

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development/ Knowledge	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

This course covers the concept of phases, fundamental of electrochemistry, applications of electrochemistry, distribution Law and applications of distribution law.

Course Objective:

The objective of this course is to gain the knowledge about the concepts of electrolytic solutions and electrolytes. It will also give the information regarding the number of phase present in a chemical component and to know their applications in various fields.

Detailed Syllabus

Unit 1: Phase Equilibria-I

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for non-reactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Unit 2: Phase Equilibria-II

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions. Three component systems, water-chloroform-acetic acid system, triangular plots.

Unit 3: Phase Equilibria-III

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non-ideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation.

Unit 4: Fundamental of Electrochemistry (I)

Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), wien effect, Debye- Falkenhagen effect and Walden”s effect. Transport number, definition and determination by Hittorf's method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conduct metric titrations. Quantitative aspects of Faraday’s laws

of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples.

Unit 5: Distribution Law

Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination. Applications of distribution law:
(i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride.
(ii) Determination of equilibrium constant of potassium tri-iodide complex and process of extraction.

Learning Outcome

Having successfully completed this course, the student will be able to:
CO1: Predict the reactivity of gases and knowledge about miscibility of liquid.
CO2: Develop basic skills for the measurement of conductivity and determination of solubility.
CO3: To understand the basic working principle of different kinds of batteries.
CO4: Knowledge about fundamentals of ionic reactions and applications of various laws.

TEXT BOOK [TB]:

1. Essentials of Physical Chemistry by Arun Bahl, B. S. Bahl, G. D. Tuli, S Chand Publishing 2014.
2. A textbook of physical chemistry by KL Kapoor Vol 1 & 3, McGraw Hill Education (India)Pvt. Ltd
3. K. L Kapoor, Textbook of physical chemistry, Volume III (2015)

REFERENCE BOOKS [RB]:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

Sr. No.	LIST OF EXPERIMENTS
1	Study the equilibrium of at least one of the following reactions by the distribution method: **(i)** $I_2(aq) + I^- \rightarrow I_3(aq)$ **(ii)** $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$
2	Perform the following potentiometric titrations (at least two): **(i)** Strong acid with strong base **(ii)** weak acid with strong base and **(iii)** dibasic acid with strong base
3	Potentiometric titration of Mohr's salt with potassium dichromate
4	Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.
5	Phase equilibria: Construction of the phase diagram of **(i)** simple eutectic and **(ii)** congruently melting systems, using cooling curves and ignition tube methods

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-206	Subject Title	INORGANIC CHEMISTRY-III						
LTP	3 1 2	Credit	5	Subject Category	CC	Year	2nd	Semester	IV

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

This course covers chemistry of transition elements and understanding of their coordination theories. This course also covers chemistry of actinides and lanthanides along with the brief understanding of Bioinorganic Chemistry of elements.

Course Objective:

The objectives of this course are to develop skill and to learn basics concepts of metal-ligand interaction and their applications in medicine, pharmaceuticals, medical sciences and in allied areas.

Course Pre/Co- Requisite (If Any):

The student must have basic knowledge of electrostatics and magnetostatics.

Detailed Syllabus

Unit 1: Coordination Chemistry **9 Hrs**

Werner's theory, valence bond theory (inner and outer orbital complexes), Crystal field theory, measurement of 10 Dq (Δo), CFSE in weakand strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry. Jahn-Teller theorem, square planar geometry. IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexeswith 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

Unit 2: Transition Elements **9 Hrs**

General group trends with special reference to electronic configuration, colour, variablevalency, magnetic and catalytic properties and ability to form complexes. Stability of various oxidation states. Difference between the first, second and third transition series. Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their metallurgy)

Unit 3: Lanthanoids **6 Hrs**

Electronic configuration, oxidation states, color, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

Unit 4: Actinoids **6 Hrs**

Electronic configuration, oxidation states, color, spectral and magnetic properties of actinides and separation of lanthanides

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Unit-5 Bioinorganic Chemistry **9 Hrs**

Metal ions present in biological systems, classification of elements according to their actionin biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals.

Toxicity of metal ions (Hg, Pb, Cd and as), reasons for toxicity, Use of chelating agents in medicine. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

Learning Outcome

Students will gain an understanding of:

CO1: the bonding fundamentals for both ionic and covalent compounds, including electro negativities, bond distances and bond energies using MO diagrams.

CO2: predicting geometries of simple and complex molecules

CO3: the fundamentals of the chemistry of transition elements, lanthanides and actinides and important applications in bioinorganic chemistry.

CO4: the bonding models, structures, re-activities, and applications of coordination complexes, and organometallic chemistry.

TEXT BOOKS

1. Purcell, K.F &Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977.
2. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.

REFERENCES

1. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
2. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. Wiley-VCH, 1999
3. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley &Sons, NY, 1967.

Sr. No.	EXPERIMENT NAME
1	**(a) Complex metric Titrations:**
	(i) Complex metric estimation of (i) Mg2+ (ii) Zn2+ using EDTA
	(ii) Estimation of total hardness of water samples
	(iii) Estimation of Ca2+ in solution by (substitution method) using Erio-chrome black-T as indicator.
	(iv) Estimation of Ca/Mg in drugs and Biological samples
2	**(b) Argentometry**
	Estimation of Cl^- (i) By Mohr's method, (ii) By Vohlard's method, (iii) By Fajan's method.
3	**(c)** Paper Chromatographic separation of Ni (II) and Co(II); Cu(II) and Cd (II)C

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Department of Chemistry
Course Code	CHF217
Course Title	Organic Chemistry III
Credits	5
Contact Hours (L:T:P)	3:1:2
Prerequisites (if any)	None
Course Basket	Core

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓		
Employability				✓	
Entrepreneurship					✓

Course Summary

This course covers preparation and important reactions of nitrogen containing compounds like nitro-, amino-, nitriles, is nitrile derivatives, alkaloids and heterocyclic aromatic compounds. Course also covers polynuclear aromatic compounds and structural elucidation of terpenes and their preparation.

Course Objectives:

The objective of this course is to learn the various classes of heterocyclic organic compounds, their relativities and reactions. To enable the students to employ the organic name reactions and the strategic plans for the synthesis of various heterocyclic compounds present in different natural products. The concepts learnt in this course will enhance employability and also provide a pathway to be an entrepreneur in this field.

Curriculum Content

Unit 1: Nitrogen Containing Functional Groups **8 Hrs**

Preparation and important reactions of nitro- and amino-compounds, nitriles and isonitrile derivatives. **Amines:** Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1^o, 2^o and 3^o amines with Hinsberg reagent and nitrous acid; **Diazonium Salts:** Preparation and their synthetic applications.

Unit 2: Polynuclear Hydrocarbons **7 Hrs**

Reactions of naphthalene, phenanthrene and anthracene: Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

Unit 3: Heterocyclic Compounds **9 Hrs**

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Indole, Fischer indole synthesis and Madelung synthesis.

Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction for Quinolines and Isoquinolines.

Unit 4: Alkaloids **8 Hrs**

Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

Unit 5: Terpenes **7 Hrs**

Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Menthol and α-terpineol.

Course Outcome:

Having successfully completed this course, the student will be able to:

CO1: Predict the reactivity of any heterocyclic compound from its structure and explain its reaction products.

CO2: Develop basic skills for the multi-step synthesis of heterocyclic compounds.

CO3: Work out a reasonable mechanism for a chemical reaction.

CO4: Identify the various classes of natural products and the total synthesis plan for various Natural products.

CO5: Explain the structure elucidation chemistry for different classes of natural products and their isolation process.

TEXT BOOK:

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: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

REFERENCE BOOKS:

1. J. Cleyden and S. Warren, Organic Chemistry, Oxford University Press; Second edition (2012)
2. F.A. Carey & R. Sundberg, Advanced Organic Chemistry-(Part-A & B), Springer; 5thedition
3. R. B. Grossmann, The Art of Writing Reasonable Organic Reaction Mechanisms, Springer;
4. J. J. Li and E. J. Corey, Total Synthesis of Natural Products. Springer, 2012

Sr. No.	LIST OF EXPERIMENTS
1	Diels-Alder reaction between anthracene and maleic anhydride
2	Reduction: nitrobenzene to azobenzene (TLC of the mixture), m-dinitrobenzene to m-nitroaniline.
3	S-benzyl isothiuranum salts of any one water-soluble and one water-insoluble acid: acetic acid, phenylacetic acid, oxalic acid, benzoic acid, phthalic acid
4	Photochemical reduction of benzophenone to benzo pinacol
5	Benzoin condensation of benzaldehyde (using thiamine hydrochloride)
6	Condensation of p-toluidine with benzaldehyde/salicylaldehyde/2-hydroxy-3- methoxy benzaldehyde to get Schiff's base (solventless condensation).
7	Estimation of Phenol and aniline by bromination with potassium bromate-potassium bromide method
8	Glycine by formylation method 3. Saponification value of an oil/fat

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-218	Subject Title	PHYSICAL CHEMISTRY-IV					
LTP	3 1 2	Credit	5	Subject Category	CC	Year	2nd	Semester	IV

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development/ Knowledge	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

This course covers the electrochemistry of electrolytes; kinetics of chemical reactions, reactions under photolytic conditions, the role of catalysts in chemical reactions also covers physical properties.

Course Objective:

The main objective of this course is to understand the Physical Properties of matter with respect to the surrounding environment. Hands-on practices through experiments are also provided to the students for skill development.

Detailed Syllabus

Unit I: Electrochemistry-(II) **12Hrs**

The electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells.

Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation),

Unit II: Chemical Kinetics **7 Hrs**

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second-order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

Unit III: Catalysis & Surface Chemistry **6Hrs**

Surface chemistry: Physical adsorption, chemisorption, adsorption isotherms. Nature of adsorbed state, Adsorption of gases on solids, Freundlich isotherm, Langmuir adsorption isotherm and BET isotherms.

Catalysis: Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Unit IV: Photochemistry **7 Hrs**

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photo-sensitized reactions, quenching. Role of photochemical reactions in biochemical processes, photo-stationary states, chemiluminescence.

Unit V: Physical Properties and Chemical Constitution **8 Hrs**

Surface Tension and Chemical Constitution, use of Parachor in elucidating structure, Viscosity and Chemical Constitution, Dunstan Rule, Molar Viscosity, Rheochor, Dipole Moment, Determination of Dipole moment, Dipole moment and molecular structure, Dipole moment and Ionic Character, Molar refraction and chemical constitution, Optical activity and chemical constitution, Magnetic properties, Paramagnetic and Diamagnetic Substances.

Learning Outcome: -

At the end of the course, the student will be able to:

CO1: understand the electrolysis process and principles involved.
CO2: study the rate of reaction and effect of physical properties on it.
CO3: study the photonic properties of electrons and it behaviour towards light.
CO4: analyze the effect of the Catalyst on the reaction mechanism.
CO5: study the different processes in gaseous state.

TEXT BOOKS

1. Essentials of Physical Chemistry by Arun Bahl, B.S Bahl, G.D. Tuli, S Chand Publishing 2014.
2. A textbook of physical chemistry by KL Kapoor Vol 3 & 5, McGraw Hill Education (India)Pvt. Ltd.
3. K. L Kapoor, Textbook of physical chemistry, Volume III and V (2015)

REFERENCES BOOK: -

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Laidler, K. J. Chemical Kinetics Pearson Education: New Delhi (2004).
5. K. L Kapoor, Textbook of physical chemistry, Volume III and V (2015).

Sr. No.	EXPERIMENT NAME
1	**To study changes in conductance in the following systems** **(i)** strong acid-strong base **(ii)** weak acid-strong base and **(iii)** mixture of strong acid and weak acid-strong base
2	**Study the kinetics of the following reactions.** **1.** Initial rate method: Iodide-persulphate reaction **2.** Integrated rate method: **(a)** Acid hydrolysis of methyl acetate with hydrochloric acid, volumetrically or conduct metrically. **(b)** Iodide-persulphate reaction **(c)** Saponification of ethyl acetate.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Department of Chemistry**
Course Code	CHF306
Course Title	Organic Chemistry IV
Credits	5
Contact Hours (L:T:P)	3:1:2
Prerequisites (if any)	None
Course Basket	Core

Course Mapping

	Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**
Skill Development		✓	✓	✓	
Employability	√				✓
Entrepreneurship					

Course Summary

This course is designed to provide an overview of organic chemistry. The student will understand the relationship between structure and function and molecule, major classes of reaction and synthesis of organic compounds. These cover polymers, biomolecules pharmaceutical compounds. The concept of polymers and dyes learned in this course are required in industrial processes hence raising chances of employability in this sector.

Course Objectives:

The objective of this course is to learn the basics concepts of polymerization and the importance of biomolecules, and pharmaceutically relevant drug molecules. This course recalls the fundamental principles of organic molecules like dyes, terpenes, carbohydrates, amino acids and lipid molecules.

Curriculum Content

Unit 1: Polymers **9 Hrs**

Introduction and classification of polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polymerisation reactions - Addition and condensation polymerization- Mechanism of cationic, anionic and free radical addition polymerization; Ziegler-Natta catalyst polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene, Nylon-6, Nylon 6,6, Polyethylterephthalate); Rubbers- natural and synthetic: Buna-S, Buna-N, Chloroprene and Neoprene; Vulcanization; Biodegradable and conducting polymers with examples.

Unit 2: Biomolecules **9 Hrs**

Carbohydrates: Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis; Disaccharides – Structure elucidation of maltose, lactose and sucrose Polysaccharides – starch, and cellulose.

Nucleic Acids: Components of nucleic acids, Nucleosides and nucleotides;

Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides.

Amino acids, Peptides and Proteins: Amino acids, Peptides and their classification. α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis; Study of peptides: determination of their primary structures-end group analysis, **Lipids:** Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity

Unit 3: Pharmaceutical Compounds: Structure and Importance 8 Hrs

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

Unit 4: Terpenes-II 6 Hrs

Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neraland α-terpineol.

Unit 5: Dyes 7 Hrs

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes - Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin.

Course Outcomes

At the end of the course, the student will be:

CO1: Predict the mechanism of polymerization of monomeric units.
CO2: Develop basic skills for the synthesis of polymers and understanding about the biomolecules.
CO3: Justify a reasonable mechanism for pharmaceutically relevant molecules.
CO4: Predict reactivity and synthesis of terpenes.
CO5: Identify name the functional groups and different class of organic dyes

Text book:

1. Organic Chemistry Morrison, R. T. & Boyd, R. N., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry Finar, I. L. (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Reference books:

1. Principles of Biochemistry, Nelson, D. L. & Cox, M. M. Lehninger's Fourth Edition, W. H. Freeman.
2. L. Biochemistry, Berg, J. M., Tymoczko, J. L. &Stryer, Sixth Edition, W. H. Freeman.
3. Polymer Science Textbook of, Billmeyer, F. W. John Wiley & Sons, Inc.

Sr. No	EXPERIMENT NAME
1	Systematic analysis of extra elements in the given unknown compounds
2	Tests for following functional groups and unsaturation
3	Qualitative analysis of the following types of unknown organic compounds Carboxylic acids Phenols Alcohols Aldehydes Ketones Esters
4	Synthesis of phenol-formaldehyde resin.
5	Preparation of phenolphthalein
6	Preparation of Schiffs base of amines.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF307	Subject Title	PHYSICAL CHEMISTRY-V					
LTP	3 1 2	Credit	5	Subject Category	CC	Year	3rd	Semester	V

Course Mapping:

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development/ Knowledge	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:
This course would cover Schrödinger equation wave functions**,** Qualitative treatment of hydrogen atom and hydrogen-like ions

Course Objective:
To gain the knowledge of the various aspects of Physical properties of the compound and their components.

Course Pre/Co- requisite (if any): The student must have basic knowledge of Bohrs & Thomson model of atom. Functional property of different atoms.

Detailed Syllabus

Unit I: Quantum Chemistry: Wave Mechanics **9 Hrs.**

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box", quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties, Extension to two- and three-dimensional boxes, separation of variables, degeneracy.
Average and most probable distances of electron from nucleus.
Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Unit 2: Quantum Chemistry: Schrödinger equation for Atomic orbitals **6 Hrs**

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals. Qualitative extension to H_2.
Comparison of LCAO-MO and VB treatments of H_2 (only wave functions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB).

Unit 3: Rotational Spectroscopy **10 Hrs**

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Unit 4: Vibrational spectroscopy

Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.
Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Unit 5: Molecular Spectroscopy: Electronic Transitions and Magnetic Resonance 8 Hrs

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and pre-dissociation, calculation of electronic transitions of polyenes using free electron model.
Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low-resolution spectra, different scales, spin-spin coupling and high-resolution spectra, interpretation of PMR spectra of organic molecules.
Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structures, ESR of simple radicals.

Learning outcome: -

At the end of the course student will be able to:

CO1: get idea about the wave nature of the atom and molecules
CO2: study the functional property of different atoms
CO3: study the vibrations of the molecules
CO4: differentiate between the transitions of atom between energy levels
CO5: study of Physical Properties of the compound

TEXT BOOKS

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Laidler, K. J. Chemical Kinetics Pearson Education: New Delhi (2004).

REFERENCES

1. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
3. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
4. Lowe, J. P. & Peterson, K. Quantum Chemistry Academic Press (2005).
5. K. L Kapoor, Textbook of physical chemistry, Volume IV (2015)

Sr. No.	EXPERIMENT NAME
1	Verification of Lambert-Beer's Law
2	Determination of pK (indicator) for phenolphthalein or methyl red.
3	Study the kinetics of interaction of crystal violet with sodium hydroxide calorimetrically.
4	Analysis of the given vibration-rotation spectrum of HCl(g)
5	Record the UV spectrum of p-nitro phenol (in 1:4 ethanol: water mixture). Repeat after adding a small crystal of NaOH. Comment on the difference, if any.
6	Record the U.V. spectrum of a given compound (acetone) in cyclohexane (a) Plot transmittance versus wavelength. (b) Plot absorbance versus wavelength. (c) Calculate the energy involved in the electronic transition in different units, i.e. cm^{-1}, kJ/mol, kcal/mol & eV.
7	Study the formation of a complex between ferric and thiocyanate (or salicylate) ions.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-216	Subject Title	INORGANIC CHEMISTRY--IV					
LTP	3 1 2	Credit	5	Subject Category	CC	Year	3rd	Semester	V

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

The course begins with an understanding of organometallic compounds and general principles of Metallurgy

Course Objective:

The objectives of this course are to learn the basic concepts involved in the chemistry of cations and anions. Study of organometallic compounds with their applications in medicine, pharmaceuticals, medical sciences and in allied areas.

Detailed Syllabus

Unit I: Theoretical principles **8 Hrs**

Theoretical principles and chemistry involved in qualitative analysis of mixture of cations and anions including interfering and insoluble. Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

Unit II: General Principles of Metallurgy **7 Hrs**

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Mond's process, Zone refining

Unit III: Organometallic Compounds-I **8 Hrs**

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls

Unit IV: Organometallic Compounds-II **9 Hrs**

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene Role of triethylaluminium in polymerisation of ethene (Ziegler –Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium.

Unit V: Catalysis by Organometallic Compounds **7 Hrs**

Study of the following industrial processes and their mechanism: 1. Alkene hydrogenation (Wilkinsons Catalyst) 2. Hydroformylation (Co salts) 3. Wacker Process 4. Synthetic gasoline (Fischer Tropsch reaction) 5. Synthesis gas bymetal carbonyl complexes.

Learning Outcome

Students will gain an understanding of:

CO1: Principles and chemistry involved in qualitative analysis of mixture of cations and anions and the role ofinterfering ions.
CO2: Introduction of different metallurgical processes used for different industries
CO3: Detailed study of different types of organometallic compounds
CO4: Organometallic compounds and their biological importance.
CO5: Different catalytic processes initiated by organometallic compounds.

TEXT BOOKS

1. N.N. Greenwood, and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
2. J. D. Lee, Concise Inorganic Chemistry, ELBS 1991.
3. Canham, G.R. and Overton, T., Descriptive Inorganic Chemistry, Freeman & Co.2006.
4. F. A. Cotton andG. Wilkinson; Advanced Inorganic Chemistry, Wiley, VCH, 1999.
5. Svehla, G. Vogel's Qualitative Inorganic Analysis, 7th Edition, Prentice Hall, 1996-03-0
6. Powell, P. Principles of Organometallic Chemistry, Chapman and Hall, 1988.

REFERENCE BOOKS

1. T. H. Dunning and D. E. Woon; p-Block Elements-Inorganic chemistry, Magnum Publishing, 2016
2. W. N. Lipscomb; Boron Hydrides, Dover Publications.inc, 2012
3. Spessard, Gary O., &Gary L. Miessler. Organometallic Chemistry. Upper Saddle River, NJ: Prentice-Hall, 1996.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Sr. No.	EXPERIMENT NAME
1	Using H_2S /PTC/ Thioacetamide or any other reagent. Identification of cations and simple anions in a mixture of salts containing not more than six ions (Three cations and three anions) interfering anions using semi micro scheme of analysis. If combination of cations or anions is given in the mixture, insoluble should be avoided. Spot tests should be carried out for final identifications wherever feasible. Cation: Pb^{2+},Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+} or Sn^{4+}, Fe^{2+} or Fe^{3+}, Al^{3+}, Cr^{3+},Co^{2+}, Ni^{2+}, Zn^{2+}, Mn^{2+}, Ba^{2+},Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4 , K
2	Using H_2S /PTC/ Thioacetamide or any other reagent. Identification of cations and simple anions in a mixture of salts containing not more than six ions (Three cations and three anions) interfering anions using semi micro scheme of analysis. If combination of cations or anions is given in the mixture, insoluble should be avoided. Spot tests should be carried out for final identifications wherever feasible. $2-$ $2-$ $-$ $-$ $-$ $-$ $-$ $2-$ $3-$ $3-$ $-$ $2-$ Anion : CO_3 , SO_3 , $S2-$, NO_2 , CH_3COO , NO_3 , Cl , Br , I , SO_4 , PO_4 , BO_3 , F , C_2O_4
3	Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs thermodynamic factors.
4	Preparation of acetylacetanato complexes of Cu^{2+}/Fe^{3+}. Find the λmax of the complex.
5	Synthesis of ammine complexes of Ni(II)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Department of Chemistry
Course Code	CHF316
Course Title	Organic Chemistry V
Credits	5
Contact Hours (L:T:P)	3:1:2
Prerequisites (if any)	None
Course Basket	Core

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓	✓	
Employability					
Entrepreneurship					

Course Summary

This course covers the elucidation of molecular structures and spectroscopy of molecular compounds.

Course Objectives:

The objective of this course is to learn basic techniques for the identification and characterization of organic compounds. In this unit, students will learn the characterization of organic compounds in multistep synthesis and step-by-step synthesis. This course not only refreshes the fundamental concepts of spectroscopy but also aids in the interpretation of spectrum data, which is essential for employment in the pharmaceutical business.

Curriculum Content

Unit 1: UV Spectroscopy of Organic Compounds **8 Hrs**

UV Spectroscopy: Types of electronic transitions, λ-max, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ-max for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and hetero annular; Application of Woodward Rules for calculation of λ-max for extended conjugated systems (aldehydes, ketones and dienes); the distinction between cis- and trans-isomers

Unit 2: IR Spectroscopy of Organic Compounds: **8 Hrs**

Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups. Effect of H- bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

Unit 3: NMR Spectroscopy of Organic Compounds: **8 Hrs**

Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpetation of NMR spectra of simple compounds

Unit 4: Mass Spectroscopy of Organic Compounds: **7 Hrs**

Types of ionization techniques, basic principles of EI. Fragmentation processes and structural analysis. ESI, GC/MS, LC/MS and MS/MS techniques, the fragmentation pattern of small molecules and Mc Lafferty rearrangement.

Unit 5: Application of Spectroscopic Technique in Characterization of Organic Compounds
8 Hrs

Interpretation of spectroscopic (NMR, IR and mass) data as applied to organic compounds. Problems incorporating spectroscopic data. Application of spectroscopic technique in step by step and multistep synthesis

Course Outcome

At the end of the course, the student will be able to:

CO1. To understand the role of NMR spectroscopy in the structural elucidation of organic compounds.
CO2. Develop the basic skills for the characterization of multi-step synthesis of organic compounds.
CO3. Predict the active nuclei in nuclear magnetic resonance spectroscopy.
CO4. Identify the functional groups in organic compounds by IR spectroscopy
CO5. Predict the structure of simple organic compounds by UV, IR, NMR, and mass spectroscopy

TEXT BOOKS:

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Kemp, W. Organic Spectroscopy, Palgrave.
3. Kalsi, P. S. Textbook of Organic Chemistry (1st Ed.), New Age International (P) Ltd.Pub.

REFERENCE BOOKS:

1. J. Cleyden and S. Warren, Organic Chemistry, Oxford University Press; Second edition (2012)
2. Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce Spectrometric Identification of Organic Compounds, 8th Edition published by Wiley.

Sr. No.	EXPERIMENT (Synthesis and isolation of the product by column chromatography)
1	Preparation of Benzyl alcohol from benzaldehyde.
2	Esterification of carboxylic acid.
3	Williamson synthesis of ether
4	Synthesis of oxime from ketones
5	Oxidation of alcohol to ketone
6	Oxidation of aldehyde to carboxylic acid
7	Hydrolysis of triglyceride
8	Preparation of bio Diesel by trans esterification reaction.
9	Iodination of α-Naphthol
10	Multistep synthesis

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF317	Subject Title	Inorganic Chemistry -V					
LTP	3 1 2	Credit	5	Subject Category	CC	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	√	√	√	√	√
Employability					
Entrepreneurship					

Course Outline:

This course highlights the applications in industry. The course covers different sources of energy and its correlation with environment and metallurgical processes.

Course Objective:

The objectives of this course are to learn basics concepts involved in inorganic chemicals and industrial gases. To study of energy and environment with introduction of biocatalysts and their importance in green chemistry as well as in chemical industries to understand their role in environment. The intend to develop skill and give fundamental concept of inorganic chemicals, biocatalyst etc.

Detailed Syllabus

Unit I: Industrial Gases **8 Hrs**

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Unit II: Inorganic Chemicals **7 Hrs**

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

Unit III: Energy &Environment **9 Hrs**

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Unit IV: **Biocatalysts** **6 Hrs**

Introduction to biocatalysis: Importance in “Green Chemistry” and Chemical Industry.

Unit V: Industrial Metallurgy 9 Hrs

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Learning Outcome:

Students will gain an understanding of:

CO1: Industrial gases, their production and hazardous effects.

CO2: Introduction of different types of inorganic chemicals and their uses for domestic as well as inindustrial purposes.

CO3: Detailed study of different sources of energy and its correlation with environment.

CO4: Role of biocatalysts with special reference to green chemistry.

CO5: Different metallurgical processes used for metals.

TEXT BOOKS

1. N.N. Greenwood, and Earnshaw, Chemistry of the Elements, ButterworthHeinemann. 1997.
2. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
3. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, NewDelhi.
4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
6. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.

REFERENCE BOOKS

1. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
2. S.E. Manahan, Environmental Chemistry, CRC Press (2005).
3. G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
4. A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

Sr. No.	EXPERIMENT NAME
1	Determination of dissolved oxygen in water.
2	Percentage of available chlorine in bleaching powder
3	Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$and potassium chromate).
4	Determination of Chemical Oxygen Demand (COD)
5	Determination of Biological Oxygen Demand (BOD)
6	Study of some of the common bio-indicators of pollution.
7	Preparation of borax/ boric acid.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-346	Subject Title	GREEN METHODS IN CHEMISTRY					
LTP	3 0 0	Credit	3	Subject Category	DSE	Year	3rd	Semester	V

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓	✓	
Employability				✓	
Entrepreneurship					✓

Course Outline:
This course would include application of twelve principles of green chemistry

Course objective: -

1. To impart basic knowledge and designing skills with reference to green chemistry.
2. To teach alternate eco-friendly techniques for chemical reactions
3. To understand the green & renewable raw materials and clean synthesis processes.
4. To recognize the sustainable bio-approaches in catalytic processes and industrial operations.
5. To figure out the nature friendly techniques in routine chemical procedures.
6. To not only enhance basic knowledge related to green chemistry but also provide basics required to be professionals or to be an entrepreneur in this field.

Course Pre/Co- requisite (if any): The student must have basic knowledge of methodology and reaction mechanism for various conventional preparation.

Detailed Syllabus

Unit – 1 Introduction to Green Chemistry **6 Hrs**

Emergence of green chemistry, twelve principle of green chemistry, Use of alternative feedstock (biofuels), Use of innocuous reagents, Use of alternative solvents, Design of safer chemicals, designing alternative reaction methodology, Minimizing energy consumption.

Unit – 2 Alternative Reaction Conditions **9 Hrs**

Ionic liquids: “Designer” solvents for green chemistry, supported liquid-phase systems in transition metal catalysis, Organic chemistry in water: green and fast formation, mechanisms, and minimization of chlorinated micro pollutants (Dioxins) formed in technical incineration processes

Unit – 3 Green Reagents **7 Hrs**

The four-component reaction and other multicomponent reactions of the isocyanides, Carbohydrates as renewable raw materials: A major challenge of green chemistry, Photo-initiated synthesis: A useful perspective in green chemistry, Dimethyl carbonate as a green reagent

Unit-4: Green Catalysis and Biocatalysis **9 Hrs**

Green Chemistry: Catalysis and Waste Minimization, Seamless Chemistry for Sustainability

Enantioselective Metal Catalyzed Oxidation Processes, Zeolite Catalysts for Cleaner Technologies, Acid and Super Acid Solid Materials as No Contaminant Alternative Catalysts in Refining, The Oxidation of Isobutene to Meth Acrylic Acid: An Alternative Technology for MMA Production, Biocatalysts for Industrial Green Chemistry

Unit -5: Case Studies **8 Hrs**

A green synthesis of ibuprofen which creates less waste and fewer byproducts (Atom economy), Surfactants for Carbon Dioxide – replacing smog-producing and ozone-depleting solvents with CO2 for precision cleaning and dry cleaning of garments, Environmentally safe antifoulant, CO2 as an environmentally friendly blowing agent for the polystyrene foam sheet packaging market, Using a catalyst to improve the delignifying (bleaching) activity of hydrogen peroxide, A new generation of environmentally advanced preservative: getting the chromium and arsenic out of pressure treated wood, Rightfit pigment: synthetic azo pigments to replace toxic organic and inorganic pigments, Development of a fully recyclable carpet: cradle to cradle carpeting.

Learning outcome:

The student will be able to:

CO1: develop proficiency in fundamental principles of green chemistry.
CO2: become well versed with nature's harmonious chemical reaction techniques.
CO3: The learner will be proficient to adopt cleaner raw material & synthesis approaches in chemistry.
CO4: The student comprehends the environment-friendly catalysis methods in chemical processes.
CO5: The scholar will be well acquainted with routine chemical processes harmonious with nature.

TEXT BOOKS-

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. Mishra, A. (2005) Environmental Studies. Selective and Scientific Books, New Age publishers.

REFERENCE BOOKS

1. "Methods and Reagents for Green Chemistry – An Introduction" edited by Pietro Tundo, Alvise Perosa and Fulvio Zecchini, published by John Wiley and Sons Inc. in 2007.
2. Cann, M. C. & Thomas, P. Real world cases in Green Chemistry, American Chemical Society (2008).

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-347	Subject Title	POLYMER CHEMISTRY					
LTP	3 00	Credit	3	Subject Category	DSE	Year	3rd	Semester	V

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓	✓	✓
Employability					
Entrepreneurship					

COURSE OUTLINE:

This course would be a pre-requisite for the advanced level course at the post graduate Level. The course begins with the topics related to basic terminologies and classification system used in Polymer science. In the second unit, the kinetics and morphological description of polymers are included which is followed by the description of physical models for the structure-property relationships of the polymers in the third unit. Fourth and fifth units are about the characteristics and applications of various commodity polymers and studies of various engineering and specialty polymers and their application in materials design.

COURSE OBJECTIVE:

- To develop among students basic concepts regarding polymers
- To make them understand of the kinetics, process of polymerization for various kinds of polymers and their applications
- The course imparts a considerate learning on the Structure-Properties relations of polymers and to develop an insight towards interpretations of physical parameters through applying thermodynamics of polymer mixtures.
- To make them employable and well versed with various kind of specialty and engineering polymers

Course Pre/Co- Requisite (If Any):

The student must have basic knowledge of polymer reactions, polymer product such as thermoplastic thermosetting elstromers extra.

Detailed Syllabus

Unit 1: Introduction, Basic terms and Functionality of Polymeric Materials 7 Hrs

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

Unit 2: Kinetics of Polymerization and Crystallization of Polymers 9 Hrs

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques. Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Unit 3 Structure Property relationships of Polymers 9 Hrs

Determination of molecular weight of polymers (Mn, Mw, etc.) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance, Polydispersity index. Solubility parameters for solutions of polymer mixtures, Thermodynamics of polymer solutions; Enthalpy and free energy change of mixing of polymers solutions, Free volume and Glass transition temperature (Tg) determination and factors affecting Tg.

Unit 4 Properties (Physical, thermal, Flow & Mechanical) of selected Synthetic Polymers 8 Hrs

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, Phenol formaldehyde resins (Bakelite, Novalac),

Unit 5 Some Selected Engineering Polymers, Properties and their Modern Applications 6 Hrs

Polycarbonates, Polamides compounds (PAI, Aramids), Thermoplastic polyurethanes (TPUs), Silicone polymers; Biocompatible polymers: Polylactide-co-glycolides, Conducting Polymers, [polyacetylene, polyaniline, polyIndoles

Learning Outcome: -

At the end of this course, the student will be able to:

CO1: isolate the key design features of a product that relate directly to the material(s) used in its construction

CO2: Indicate how the properties of polymeric materials can be exploited by a product designer

CO3: describe the role of rubber-toughening in improving the mechanical properties of polymer

CO4: estimate the number, weight and average molecular masses of polymer samples given the degree of polymerization and mass fraction of chains present.

TEXT BOOKS

1. Text Book of Polymer Science, F.W. Billmeyer: John Wiley.
2. Polymer Science & Technology, P. Ghosh: Tata Mcgraw-Hill.

REFERENCE BOOKS

1. Polymer Chemistry, Seymour's Marcel Dekker, Inc.
2. Principles of Polymerization G. Odian: John Wiley.
3. Organic Chemistry R.W. Lenz: of Synthetic High Polymers.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-349	Subject Title	FUNDAMENTALS OF BIOCHEMISTRY					
LTP	3 1 2	Credit	5	Subject Category	DSE	Year	3rd	Semester	V

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓	✓	✓
Employability					
Entrepreneurship					

Course Outline:

This course constitutes the premises of developing the perspectives for chemistry undergraduates to comprehend the biochemical basis of clinical pathology where the students would enhance their knowledge of structural and functional roles of various biomolecules, and further, the course explains the biochemical significance of typical metabolic pathways for biomolecules synthesis or breakdown and their enzymatic regulations. The course in its last unit, elaborates on the clinical implications of alienated metabolic pathways and corresponding deranged values of intermediate markers that appear in the blood or urine so that chemistry students might correlate the basis of analytical methods followed in the qualitative and quantitative estimation of blood markers.

Course Objective:

The goal of this course is to provide chemical knowledge of structures and functions of various classes of biomolecules and further, to give mechanistic explanations of the malfunctioning of typical metabolic pathways leading to a pathological state. The course finally provides various analytical methods in clinical pathology labs performed on blood serum and urine samples.

Course Pre/Co- requisite (if any): The students should have a basic understanding of functionalized organic structures and their properties, particularly, the basic knowledge of different monomers giving rise to corresponding biomolecules.

Detailed Syllabus

UNIT-1: Basic understanding of the structures, properties and functions of carbohydrates

Review of concepts studied in the core course:

Carbohydrates: Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle. Isolation and characterization of polysaccharides.

Unit 2: Basic understanding of the structures, properties and functions of proteins

Proteins: Classification, biological importance; Primary and secondary and tertiary structures of proteins: α-helix and β- pleated sheets, Isolation, characterization, denaturation of proteins.

Enzymes: Nomenclature, Characteristics (mention of Ribozymes), Classification; Active site, Mechanism of enzyme action, Stereo specificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Unit 3: Basic understanding of the structures, properties and functions of lipids

Lipids: Classification. Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications. Lipoproteins. Properties, functions and biochemical functions of steroid hormones. Biochemistry of peptide hormones.

Unit 4: Structure of Nucleic Acid

Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological rolesof DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy.

Enzymes: Nomenclature, classification, effect of pH, temperature on enzyme activity, enzyme inhibition.

Unit 5: Biochemistry of disease: A diagnostic approach by blood/ urine analysis

Blood: Composition and functions of blood, blood coagulation. Blood collection and preservation of samples. Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin. Urine: Collection and preservation of samples. 6. Formation of urine. Composition and estimation of constituents of normal and pathological urine

Learning Outcome: -

At the end of the course, the student will be able to:

CO1: Understand the basis of preparation of various reagents and perform reactions tocharacterize biomolecules.

CO2: Explain the various conformations and complexity levels of proteins and enzyme kinetics.

CO3: Understand the classes of phospholipids and their biochemical roles in cellsignaling and also able to explain various disease models based on their malfunctioning.

CO4: Prepare various blood samples using specific additives for different types of biochemical assays.

CO5: Explain and interpret the blood and urine sample reports based on analytical results and identify the disease types.

TEXT and REFERENCE BOOKS

1. T.G. Cooper: Tool of Biochemistry
2. Keith Wilson and John Walker: Practical Biochemistry.
3. Alan H Gowenlock: Varley's Practical Clinical Biochemistry.
4. Thomas M. Devlin: Textbook of Biochemistry
5. Jeremy M. Berg, John L Tymoczko, LubertStryer: Biochemistry.
6. G. P. Talwar and M Srivastava: Textbook of Biochemistry and Human Biology.
7. A.L. Lehninger: Biochemistry.
8. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.

Sr. No.	EXPERIMENT NAME
1	Carbohydrates – qualitative and quantitative.
2	Lipids – qualitative.
3	Determination of the iodine number of oil.
4	Determination of the saponification number of oil.
5	Determination of cholesterol using Liebermann- Burchard reaction.
6	Proteins – qualitative.
7	Determination of protein by the Biuret reaction.
8	Lipids – qualitative.
9	Isolation of protein.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-348	Subject Title	FUEL CHEMISTRY					
LTP	3 1 2	Credit	3	Subject Category	DSE	Year	3rd	Semester	V

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓	✓	✓
Employability					
Entrepreneurship					

Course Outline:

This course will cover fuel, Petroleum and petrol products: it includes topics related to industrial chemistry.

Course Objective:

To develop understanding among students regarding chemical composition and properties. To make familiar with various sources and isolation procedures of petroleum. To provide understanding of the development and advancements of alternating fuels and advance battery material. To impart knowledge and skill development regarding various processes for synthetic fuels, characterization and related mechanism.

Course Pre/Co- Requisite (If Any):

The student must have basic knowledge of calorific value refining of petroleum product and knowledge of solid liquid and gaseous fuel.

Detailed Syllabus

Unit 1 **8 Hrs**

Review of energy sources (renewable and non-renewable) – classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non-fuel) in various industries, its composition, carbonization of coal - coal gas, producer gas and water gas – composition and uses Fractionation of coal tar – uses of coal tar based chemicals, requisites of a good metallurgical coke, coal gasification (Hydro gasification and catalytic gasification) coal liquefaction.

Unit 2 **8 Hrs**

Petroleum and petrol chemical industry: Composition of crude petroleum. Refining and different types of petroleum products and their applications, fuels derived from biomass, fuel from waste, synthetic fuels (gaseous and liquids), clear fuels, petro chemicals: vinyl acetate, propylene oxide, isoprene, butadiene, toluene. Petro chemicals: vinyl acetate, propylene oxide, isoprene, butadiene, toluene.

Unit 3 **8 Hrs**

Fractional distillation (principle and process), cracking (Thermal and catalytic cracking) Reforming petroleum and non-petroleum fuels (LPG, CNG, LNG). 2 Bio-fuels- Biogas, Bio-ethanol, Bio-diesel.

Unit-4 **8 Hrs**

Lubricants: Classification of lubricants, Theories of Lubrication conducting) Lubricating oils (conducting and non-solid and semi-solid lubricants. Properties of lubricants (viscosity index, cloud

point, pore point) and their determination. Synthetic lubricants.

UNIT-5 **7 Hrs**

Batteries: Primary and secondary batteries, battery components and their role. Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Learning Outcome:

At the end of this course –

The student will be able to

CO1: understand the conventional and advance fuel.

CO2: understand the various manufacturing process and design methodology of the chemical steps.

CO3: grasp the idea of advanced materials used in nonconventional fuels and fuel cells.

TEXT BOOKS:

1. Synthetic Fuels by Ronald F. Probstein, R. Edwin Hicks. Published January 31st 2006 by Dover Publications 5th Edition

REFERENCE BOOKS

1. Industrial Chemistry, E. Stochi: Vol-1, Ellis Horwood Ltd.UK
2. Engineering Chemistry, P. C. Jain, M. Jain: Dhanpat Rai & sons, Delhi.
3. Industrial Chemistry, B. K. Sharma: Goel Publishing house, Meerut.

Experiment List

1.	To determine the heat of neutralization of NaOH AND HCl
2.	Determination of Aniline point.
3.	To determine flash point of an oil by Pensky and Martin apparatus.
4.	To determine fire point of an oil by Pensky and Martin apparatus.
5.	Determination of Iodine value of an oil.
6.	Determination of viscosity of heavy oil by means of Redwood viscometer.
7.	Determination of Saponification of an oil.
8.	To determine percentage moisture, volatile, fixed carbon and ash contents in a given coal sample by proximate analysis.
9.	Determination of heat of neutralization of hydrochloric acid with sodium hydroxide.
10.	Determination of Acid value (Acidity) of an oil.
11.	Determination of saponification value of oil.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-356	Subject Title	BUSINESS SKILLS FOR CHEMISTS AND IPR					
LTP	3 0 0	Credit	3	Subject Category	DSE	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	√	√	√	√	√
Employability				√	√
Entrepreneurship					

Course Outline:

The course gives an idea of the Chemical Industry: opportunities and Challenges Business Plans and Business ModelInnovation this will also help student to learn about supply chain management.

Course Objective:

The key objective of this course is to familiarize students with Business plans, opportunities and challenges in chemical industries, supply chain management and above all to give understanding of property rights and patenting opening doors of employability in industries.

Course Pre/Co- Requisite (If Any):

The student should have Data Analysis and knowledge with Excel.

Detailed Syllabus

Unit I: Business Plans and Business Model Innovation 7Hrs

Key business concepts: Business plans, market need and project management. The value of Business models and Business model innovation; Tools.

Unit II: Indian Chemical Industry: Opportunities and Challenges 8 Hrs

Segments of Indian Chemical Industry and Percent Economic size. Demand drivers and recent investments. Concept theme of Sustainable Natural Resource Management, Impact of Green Chemistry and Modern Design of the Chemical Enterprise and challenges.

Unit III: Supply chain management 9 Hrs

Basics of: The Supply chain management; finance need, Information systems, Manufacturing and Process operations in the Chemical Industry.

Factors governing Supply chain resources and long-term challenges.

Unit IV: Introduction to Intellectual Property and Patents 7Hrs

Different Types of IP, Importance of protecting IP; Basics of Copyrights and Trade Marks;

Patents: WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

International Agreements: Word Trade Organization (WTO), Trade Related Intellectual Property Rights (TRIPS) agreement, General Agreement on Trade-related Services (GATS), Budapest Treaty and Paris Convention. IP Infringement issue and enforcement; Various laws in India Licensing and technology transfer.

Unit V: Marketing and Data Analysis **8 Hrs**

Introduction to marketing analytics, Organization Data Analysis & Visualization with Excel.

Learning outcome: -

At the end of the course, the student can:

1. Develop an understanding of Green chemistry and Sustainable resource management-related policies and challenges to realize new business models
2. workout on the documentation related to IPR and trade secrets and budgeting
3. perform data analysis using spreadsheets and data visualization for the financial need of an organization
4. able to understand the structure plan of a new business model and able to evaluate the robustness of business model towards trends and uncertainties

TEXT BOOKS

1. Martha J. Boss (Editor), Brad Boss (Editor), Cybil Boss (Editor), Dennis W. Day (Editor), Handbook of Chemical Regulations: Benchmarking, Implementation, and Engineering Concepts, CRC PRESS (2016)

REFERENCES

1. P. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).
2. Jayashree Watal, Intellectual property rights in the WTO and developing countries, Oxford University Press, Oxford (2003)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-357	Subject Title	PESTICIDE CHEMISTRY					
LTP	3 00	Credit	3	Subject Category	DSE	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓			✓
Employability				✓	
Entrepreneurship			✓		

Course Outline:

This course covers Synthetic Pesticide Analysis of Pesticides in food materials Toxicological and environmental impact of pesticides on human being and aquatic animals.

Course Objective:

The objective of this course is to learn basics concepts of Pesticides and its importance. This course recalls the basic fundamentals of synthetic and natural pesticides. They will also learn analysis of pesticides in food materials, in soil, water and in air. Student also gain knowledge regarding regulations on the use of pesticides and provide them the employability in various chemical/Pesticide industries. The course includes a definite and concise module on Pesticide industry.

Detailed Syllabus

Unit 1: Introduction of Pesticides **7 Hrs**

General introduction to pesticides. Importance of pesticides, Classification of pesticides based on origin (natural and synthetic).

Benefits and adverse effects of pesticides, changing concepts of pesticides, structure activity relationship.

Unit 2: Natural Pesticides **8 Hrs**

Occurrence and isolation, General properties, Structural determination, naturally occurring pesticides-rotenone and pyrethroids obtained from pyrethrin flowers, nicotine obtained from tobacco leaves.

Unit 3: Synthetic Pesticide **9 Hrs**

Preparation and properties of following synthetic pesticides

1. Organochlorine pesticides: Example-dichlorodiphenyltrichloro ethane (DDT or 1,1,1-trichloro-2,2-bis-p-chlorophenyl ethane).
2. Organophosphorus pesticides: Example- Parathion, Para Oxon
3. Organ carbamates and
4. Synthetic Pyrethroids.

Unit 4: Analysis of Pesticides in food materials **8 Hrs**

Identification of pesticides in food material, in vegetables, in rice and wheat and in soil.

Unit 5: Toxicological and environmental impact of pesticides **7 Hrs**

Properties or characteristics of pesticides, Regulations on the use of pesticides,

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Learning Outcome:

At the end of this course – The student will be able to

CO1: To develop understanding among students regarding various natural and synthetic pesticides.

CO2: To make familiar with various environmental impacts and toxicology on human beings and aquatic animals.

CO3: To make them well-versed in the interpretation of pesticides by analytical methods.

TEXT BOOKS

1. Chemistry of Pesticides by N. K. Roy published by CBS publishers and distributors Pvt. Ltd.
2. Manures Fertilizers and Pesticides by A. Rakshit
3. Chemistry of Pesticides by N. N. Melnikov, R. L. Busbey, et al.

REFERENCE BOOKS

1. Pesticide Formulation and Adjuvant Technology Hardcover – by Chester L. Foy (Author), David W. Pritchard (Author)
2. Chemistry of Pesticides by Karl Heiz Büchel

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-358	Subject Title	MEDICINAL AND PHARMACEUTICAL CHEMISTRY					
LTP	3 00	Credit	3	Subject Category	DSE	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓	✓		✓
Employability				✓	
Entrepreneurship					

Course Outline:
This course covers generic drugs and the use basic principle of drugs action on human system.

Course Objective:
The subject is designed to impart knowledge about the classification of pharmaceutical drugs and basic principles of medicinal chemistry of drug action. Course deals with the synthetic methods of industrial drugs preparation of selected classes. Course is also useful for industrial applications and impart employability in pharmaceutical industry.

Detailed Syllabus

Unit I: Basic Principles of Drugs Action **9 Hrs**

Physiochemical aspects of Drug action- Stereo chemical aspects of drug action (Optical, geometric and bio-isosterism of drug molecules with biological action), conformational isomerism, solubility and partition coefficient, chemical bonding. Drug-receptor interactions, receptor-effector theories, types of receptors and their actions including transduction mechanism and G- proteins. Principles of drug design (Theoretical aspects)

Unit II: Medicinal chemistry of NSAIDs and Synthetic Antibiotics **7 Hrs**

Classification, structure and therapeutic uses of NSAIDs: Ibuprofen (with synthesis), Etoricoxib (with synthesis). Classification, structure and therapeutic uses of Antibiotics: Antimalarials (Amodiaquine (with synthesis) and Artemesinin. Antibacterial and antifungal agents; (Fluoroquinolones, Fluconazole, Sulphamethoxazol, Trimethoprim, Metronidazole).

Unit III: Medicinal chemistry of CNS and CVS Drugs **8 Hrs**

Classification, Medicinal Chemistry and Synthesis of the representative drugs of the following classes: Central Nervous System agents (Phenobarbital, Diazepam, Imipramine), Cardiovascular (Atenolol, clonidine), HIV-AIDS related drugs (AZT- Zidovudine), Antiviral agents (Acyclovir).

Unit IV: Fermentation technology for Important Pharmaceutics **8 Hrs**

Fermentation: Aerobic and anaerobic fermentation. Production of (i) Acetic Acid and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, and Gentamycin (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Ascorbic acid.

Unit V: Medicinally Important Drugs from Plants & Marine **7 Hrs**

Pharmaceutics and Medicinal chemistry of Anticancerous and Antioxidants from natural products (selected examples; curcumins, Resveratrol, Taxol, Vincristine, Azadirachtin etc.); Flavonoids and Polyphenols (selected examples).

Learning outcome: -

At completion of this course it is expected that students will be able to understand-

CO1: Rationality in Drugs Design and Drug-Target specific interactions and inhibitions.

CO2: Tools (basics) of medicinal chemistry in drug research.

CO3: Design of chemical schemes for the industrial methods of drugs synthesis of various classes.

CO4: Fermentation technology process for various complex drugs for which synthesis is not viable.

CO5: Fundamental medicinal chemistry of advanced natural products, basis of their anticancer and anti-inflammatory (diabetes) preparations from active principles.

TEXT BOOKS

1. Medicinal and Pharmaceutical Chemistry, H. Singh and V. K. Kapoor, Vallabh Prakashan, Delhi.
2. Medicinal Chemistry, Ashutosh Kar, New Age Publication (2018)

REFERENCES

1. Foye's Principles of Medicinal Chemistry by Lemke T.L., Williams D.A., Roche V.F. and Zito S.W., 7th Ed. (2012).
2. Lippincott Williams and Wilkins, Philadelphia.
3. Synthesis of Essential Drugs by Vardanyan R.S. and Hruby V.J., Elsevier, Philadelphia.
4. Contemporary Drug Synthesis by Jie Jack Li (Author), Douglas S. Johnson (Author), Drago R. Sliskovic (Author), Bruce D. Roth (Author), Wiley-Interscience; 1st edition (June 25, 2004)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-359	Subject Title	CHEMISTRY OF COSMETICS AND PERFUMES					
LTP	3 00	Credit	3	Subject Category	DSE	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development					
Employability	✓	✓	✓	✓	✓
Entrepreneurship					

Course Outline:

The course includes study of potential chemical use in Cosmetics: Hair & Care Cosmetics. This also covers Raw materials in cosmetics: Various oils, fats and waxes.

Course Objective:

The course is designed to impart knowledge about the various principal ingredients used in cosmetics preparations for Skin and Hair care products, their basic chemistry and principles of physiological actions. The course also gives details and explanation for the use of different surfactants and other additives in cosmetics. The course includes a definite and concise module on Perfumery industry; the major raw materials and concept of sensorial perception of fragrance. A general description of various legislations and Regulatory statutory bodies along with Market trends is included in the course. Course intends to provide concept of cosmetic industry from formulation to regulatory bodies to recent market trends hence enhance chances of employability in this sector.

Detailed Syllabus

Unit 1 Introduction to Cosmetics: Hair & Care Cosmetics **7 Hrs**

Raw materials in cosmetics: Various oils, fats and waxes; powders, emulsifiers, thickeners and gums. Major ingredients and their uses in the formulations of Shampoos (including hair growth/strength enhancers), Hair oils (hair strength enhancers) and hair dyes. Major ingredients and their uses in the formulations of Face and Talcum powders.

Unit 2 Skin care cosmetics and Physiological Actions **9Hrs**

Major ingredients and their uses in the formulations of various creams (cold creams, face creams, whitening creams, gels and lotions). Natural products (selected) extracts used in cream formulations, (Wheat germ and wheat germ oil, Rose hydrosols, Shea butter, Evening primrose oil, Borage, Hemp seed oils, Jojoba and Avocado kernels), chemical compositions, physiological actions and identification.

Unit 3: Minerals and additives in cosmetics and Sun screens **8 Hrs**

Study of mineral ingredients. Kaolin, Bentonite, Talc, Fuller's earth, Tannins, Calamine, Bismuth-oxychloride. Dyes and pigments used in lipsticks, nail polish and foundations.
Speciality products- Sun protection formula (SPFs)

Unit-4 Basics of Perfumery **8 Hrs**

Raw materials in Perfumery; Essential oils and their importance in cosmetic industries with reference

to Eugenol, Geraniol, Sandalwood oil, Eucalyptus, Rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone. Alcoholic and Non-Alcoholic multifunctional perfumery.

Unit-5 Cosmetics Regulation and Market **7 Hrs**

Legislation and regulations for perfumes and cosmetics; Cosmetic Product Notification Portal, Cosmetic ingredient Review (CIR), Artwork and Labeling (FPLA). Safety testing and toxicology. Cosmetic Product Development Sequence and Logic. Market Trends in Cosmetics and Hair dyeing agents. Efficacy Testing and Clinical Trials

Learning outcome: -

On successful learning through this course it is expected that students will be able to understand-

CO1: Chemistry of various ingredients used in Hair products, Skin creams, Lotions and gels

CO2: Chemistry and specific roles of various additives and surfactants used in different cosmetic preparations

CO3: Basic technology involved in the extraction of rewarded natural products and their applications in skin care cosmetics

CO4: Legislation and Regulatory issues pertaining to cosmetic products and current Market trends.

TEXT BOOKS

1. Handbook of Cosmetic Science and Technology 3rd Edition by André O. Barel, Marc Paye, Howard I. Maibach. Informa Healthcare, CRC Press, New York (2009).

REFERENCE BOOKS

1. Introduction to Cosmetic Formulation and Technology 1st Kindle Edition, by Gabriella Baki (Author), Kenneth S. Alexander (Author), Wiley (2015).
2. Handbook of Cosmetic Science and Technology 4th Edition by André O. Barel, Marc Paye, Howard I. Maibach. Informa Healthcare, CRC Press, New York (2009).
3. Formulas, Ingredients and Production of Cosmetics Technology of Skin- and Hair-Care Products in Japan, Iwata, Hiroshi, Shimada, Kunio, Springer (2012)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-366	Subject Title	Green Chemistry					
LTP	3 00	Credit	3	Subject Category	DSE	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓		✓	
Employability			✓		✓
Entrepreneurship					

Objective:

Course aims to impart the basic principles of green and sustainable chemistry. Scholars must be able to do and understand stoichiometric calculations and relate them to green process metrics. They learn alternative solvent media and energy sources for chemical processes. They learn about renewable feedstock's for the chemical industry, present and under development. They review the principles of catalysis, photochemistry and other interesting processes from the viewpoint of green chemistry. They perform laboratory experiments in which they apply some of the concepts previously learnt (stoichiometry, green metrics etc.) and they put into practice some of the principles of green chemistry.

Course Outcome:

At the end of the course, the student will be able to:

CO1. Demonstrate the fundamental concepts of green chemistry.

CO2. Able to depict the basic principles of green chemistry and clean synthesis approaches.

CO3. Understands green products synthesis and bio-production techniques.

CO4. Identify renewable and sustainable methods in chemical processes.

CO 5. Illustrate and analyze various green technologies for the future of sustainable chemistry and enhance employability in labs working on developing new methods of synthesis based on Green Chemistry.

Unit 1: Introduction to Green Chemistry **4 Hours**

Introduction, Definition & Concepts of Green Chemistry. Need for Green Chemistry. Goals of Green Chemistry. Limitations in the pursuit of the goals of Green Chemistry.

Unit 2: Principles of Green Chemistry and Green Chemical synthesis **10 Hours**

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Waste: Production, Problems, Prevention; prevention/ minimization of hazardous/ toxic products; designing safer chemicals, Organic Solvents: Environmentally Benign Solutions (Focus on Water and Ionic Liquids; fluorous solvents and supercritical CO_2), Some Examples of green synthesis/ reactions.

Unit 3: Green products and green processes **10 Hours**

Green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups; Catalysis and Green Chemistry: Introduction, Basics of Organometallic Chemistry & Catalysis, use of catalytic reagents

(wherever possible) in preference to stoichiometric reagents; bio-transformations and bio-production approaches. Designing of biodegradable products; prevention of chemical accidents

Unit-4 Renewable and Sustainable approaches in Green Chemistry 06 Hours

Renewable Resources: What's Available? Renewable Resources: Chemicals from Biomass. Sustainable Polymers: The Case of Polylactide. Sustainable Polymers: Using CO_2 and other feedstocks. Bio-degradation approaches in green chemistry. Bio-fuels generation through green approaches.

Unit-5: Future Trends in Green Chemistry 06 Hours

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; oncovalent derivatization; Green chemistry in sustainable development. Alternative energy sources in chemistry, Green Chemistry and Public Policy.

TEXT BOOKS

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. P.T. Anastas & J.K. Warner: Oxford Green Chemistry- Theory and Practical, University Press (1998).
3. M. Lancaster, "Green Chemistry. An Introductory Text", 2nd Ed., RSC Publishing, 2010.
4. J. Clark, D. Macquarrie, "Handbook of Green Chemistry & Technology", Blackwell Science, 2002.

REFERENCES

1. P. Tundo, A. Perosa, F. Zecchini (Eds.), "Methods and Reagents for Green Chemistry. An introduction", Wiley-Interscience, 2007.
2. A.S. Matlack: Introduction to Green Chemistry, Marcel Dekker (2001).
3. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CHF-367	Subject Title	Forensic Chemistry					
LTP	3 00	Credit	3	Subject Category	DSE	Year	3rd	Semester	VI

Course Mapping

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Skill Development	✓	✓			
Employability			✓	✓	✓
Entrepreneurship					

Course Outline:

This course covers basics of forensic concepts and Analysis the crime evidences on the basis of various advanced instrumental methods

Course Objective:

The course is designed to impart knowledge on the concepts of forensic science, chemistry of various biological and non-biological samples obtained at the crime scene and their sampling methods. The course also gives details of the advanced instrumental methods employed in the detection of various biological samples and interpretation of results and creates provision of employment in various forensic labs.

The course renders the description of various advanced Biometric data and DNA fingerprinting assays.

Detailed Syllabus

Unit -1 Fundamental Concepts of Forensic Science **7 Hrs**

Forensic Science: Definition, History & Development, Scope, Ethics in Forensic Science

Physical Evidence: Nature, Types, Search methods, Collection, Preservation, Packing & Forwarding of Physical & Trace evidence for forensic analyses, Chain of Custody Crime Scene: Nature, Types, Preservation of Scene of Crime Criminal Investigations: Unnatural deaths, Criminal assaults, Sexual offences, Poisoning, Vehicular accidents

Unit -2 Instrumentation methods used in Forensic Chemistry **11 Hrs**

Microscopy: Polarizing, Comparison, Stereoscopic, Fluorescent and Electron Microscopes

Spectrophotometry: UV, Visible, IR, Raman, Atomic absorption, Emission, Neutron Activation Analysis, X – rays and x-ray based techniques such as XRD, XRF, Mass Spectroscopy Chromatographic Techniques: TLC, GLC, HPLC, HPTLC Hyphenated Techniques: GC-MS, LC-MS, IR-MS and ICP-MS, Electrophoresis: High and Low voltage electrophoresis, Immuno electrophoresis Immunoassays: Principle, Types, Techniques and applications

Unit -3 Detection and Identification of biological fluids **8 Hrs**

Determination of Species of Origin, Blood Group Systems, Techniques of Determination of Blood groups of Blood Stains, Detection of Seminal and other body fluids and their Blood Grouping, Red cells Enzymes, Serum Proteins of forensic significance, Disputed Paternity & Maternity

DNA: Structure, DNA as genetic marker, DNA Extraction and Profiling Techniques

DNA Phenotyping and RNA Profiling & their applications

Unit -4 Biometric Systems of Identification and its relevance **7 Hrs**

Fingerprints: Characteristics, Types, Classification;
Biometric computerization of Fingerprints, AFIS, Track Marks: Foot Prints, Shoe Prints, Tire Marks, Their Preservation & Casting, Comparison, Skid marks. Gait pattern and Voice Analysis: Introduction, Significance, Structure of Human Voice apparatus, Voice spectrography, Voice analysis, Legal aspects and limitations

Unit -5 Forensic Analysis of some materials **6 Hrs**

Hair & Fibers: Nature, Types, Structure and Examination, Pollens and Diatoms: Their application in Forensic investigation, Dust & Soil: Nature, Types, Forensic Examination, Paint, Lacquer & Varnishes: Nature, composition and forensic examination Glass: Composition, Types, Fractures, Examination, Cement, Mortar and Concrete: General Composition, Forensic Analysis

Learning outcome:

1. Understand the basics of forensic concepts, types of criminal assaults and crime scene investigation
2. Understand the chemistry of biological fluids, genetics and other non-biological materials at the crime scene
3. Analyze the crime evidences on the basis of various advanced instrumental methods and interpretations
4. Develop an insight of the integrated approaches using biometric tests and DNA/RNA profiling.

TEXT BOOKS:

1. Basic Principles of Forensic Chemistry, Javed I. Khan, 1st Ed., Springer, (2011)
2. Forensic Chemistry by Max Houck, ElsevierIst edition

REFERENCE BOOKS:

1. Introduction to Forensic Chemistry, Kelly M. Elkins,1st Edition, CRC Press, (2018).

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Humanities & Liberal Arts**
Course Code	LAF181
Course Title	Professional Communication
Credits (L:T:P:C)	2:0:2:3
Contact Hours (L:T:P)	2:0:2
Prerequisites (if any)	NIL
Course Basket	Language and Literature

Course Summary

This course is to enhance the Communication Skills of the students. It also focuses onBasic facets of communication. It introduces the students to LSRW and Non-verbal Language and how to master these aspects to be an effective communicator.

Course Objectives

The course aims at developing the LSRW skills of students for effective communication.Also to equip them for a business environment. It also focusses at preparing the studentsunderstand and present themselves effectively.

Course Outcomes

On successful completion of the course, students will be able to achieve thefollowing:

1. Communicate smoothly
2. Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
3. Present themselves effectively
4. Prepares the students to face future challenges and excel in their personal andprofessional lives.

Curriculum Content

Unit 1: Communication

Communication: Meaning, Types of Communication: General & Technical Communication Knowledge and adoption of Non Verbal cues of communication: Kinesics, Proxemics, Chronemics, Oculesics, Haptics, Paralinguistics, Barriers to Communication, Overcoming strategies.

Unit 2: Listening & Speaking Skills

Listening Comprehension: identifying General & Specific information, Note taking and drawing inferences Introduction to Phonetics: Articulation of consonants and vowel sounds.

Unit 3: Reading Skills & Technical Writing Skills

Reading Strategies and Vocabulary Building Reading Comprehension, Paragraph development, Intra office Correspondence: Notice, Agenda, Minutes and Memorandum Technical Proposal & Report

Unit 4: Communication at Work

Business Letter Writing, Job Application Letter & Resume, Interview Skills, Impression Management, SWOT Analysis (Identifying Strength & Weakness), EQ and Its Dimensions

TEXTBOOK(S)

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Raman, Meenakshi and Sangeeta Sharma, Technical Communication: Principles and Practice, 2nd Edition. New Delhi: Oxford University Press. 2011.

REFERENCE BOOKS

1. Aslam, Mohammad. Introduction to English Phonetics and Phonology Cambridge.2003.
2. Ford A, Ruther. Basic Communication Skills; Pearson Education, New Delhi.2013.
3. Gupta, Ruby. Basic Technical Communication, Cambridge University Press, NewDelhi.2012.
4. Kameswari, Y. Successful Career Soft Skills and Business English, BS Publications, Hyderabad.2010.
5. Tyagi, Kavita & Padma Misra. Basic Technical Communication, PHI, New Delhi. 2011.
6. Ghosh, B. N. Managing Soft skills for Personality development, Laxmi Publications Ltd.,New Delhi, 2013.
7. Elizabeth B. Hurlock. Personality Development, TMH Publication,2010

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Assignments, Class Tests etc. will be done. Various teaching methods like Discussion Method, Case Study Method and Lecture Method will be adopted.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Humanities & Liberal Arts**
Course Code	LAF182
Course Title	Indian English Literature
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Language and Literature

Course Summary

Indian English Literature is an honest enterprise to demonstrate the ever rare gems of Indian Writing in English. From being a singular and exceptional, rather gradual native flare – up of geniuses, Indian Writing has turned out to be a new form of Indian culture and voice in which India converses regularly. This course will introduce various authors and will help to understand the role of literature in reflecting the social context and the shaping of a young nation.

Course Objectives

- The course will enable the students to understand the level of Indian English Literature.
- It will also enable the students to understand different genres such as prose, poetry, and fiction in Indian Writers in English.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

Course Outcome:

- The students will develop an insight into Indian literature.
- The students will learn to appreciate different genres of literature of Indian Literature in English.
- The students will understand the role of literature in reflecting the social context and the shaping of a young nation.
- The students will demonstrate knowledge and comprehension of major texts and traditions of language and literature written in English as well as their social, cultural, theoretical, and historical contexts.

Curriculum Content

Unit 1 Prose

APJ Abdul Kalam: Unity of Minds
Swami Vivekananda: The Cosmos-Macrocosm
Mahatma Gandhi: Hind Swaraj, what is Civilization? (Chapter XIII) Education (ChapterXVIII)

Unit IIPoetry

Toru Dutt:	Our Casuarina Tree
Rabindranath Tagore:	Geetanjali – Where the mind is without fearSri
Arbindo:	Stone Goddess
Sarojani Naidu:	Life
Nissim Ezekiel:	The Night of Scorpion
Kamla Das:	An Introduction

Unit III Short Stories

R. N. Tagore:	Kabuliwala
Mulk Raj Anand:	Duty
R.K. Narayan:	An Astrologer's Day
Nayantara Sehgal:	Martand

Unit IVNovel

Ruskin Bond: Flights of Pigeons

TEXTBOOK(S)

1. Kumar, Shiv K. (ed), Contemporary Indian Short Stories in English, 2007 Sahitya Akademi.
2. Anand, Mulk Raj; Saros Cowasjee (ed.); Selected Short Stories Penguin Books, 2006
3. Bond, Ruskin. Flights of Pigeons, Penguin Books, 2003

REFERENCE BOOKS

1. Tagore, Rabindra. Nationalism. Delhi: Rupa Publications, 1992.Print.
2. Chinhade, Sirish. Five Indian English Poets. New Delhi: Atlantic Publishers and Distributors, 1996.Print.
3. Naik, M.K. A History of Indian English Literature. New Delhi: Sahitya Akademi, 2004.Print.
4. Agrawal, K.A. Ed. Indian Writing in English: A Critical Study. Atlantic Publishers & Dist, 2003.Print.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Humanities & Liberal Arts
Course Code	LAF183
Course Title	English Language Teaching (ELT)
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Language and Literature

Course Summary

This course will offer a historical perspective to the teaching of English as a second language. It will trace the changes in language teaching methods throughout history depending on changes in the kind of proficiency learners need. It includes the different approaches used over the years and their application in teaching English as a second language in the classroom. It also traces the status of English language and the 'World English' and how it affects the teaching of English.

Course Objectives

To introduce students to the nature of English language learning and its theoretical implications. The main objective of the course is to enable students to evaluate a variety of language learning methods and approaches. It also aims to empower students to understand ELT in their contexts of language learning.

Course Outcomes

On successful completion of the course, students will be able to achieve thefollowing:

1. Students will learn about communicative approaches to English language teaching.
2. Be able to understand the theories and methodologies of ELT
3. Be able to explore core components of communicative language teaching
4. Students will learn to apply ELT theories

Curriculum ContentUnit 1

Historical Perspective, ELT and its beginnings: development of reading approach, oralmethod and audio-lingual method

Unit 2

Communicative Language Teaching (CLT): the concept of 'communicative competence;ESL in India: a historical trajectory

Unit 3

Halliday's notion of 'transitivity' and 'meta-functions'

Corpus Linguistics ELT: corpus studies and how it can be used for language teaching

Unit 4

'World English' and ELT, Model of the 'Concentric Circles' and its impact on ELT

TEXTBOOK(S)

1. Maybin, Janet and Swann, Joan. (2009). The Routledge Companion to English LanguageStudies. London: Routledge, Print

REFERENCE BOOKS

1. Richards, J. & T.S. Rogers. (1986). Approaches and Methods in Language Teaching. Cambridge: Cambridge University Press, Print.
2. Ur, Penny. (1996). A Course in Language Teaching: Practice and Theory. Cambridge: Cambridge University Press, Print.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your coursein Moodle for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	LAF 184	Subject Title	CORPORATE COMMUNICATION & SOFT SKILLS					
LTP	2 0 2	Credit	3	Subject Category		Year	I	Semester	II

Course Summary

This course is to enhance the soft skills of the students. It also focuses on Business communication. It will help the students to develop professional skills and how to be effective communicator at work place.

Course Objectives

- To introduce to students to the business & corporate environment and its expectations.
- To help students to identify and sharpen their personal and professional skills.
- To ensure employability of students through a perfect blend of hard & soft skills.

Course Outcomes

On successful completion of the course, students will be able to achieve the following: Students identify their goals and through enhanced soft skills work towards achieving them.

- Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
- Prepares the students to face future challenges and excel in their personal and professional lives.

Unit 1

Business Communication **8hrs**

Importance & Features of Business Communication, Flow of Communication: Channels & Networks Business Presentation

Business Etiquette, Telephonic Etiquette Interview Skills, Impression Management

Unit 2 **8hrs**

Business Letter Writing

Job Application Letter & Resume Communication: E mails & E- Tools

Unit 3

Personal Skills for Corporate Communication **8hrs**

SWOT Analysis: Self-Assessment, Identifying Strength & Weakness Self-Awareness, Self-Disclosure & Self-Management (Stress, Anger) Goal Setting: Personal & Professional Goals, SMART-ER Goals Human Perception: Understanding People, Perceptions, Attitudes Personality (Personality Test)

Unit 4 **8hrs**

Professional Skills for Corporate Communication Decision Making: Techniques, Six Thinking Hats Creative Thinking, Lateral Thinking

Team Building & Leadership Skills

Time Management: Planning Organizing, Time Wasters Conflict Resolution Skills

Negotiation Skills

Lab 1 Telephone Etiquette: Making an appointment, answering calls (Role Play)
Lab 2 Telephone Etiquette: Making an appointment, answering calls (Role Play)
Lab 3 Business Presentations (PPT Presentation)
Lab 4 Business Presentations (PPT Presentation)
Lab 5 Interview Skills: Mock Interview
Lab 6 Interview Skills: Mock Interview
Lab 7 Panel Discussion
Lab 8 Panel Discussion
Lab 9 Conflict & Negotiation (Situational Role Play)
Lab 10 Conflict & Negotiation (Situational Role Play)
Lab 11 Evaluation
Lab 12 Evaluation

TEXT BOOKS

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi.2005.
2. Gulati, Sarvesh. Corporate Soft skills, Rupa & Company, 2006

REFERENCE BOOKS

1. Steven R. Covey. The Seven Habits of Highly Effective People, Simon and Schuster,London, 2007.
2. Robbins, Stephen. Management, Pearson Prentice Hall. 2009
3. Carnegie, Dale. How to Win Friends and Influence People, Simon and Schuster,London, 2009.
4. Dr. Alex. Soft Skills: Know Yourself & Know the World, S. Chand Publications,2001.
5. Gopalswamy, Ramesh. The ACE of Soft Skills: Attitude, Communication andEtiquette for Success, Pearson, New Delhi, 2008.
6. Ghosh, B. N. Managing Soft skills for Personality development, Laxmi PublicationsLtd., New Delhi, 2013.
7. Elizabeth B. Hurlock. Personality Development, TMH Publication, 2010.

Teaching and Learning Strategy:

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Computer Science and Engineering
Course Code	CSF101
Course Title	Programming for problem solving
Credits (L:T:P:C)	3:0:2:4
Contact Hours (L:T:P)	3:0:2
Prerequisites (if any)	
Course Basket	Engineering Sciences

Course Outline:
This course contains the fundamental concepts about the computer hardware and intends to provide to students about the knowledge of C language

Course Objective:
The objective of the course is to make the students to understand the key hardware components in a modern computer system and as to how the software is mapped to the hardware. The student shall also be able to learn make the computer programs using C language by exploring the various features of C.

Course Outcomes:
At the end of the course, the student will be able to:
CO1. To formulate simple algorithms for arithmetic and logical problems.
CO2. To implement conditional branching, iteration and recursion.
CO3. To decompose a problem into functions and synthesize a complete program usingdivide and conquer approach.
CO4. To use arrays, pointers and structures to formulate algorithms and programs.
CO5. To apply programming to solve matrix addition and multiplication problems andsearching and sorting problems

Curriculum Content
UNIT 1: Introduction to Computer, Programming & algorithms (8L)
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples, From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT 2: Arithmetic Expression, and Conditional statements, Loops, Expression: (7 L)
Arithmetic, Logical, Relational expressions and precedence.
Loops & Branching: Writing and evaluation of conditionals and consequent branching,Iteration and loops.

UNIT 3: Arrays & Functions (7 L)
Arrays: Arrays (1-D, 2-D), Character arrays and Strings.
Functions: functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Searching & Sorting: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT 4: Recursion and Structure (8L)

Recursion: Recursion, as a different way of solving problems. Example programs, such asFinding Factorial, Fibonacci series, Ackerman function etc.

Structure: Structures, Defining structures and Array of Structures.

UNIT 5: Pointers & File handling (7L)

Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures,notion of linked list.

File handling: different modes of opening a file in C, reading, writing from files.

TEXT BOOKS

1. Byron Gottfried, “Schaum's Outline of Programming with C”, 2nd edition 2006 McGraw-Hill.
2. E. Balaguruswamy, “Programming in ANSI C”, 8th Edition 2019, McGraw-Hill Education India.

REFERENCES

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2nd edition1988, Prentice Hall of India.

TEACHING AND LEARNING STRATEGY

All materials (ppts, assignments, labs, etc.) will be uploaded in MS Team. Refer to yourcourse in MS Team for details.

LIST OF EXPERIMENTS:

Sr. No.	EXPERIMENT NAME
1	Familiarization with programming environment.
2	Programming for Simple computational problems using arithmetic expressions.
3	Programming for Problems involving if-then-else structures.
4	Programming for Iterative problems e.g., sum of series.
5	Programming for 1-D Array manipulation.
6	Programming for Matrix problems, String operations.
7	Programming for Simple functions
8	Programming for Recursive functions.
9	Programming for Pointers and structures.
10	Programming for File operations

Compiler (for lab/ lecture)

Offline: https://developerinsider.co/download-turbo-c-for-windows-7-8-8-1-and-windows-10-32-64bit-full-screen/

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Course Title	**Mathematics**
Course Code	**MAF108**
Course Title	**Calculus-I**
Credits (L: T:P:C)	**3:1:0:4**
Contact Hours (L: T:P)	**3:1:0**
Prerequisites (if any)	**None**
Course Basket	**Generic elective**

Course Summary:

Course Objectives:

To prepare the students with basic concepts of limit, continuity, differentiability, andintegration of functions and their applications.

Course Outcome: Students will be able to:

- find derivative and anti-derivative of various functions and use them for furtherstudy
- draw graph of various functions in Cartesian and Polar coordinates
- determine area, volume, surface od revolutions using definite integrals
- use the concepts of calculus in higher learning.

Curriculum Content:

UNIT I: Limit and Continuity [8]

Review of functions of single variable: Exponential, Logarithmic, Trigonometric and Hyperbolic functions, Limit, Continuity, Algebra of limits and continuous functions.

UNIT II: Differentiability [10]

Differentiability, Indeterminate forms, L' Hospital rule, Rolle's Theorem, Mean value theorems & their applications, Successive differentiation, Leibnitz theorem, Maclaurin& Taylor series of functions of one variable.

UNIT III: Applications of Derivatives [10]

Review conic sections and their Graphs, Monotonicity, Maxima and Minima, Concavity, Convexity, Point of inflection & Asymptotes, Polar coordinates, Curvature,Envelope of a family of curves, Graphs of functions and curves.

UNIT IV: Integral Calculus [12]

Review of indefinite and definite integrals, Fundamental theorem of integral calculus, Integral as the limit of sum, Area, Volume and surface of revolution, Arc lengths, Double and triple integrals, Change of order of integration, Change of variables,Dirichlet's integral, Application of multiple integrals.

TEXT BOOKS:

1. G. B. Thomas and R. L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010

REFERENCE BOOKS:

1. R. K. Jain, & S. R. K. Iyenger, "Advanced Engineering Mathematics", 4thEdition, Narosa Publishing House, New Delhi, India, 2014.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10thEdition, John & Wiley Sons,U.K., 2016.
3. Gorakh Prasad, "Integral Calculus", Pothishala Private Limited, 2015

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Mathematics**
Course Code	MAF117
Course Title	Ordinary Differential Equations
Credits (L:T:P:C)	3:1:0:4
Contact Hours (L:T:P)	3:1:0
Prerequisites (if any)	None
Course Basket	Generic elective

Course Summary:

Course Objective:

This course provides an introduction to the fundamentals of ordinary differentialequations and their solutions

Course Outcomes:

After completing this course, students should demonstrate competency in thefollowing skills:

- To understand the order and degree of differential equations and classify them tolinear or nonlinear differential equations.
- To determine the solution of differential equation of first order and first degree.
- To understand and identify higher order linear differential equation and determine their solutions by various methods.
- To understand and recognize fundamentals of singular solutions, Clairaut'sequations.

Curriculum Content:

UNIT I: Differential Equations of first Order & first Degree [10]

Formation of differential equations, order and degree of differential equations, complete primitive, methods to solve the differential equations of first order and first degree; separation of variables, homogeneous differential equations, exact differential equations, equations reducible to separation of variables, homogeneous and exactdifferential equations, linear differential equations, equations reducible to linear differential equation.

Unit- II: Equations of first order but not of first degree & Trajectories [8]

Equations of first order but not first degree, Various cases & various methods todetermine solution, Singular solutions, Clairaut's form, Trajectory, Orthogonaltrajectory Self-orthogonal family of curves.

UNIT III: Second and Higher Order ODE [12]

Solution of homogeneous and non-homogeneous linear ODE with constant coefficients using inverse operator method and method of undetermined coefficients, Euler-Cauchy homogeneous linear differential equations, Simultaneous differentialequations, Method of variation of parameters, Solution of second order differential equations by changing dependent and independent variable.

Unit – IV: second order linear differential equations with variable coefficients [10]

Linear differential equations of second order with variable coefficients, followingcases: the complete solution in terms of a known integral, finding one integral in C.F. by inspection, reduction to normal form, Change of independent variable, method of variation of parameters, Simultaneous equations of the form **P1dx+Q1dy+R1dz=0, P2 dx+Q2dy+R2 dz=0**

TEXT BOOKS:

1. M. D. Raisinghania, "Ordinary and Partial Differential Equations", 19th Edition, S.Chand Publications, 2017.
2. 2. G. F. Simmons and G. Krantz Steven, "Differential Equations", 17th Reprint,McGraw Hill Education (India) Private Ltd., 2016.

REFERENCE BOOKS:

1. M. Tenenbaum, and H. Polard, "Ordinary Differential Equations", DoverPublications, 1985.
2. V.P. Mishra, and J. Sinha, "Elements of Engineering Mathematics", 3rd Edition, S.K.Kataria & Sons, 2013.
3. E. Kreyszig, "Advanced Engineering Mathematics", 10th Edition, published by JohnWiley & Sons, U.K, 2011.
4. B. Rai, D.P. Choudhary and H.I. Freedman, "A Course in Ordinary DifferentialEquations", 2nd Edition, Narosa Publishing House, 2013.
5. B.S. Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers,2012

Teaching and Learning Strategy:

All materials (Course material, assignments, tutorials) will be uploaded inMoodle/MS Teams. Refer to your course on SAP/MS Teams for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Physics**
Course Code	PYF359
Course Title	Physics of Semiconductor Devices
Credits (L:T:P:C)	3:1:0:4
Contact Hours (L:T:P)	3:1:0
Prerequisites (if any)	None
Course Basket	Discipline Elective

COURSE SUMMARY:

This course covers the knowledge of the semiconductors devices. It is appropriate for physics students who are interested to learn about semiconductors from a physics point of view. The course will also cover some basics of semiconductor devices, particularly emphasising the physical principles on which they function

Course Objective:

The objective of this course is to acquire knowledge of semiconductor physics and discuss working and applications of basic devices, including p-n junctions, BJTs and FETs.

Course Outcome

On successful completion of the course, students will be able to achieve thefollowing:

1. To explain the basic properties of semiconductors including the band gap, chargecarrier concentration, doping and charge carrier injection/excitation.
2. To explain the working, design considerations and applications of varioussemiconducting Devices including p-n junctions, BJTs and FETs.
3. To describe the working and design considerations for the various photonic deviceslike photodetectors, solar-cells and LEDs

Curriculum Content Unit 1 **10L**

Semiconductor, Bonds in Semiconductors, Energy band, Effect of temperatures on Semiconductor, Hole currents, Intrinsic & extrinsic semiconductor, carrier concentration and conductivity in intrinsic and extrinsic semiconductors and their temperature dependence, Energy bands in semiconductors.

UNIT 2 **10L**

p-n junction diode, Semiconductor diode, Crystal diode rectifiers, half wave rectifiers, Efficiency of half wave rectifier, Full wave rectifier, Centre tap full wave rectifier, Ripple factor, Filter Circuits, Voltage stabilization, Zener diode, Zener diode as Voltage stabilizer.

UNIT 3 **10L**

Transistors, Transistors connections, Common base connection, Common emitterconnection, common collector connection, Comparison of transistor connections, Transistor as an amplifier in CE arrangement. JEFT amplifying and switching, Pinch off and saturation, Gate control, I-V characteristics. MOSFET.

UNIT 4 **8L**

Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, lightemitting materials, Radiative transition, The transferred electron mechanism: The GUNN diode Emission spectra, Luminous efficiency and LED materials, Solar cell and photodetectors, Reverse saturation current in photodetector

TEXT BOOK [TB]:

1. Fundamentals of Semiconductor Devices by Joseph Lind Mayer, Charles Y. Wriggly,Litton Educational Publishing Inc.
2. Semiconductor Electronics by A.K. Sharma, New Age International (P) LimitedPublisher, New Delhi.

REFERENCE BOOKS [RB]:

1. Physics of Semiconductor Devices by S. M. Sze, John Wily & Sons, New Delhi.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Mathematics**
Course Code	MAF206
Course Title	Computer Based Numerical Techniques
Credits (L:T:P:C)	3:1:2:5
Contact Hours (L:T:P)	3:1:2
Prerequisites (if any)	None
Course Basket	Generic Elective

Course Objective:

To enable students to obtain an intuitive and working understanding of numerical methodsfor the basic problems of numerical analysis and gain experience in the implementation of numerical methods using a computer.

Unit I: Solution of system of linear equations: [7]

Direct methods: Matrix inverse method, Gauss elimination, Gauss-Jordan method and LU decomposition method, Iterative methods: Jacobi's method, Gauss-Seidal method

Unit II: Solution of Algebraic and Transcendental equations: [9]

Approximation and Errors, Initial approximation of the roots, Bisection method, Method of false position, secant method, iteration method, Newton-Raphson method and its convergence.

Unit III: Finite differences and interpolation: [12]

Finite difference operators, their properties and their interrelations, finite difference tables, Newton's forward and Newton's backward interpolation formula, various central difference formulae including Stirling's formula, Bessel's formula. Divided differences: Operators and difference table, Newton's divided difference formula, Lagrange's interpolation formula.

Unit IV: Numerical differentiation and integration: [12]

Differentiation using Newton's forward and backward interpolation formula, Newton- Cotes quadrature formula - derivations & comparison of Trapezoidal rule, Simpsons 1/3 and 3/8 rules. Numerical solution of first order differential equations: Euler's method, modified Euler's method, Runge-Kutta second order and fourth order methods.

TEXT BOOKS:

1. B. S. Grewal, **Numerical Methods in Engineering and Science,** (9th Edition), Khanna Publishers, New Delhi, India, 2010.

REFERENCE BOOKS:

1. S.S. Sastry, **Introductory Methods of Numerical Analysis,** 4th edition, PHIlearning Pvt. Ltd, 2005.
2. Curtis F. Gerald and Patrick O. Wheatley**, Applied Numerical Analysis,** 7th Edition, Pearson Education Lt, 2009.
3. M.K Jain, S.R.K Iyengar and R.K Jain, **Numerical Methods for Scientific andEngineering computation, 4th**Edition, New age International Publishers, 2003.

List of Practical:

1. Bisection Method.
2. Regula Falsi method.
3. Newton Raphson method.
4. Gauss Elimination method.
5. Gauss - Jacobi Method.
6. Gauss - Seidal Method.
7. Newton's Forward Interpolation Formula.
8. Newton's Backward Interpolation Formula.
9. Trapezoidal rule.
10. Simpson's13rd13rd rule.
11. Simpson's38rd38rd rule.
12. Euler's method.
13. Fourth order Runge - Kutta methods.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Physics**
Course Code	PYF378
Course Title	Nanomaterials And Applications
Credits (L:T:P:C)	4:0:0:4
Contact Hours (L:T:P)	4:0:0
Prerequisites (if any)	None
Course Basket	Discipline Elective

Course Summary:

The course develops a strong background of nanoscale materials, concept of quantum confinement, synthesis and characterization techniques for nanoscale materials, optical properties and applications.

Course Objective:

This course introduces the fundamentals of Nano-scale science and technology. Current and future applications of nanostructured materials will be reviewed with respect to their impactin commercial products and technologies.

Course Outcome

On successful completion of the course, students will be able to achieve the following:

1. Explain the fundamental principles of nanotechnology and their application to biomedical engineering.
2. Apply engineering and physics concepts to the Nano-scale and non-continuumdomain.
3. Identify and compare state-of-the-art nanofabrication methods
4. Explore the characterization techniques for analysis of different properties ofnanomaterials
5. Study the applications of nanomaterials in different fields

Curriculum ContentUnit **18 L**

NANOSCALE SYSTEMS: Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.

UNIT 2 **8 L**

SYNTHESIS OF NANOSTRUCTURE MATERIALS: Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots.

UNIT 3 **7 L**

CHARACTERIZATION: X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

UNIT 4 **8 L**

OPTICAL PROPERTIES: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization- absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures.

UNIT 5 **8 L**

APPLICATIONS: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

TEXT BOOK [TB]:

1. Nanotechnology: Principles & Practices, S.K. Kulkarni, 3rd edition, CapitalPublishing Company, 2014
2. Introduction to Nanoscience and Technology, K.K. Chattopadhyay and A. N.Banerjee, PHI Learning Private Limited, 2009.

REFERENCE BOOKS [RB]:

1. Textbook of Nanoscience and Nanotechnology, Universities Press (India) PvtLimited, 2014.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	PY217	Subject Title	ELEMENTS OF MODERN PHYSICS						
LTP	3 1 2	Credit	5	Subject Category	GE	Year	2nd	Semester	IV

Course Outline:
In this course, the students will get an introductory approach on various branches of physics like quantum mechanics, atomic, molecular and nuclear physics which will establish their fundamental base for learning these subjects separately.

Course Objective:
Students will apply understanding and skill related to the principles and concepts of modern physics essential for graduate school and/or professional employment in the field
Course Pre/Co- requisite (if any): student must be familiar with basic integration and differentiation

Detailed Syllabus

UNIT 1
Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson- Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them.

UNIT 2
Position measurement-gamma ray microscope thought experiment; Wave- particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction.

UNIT 3
Linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

One dimensional infinitely rigid box- energy eigenvalues and Eigen functions, normalization; Quantum dot as example; Quantum mechanical scattering and tunneling in one dimension-across a step potential & rectangular potential barrier.

UNIT 4
Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.
Law of radioactive decay; Mean life and half-life; Alpha decay; Betadecay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235

UNIT 5

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Ruby Laser and He-Ne Laser.

Learning Outcome

Having successfully completed this course, the student will be able to:

1. Outline the scientific foundation for modern physics according the Course MainContent
2. Perform quantum mechanical calculation for simple systems
3. Apply quantum mechanical principles in science and technology
4. Outline the most important experimental methods in modern physics

TEXT BOOK [TB]:

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill, 2002,
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, Tata McGraw Hill,2002
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education, 2005
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning, 2010
5. Quantum Mechanics: Theory & Applications, A. K. Ghatak & S. Lokanathan,Macmillan, 2004

REFERENCE BOOKS [RB]:

1. Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, PHI Learning, 2004
2. Theory and Problems of Modern Physics, Schaum`s outline, R.Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co.Ltd.
3. Quantum Physics, Berkeley Physics, Vol.4. E. H. Wichman, Tata McGraw-Hill Co,1971
4. Basic ideas and concepts in Nuclear Physics, K. Heyde, 3rd Edn., Institute ofPhysics Pub.
5. Six Ideas that Shaped Physics: Particle Behave like Waves, T. A. Moore, McGrawHill, 2003

Sr. No.	LIST OF EXPERIMENTS
1	Measurement of Planck's constant using black body radiation and photo-detector
2	Photo-electric effect: photo current versus intensity and wavelength of light;maximum energy of photo-electrons versus frequency of light
3	To determine work function of material of filament of directly heated vacuum diode.
4	To determine the Planck's constant using LEDs of at least 4 different colours
5	To determine the wavelength of H-alpha emission line of Hydrogen atom.
6	To determine the ionization potential of mercury.
7	To determine the absorption lines in the rotational spectrum of Iodine vapour.
8	To determine the value of e/m by Thomson Method.
9	To setup the Millikan oil drop apparatus and determine the charge of an electron.
10	To show the tunneling effect in tunnel diode using I-V characteristics.
11	To study the atomic spectra of a 2 electron system
12	To determine Lande's g factor using electron spin resonance spectrometer

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	School of liberal arts & management
Course Code	HS241
Course Title	Education and Social Change
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Objective

- To define the various types of education policies
- To understand the role in striving for social change.
- To overview on education and its implications on social changes to the students.

Unit1 **9 Hrs**

General introduction to the place of learning in society. Learning, education andtraining.
Changing meanings of education across time and society. A brief historical perspectiveon education in India.

Unit 2 **9 Hrs**

Social-political arithmetic as a spurious way of understanding education and socialchange.
Structural functionalist perspectives and structural-conflict perspectives on education

Unit 3 **12 Hrs**

Class, conflict, legitimation processes, reproduction of society. Anarchist perspectives. “New” Sociology of Education. Symbolic interactionist perspectives on education. Resistances to schooling. Critical theory and education.

Unit 4 **9 Hrs**

Neo-Weberian perspectives on education. Status politics and education. Caste, class, gender and education in India. Indian thinkers on education. Current debates on the place of education in India.

LEARNING OUTCOME:

- The students will understand how the education system assesses the importance of educationin society.
- The students will be able to take a significant action in area of education to maintain socialchange
- The student will be able to participate in the changes required in society.
- Education will be used as a tool to implement adequate changes in society.

TEXT BOOKS

1. Desai, A.R. (2005), Social Background of Indian Nationalism, Popular Prakashan.
2. Giddens, A (2009), Sociology, Polity, 6th ed.

REFERENCE BOOKS

1. Guha, Ramachandra (2007), India after Gandhi, Pan Macmillan.
2. Sharma R.S. (1965), Indian Feudalism, Macmillan.
3. Deshpande, Satish (2002), Contemporary India: A Sociological View, Viking.
4. Gadgil, Madhav & Ramachandra Guha (1993), This Fissured Land: An EcologicalHistory of India, OU Press.
5. Haralambos M, RM Heald, M Holborn (2000), Sociology, Collins.
6. Mohanty, M (ed.) (2004), Class, Caste & Gender- Volume 5, Sage.
7. Dhanagare, D.N., Themes and Perspectives in Indian Sociolog

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Subject Code	CA102	Subject Title	PROGRAMMING IN 'C'						
LTP	3 0 2	Credit	4	Subject Category	AEC	Year	2nd	Semester	III

Course Objective:
The objective of the course is to make the students to learn to make the computer programs using C language and explore various features of C.

Unit I
Problem analysis, Need for programmed languages, Introduction to algorithms, Algorithmic representations, Pseudo codes flow charts and decision tables, Structured programming and modular programming.

Unit II
Overview of C, Constant, Variables, Data, Types and size, Variable declaration, Operators and expressions, Type conversion, Conditional expression, Special operators, Precedence rules, Decision making, Looping and control structures, Data input/output, Input/output, Unformatted & formatted I/O function in C, input functions viz. scanf (), getch (), getche (), getchar (), gets (), output functions viz. printf (), putch (), putchar (), puts ().

Unit III
Arrays and String: Defining and processing an array, one dimensionalarrays, Multidimensional arrays, passing arrays to functions, Handling of character strings, Pointers: Declaration, Operations on pointers, Array of pointers, Pointers to arrays, Structure and Unions: Defining and processinga structure, User defined data types, Structure and pointers, Nested structure, Self-referential structures and unions.

Unit IV
Program structure: Storage classes, Automatic, External and static variables, Data files: Opening, Closing, Creating and processing and unformatted data field.

Unit V
File Management in C: Introduction to data files, Opening & closing a file, File types, fopen, fgets, fputs, fscanf, fprintf, fclose.

Learning Outcome: A student who successfully completes the course will have theability to
- understand the basic terminology used in computer programming.
- write, compile and debug programs in C language.
- use different data types in a computer program.
- design programs involving decision structures, loops and functions. use differentdata structures and create/update basic data files.

TEXT BOOK:

1. E. Balaguruswamy, "Programming in ANSI C", 4th Edition, Tata McGraw-Hill, 2008.
2. Jeri R. Hanly and P. Elliot**, "**Problem Solving and Program Design in C**",** 7thEdition,Pearson, 2013.

REFERENCE BOOKS:

1. Dennis Ritchie, "The C Programming Language", 6th Edition, Pearson, 2015.
2. Forouzan Ceilber, "Structured programming approach using C", 3rdEdition, Thomson learning publication, 2007.
3. Yashwant Kanetkar, "Pointers in C", 3rd Edition, BPB Publication, 2003.

List of practicals:

1. Program to find area and circumference of circle.
2. Program to find the simple interest.
3. Program to convert temperature from degree centigrade to Fahrenheit.
4. Program to calculate sum of 5 subjects & find percentage.
5. Program to show swap of two no's without using third variable.
6. Program to find that entered year is leap year or not.
7. Program to find whether given no is even or odd.
8. Program to find whether given no is a prime no or not.
9. Program to display sum of series 1+1/2+1/3+ ..... +1/n.
10. Program to add two number using pointer.
11. Program to show sum of 10 elements of array & show the average.
12. Program to find sum of two matrices.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department offering the course	**Career Development Centre**
Course Code	MAF348
Course Title	**Aptitude and Skill Enhancement-II**
Credits (L:T:P:C)	**3:0:0:3**
Contact Hours (L:T:P)	**3:0:0**
Prerequisites (if any)	**NIL**
Course Basket	**Skill and Capability Enhancement**

Course Summary

The first step of an intensive two step placement training module equips the students to successfully handle the placement program of any on-campus/off- campus company. It not only provides career guidance about the selection process but also helps students in profile building and enhancing their employability skills.

Course Objectives

- Interpret the questions of aptitude building objectively and prepare for variouscompetitive examinations
- Understand the optimized approach of dealing with placement questions
- Learn ways of representing themselves effectively in formal settings

Course Outcomes

On successful completion of the course, students will be able to achieve the following: By the end of this semester, students will be able to perceive and analyse the requirements ofplacement trends as detailed information about the selection process would be provided bycareer guidance. They will be more confident and will be able to develop a professionalprofile, both online and offline.

Curriculum Content

Unit 1 - Quantitative Aptitude

Number System

Types of numbers; Factors; Divisibility test; Place and face Value; Base system; Remainder theorem; digits at the unit places and finding last two digits in a given expression; Calculatingnumber of zeroes, Finding maximum power of any prime number or any composite number in any factorial, HCF and LCM.

Fractions–Types of fractions; Conversion of terminating and non-terminating types of decimal into fraction; Subtraction, addition and multiplication of terminating and non-terminating decimals.

Percentage

Basic concepts; Conversion from fraction to percentage; Application of percentage in – Expenditure, Cost, Consumption problems; Population increase or decrease problems; Production, Manpower and Working hour problems; successive increment or decrement; Comparison of salary or numbers; Percentage change in area or volume, etc.

Ratio and Proportion

Ratio, Proportion and Variation: Ratio- Introduction; Types of ratios; Comparison of Ratios;Concept of duplicate, triplicate, sub-duplicate and sub-triplicate ratios.

Proportion and variation – Concept of direct, inverse, continuous and mean proportions.

Profit and Loss

Introduction; Concept of single, double and triple discount and marked price.

Simple / Compound Interest

Simple Interest and compound Interest: Basic concept of Principal, Time, Amount and Rateof Interest; Concept of Lent money

Unit 2- Verbal Aptitude

Subject-Verb agreement & Gerunds, Active and Passive VoiceQuestion Types

Introduction to Question Types-I: Fill in the blanks, one-word Substitution, Spellings, understanding the right word choice, concept of para jumbles and para completion, reading comprehension, verbal analogies, odd man out, phrases and idioms.

Introduction to Question types-II: Error identification, Homophones, Usage of the various figures of speech, commonly confused words and phrases, techniques for tackling synonyms and antonyms.

Reading Comprehensions

Reading Comprehension: Basics of Comprehensions, different tones of comprehensions,cracking question types like contextual vocabulary, fill in the blanks, true/false questions, reference to context, summary and title of the passage, paraphrasing the text.

Unit 3- Logical Reasoning

Coding Decoding and Sequences

Coding Decoding, Crypt arithmetic, Sequence and Series - Finding the missing term/wrong termin the logical sequence of letter/number/word/alphanumeric, Continuous pattern series.

Verbal Analogies and Odd man out

Verbal Analogy based on various parameters - Antonym / synonym relationship, Quantity andunit, Individual and Group, Product and Raw material, cause and Effect etc.

Odd man out based on several kind of relationship – Relationship based on meaning, functional relationship, even- odd or prime-composite, divisibility rule, etc.

Blood Relation and Direction Sense

Blood Relation- Indicating form / puzzle form / coding form, Direction Sense, Directionpuzzles.

Seating Arrangements

Seating Arrangements – Linear / Circular / Distribution / comparison/ Floor and boxarrangement /Quant based arrangements/ etc.

Critical Reasoning

Statement and assumptions, course of action, statement and conclusion, probably true/false.

Unit 4- Non Verbal Communication

Types of Non Verbal Communication, Body Language-Exercises and Activities, Error Analysis& Feedback Sharing.

Suggested Activities & Exercises: (i) Communication Origami, (ii) Power of body language, (iii) Draw it.

Unit 4: Employability Skills & CV Writing

What Skills Do Employers Expect from Graduates? CV vs. Resume, CV writing Do's &Don'ts, Tips with Best Examples/ Samples, Feedback Sharing & Error Analysis.

Suggested Activities & Exercises: (i) Relevant Videos on 'Employability', (ii) GroupDiscussions on Newspaper Articles, (iii) Sample correction, (iv) writing exercise.

TEXTBOOK(S)

1. Quantitative Aptitude: How to prepare for Quantitative Aptitude, Arun Sharma,McGraw Hill, 8th edition, 2018.
2. Logical Reasoning: A Modern Approach to Logical Reasoning-R.S. Aggarwal, SChand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude: English is Easy- Chetanand Singh, BSC Publication-2018.
4. Soft Skills- The Power of Now- Eckhart Tolle, Yogi Impressions Books Pvt. Ltd.-2010.

REFERENCE BOOKS

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal S. Chand Publications-2018.
2. Quantitative Aptitude: Quantitative Aptitude- Saurabh Rawat and Anushree Sah Rawat Savera Publishing House, 1st edition-2016.
3. Logical Reasoning: Logical Reasoning and Data Interpretation for the CAT - Nishit KSinha; Pearson India; 5th edition-2016.
4. Logical Reasoning: Wiley's Verbal Ability and Reasoning - P A ANAND, Wiley -2016.
5. Verbal Aptitude: Fun with grammar- Suzanne W. Woodward Pearson EducationESL-1996.
6. Soft Skills- The Greatness Guide – Robin Sharma, Jaico Publishing House- 2006.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle/Googledrive. Refer to your course on SAP for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Mathematics and Career Development Centre
Course Code	MAF256
Course Title	Aptitude and Skill Enhancement- I
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Skill Enhancement

Course Summary

This module is focused on providing students hands-on practice on aptitude problems and prepare a stronger fundamental base for Aptitude and Soft Skills capabilities.

Course Objectives

Prepare a ground for the students to be ready in Quantitative, Logical Aptitude and Verbal Aptitude

Prepare them for becoming confident and corporate-culture fit as present-day workplace requires professionals who are not only well qualified and competent but also possess Soft Skills like interpersonal skills and good presentation skills.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Develop Leadership & Team Building Skills.
2. Receive hands-on guidance to develop an effective CV.
3. The students would be able to understand the basic trends of questions asked in the aptitude part of placements.

Curriculum Content

UNIT 1: Aptitude (Quantitative and Logical)

Progression, logarithm, Quadratic Equations (concept of determinant, real, non-real, rational and conjugate roots); Mensuration

Input Output – Sequential output tracing of logical operations applied on machine input, Ranking and Order- Test - Ordering of measurable attributes like height / weight / performances, etc.
Eligibility test, Logical sequences and series, Completion of incomplete pattern, Odd figures

Unit 2: Verbal Aptitude

Tenses and Grammar drills. Creative Writing: Essay, Report Writing, Article, Letters, E-mail: difference between formal and informal tone, appropriate use of transition words, creating a signature, understanding different situations and the responses they require (situation- based writing), Proper use of connectors.

.

Unit 3: Leadership & Team Building Skills

Importance, how to develop Leadership Skills? Best Leadership & Team Building Examples.
Suggested Activities & Exercises: (i) Leadership Pizza, (ii) Minefield, (iii) Leaders You Admire.

Unit 4: Presentation Skills

Principles of Effective Presentations, Do's and Don'ts of Formal Presentations, how to prepare for a formal presentation, Presentation Exercises a) Welcome speech, c) Farewell Speech, d) Vote of thanks etc.

Suggested Activities & Games: (i) Stand Up for Fillers, (ii) Mimes, (iii) Short Speech Challenge.

TEXTBOOK(S)

1. Quantitative Aptitude: How to prepare for Quantitative Aptitude, Arun Sharma, McGraw Hill, 8th edition-2018.
2. Logical Reasoning: A Modern Approach to Verbal & Non-Verbal Reasoning by
3. R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
4. Verbal Aptitude: English is Easy- Chetanand Singh, BSC Publication-2018

REFERENCE BOOKS

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal S. Chand Publications-2018.
2. Quantitative Aptitude: Quantitative Aptitude- Saurabh Rawat and Anushree Sah RawatSavera Publishing House, 1st edition-2016.
3. Logical Reasoning: Analytical & Logical Reasoning by Peeyush Bhardwaj-Arihant Publications; 4th edition-2015.
4. Logical Reasoning: Analytical Reasoning by M. K. Pandey BSC publishing; 3rdedition -2009.
5. Verbal Aptitude: Oxford Guide to English Grammar- John Eastwood, OxfordUniversity Press-2003.
6. Soft Skills: Talk like Ted – Carmine Gallo, St. Martin's Press.
7. Soft Skills: No Excuses – Dr. Wayne Dyer, Hay House Inc.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle / Googledrive. Refer to your course on SAP for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Mathematics and Career Development Centre
Course Code	MAF349
Course Title	Aptitude and Skill Enhancement- III
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Skill Enhancement

Course Summary

Aptitude and Skill Enhancement-III is the final step of the program and the module is designed to enhance the analytical and interpersonal skills of students to make them ready to face various placements, interviews. It will also help them learn various personality development techniques by enhancing their GD and PI skills. Mock Placement Drive will test and improve students by Feedback Sharing & Error Correction.

Course Objectives

Align themselves with the placement requirements and their needsLearn analytical and employability skills. Prepare students for job placements so that they could clear the selection process successfully and give them strategies and skills to crack GD as well as PI to get selected with decent job offers

COURSE OUTCOMES

On successful completion of the course, students will be able to achieve the following:

1. Be prepared for the upcoming placements and they will also be ready for othercompetitive exams.
2. Improve their GD and PI Skills and be able to have firsthand experience of aPlacement drive and gain sufficient confidence to perform well.

Curriculum Content

Unit 1: Quantitative Aptitude

Time Speed Distance

Introduction & types; Speed, Distance and Time: Average Velocity; Race tracks - Straight and Circular; Trains; Boats and Streams

Time and Work & Partnership

Basic concepts (relationship between men, days and work); Understanding group efficiency; Alternate work; Negative work; Wages; Pipes and Cisterns. Concept of partnership.

Permutation and Combination

Basic Principles of Counting (Addition and Multiplication); Arrangements, circular permutation, selection, grouping and distribution.

Probability Introduction, various types of events; Classical definition of probability; Random and Discrete variables; Bayes' Theorem and question types.

Data Interpretation

Introduction; Different ways of representing data- Narration based, pictorial, pie chart, Bar graph, line charts; various questions based upon them.

Unit 2: Verbal Aptitude

Cloze test

Intricacies of cloze test, correct use of specific adjectives, concept of sentenceimprovement, writing concept, auxiliaries and modals.

Words

Concept of consistency, precision, concision in terms of reading and writing, advance word choice with respect to placement papers, SAP (Subject-Audience-Purpose) approach.

Clauses

Subordinate Clauses- The noun clause, the adjective clause, the adverb clause, Analysisof simple and complex sentences, prepositional phrases, transformation of sentences.

Vocabulary

Revisiting vocabulary- high, medium and low frequency words, organization ofideas a thought in order to understand the text- The Pyramid Principle.

Questions

Various test taking skills in accordance with the placement papers.

Unit 3: Logical Reasoning

Deductive Logic

Premises and conclusion structure, Quality of deductive argument, Syllogism,Conditional Arguments- If. Then, only if. Then, If and only if, Either or.

Puzzles

Grouping and selection, Binary logic- truth teller-lie teller, Team formation andmiscellaneous puzzles.

Set Theory and Critical Reasoning

Union and Intersection of sets, Use of venn diagrams in problem solving with two, three,four set, concept of maxima-minima through Venn diagram.

Critical reasoning: Statement and Inferences, cause and Effects, Statement andArguments- Strengthen or Weaken the argument, Statement Assertion and Reason.

Data Sufficiency

Data Sufficiency based on logical reasoning field like Coding-Decoding / Puzzle Test /Blood Relations / Mathematical calculations / clock / calendar / etc.

Unit 4: Soft Skills

Group Discussion

Importance, Do's & Don'ts, Personality Traits, Tips and Strategies, Types of GroupDiscussions. Suggested Exercises, Games & Activities: Mock Group Discussions (on basic topics),with feedback sharing and error analysis.

Personal Interview

Importance, Do's & Don'ts, Personality Interview, Tips and Strategies, Etiquette Rules. Suggested Exercises, Games & Activities: Mock Personal Interviews (contd.) withfeedback sharing and error analysis.

TEXTBOOKS

1. Quantitative Aptitude**:** How to prepare for Quantitative Aptitude, Arun Sharma,McGraw Hill, 8th edition, 2018.
2. Logical Reasoning: A Modern Approach to Logical Reasoning-R.S. Aggarwal, S Chand Publishing; 2nd Colour edition-2018.
3. Verbal Aptitude: English is Easy- Chetanand Singh, BSC Publication-2018.
4. Soft Skills: Group Discussion on Current Topics by P. N. Joshi; Upkar Prakashan-2010.

REFERENCE BOOK(S)

1. Quantitative Aptitude: Quantitative Aptitude for Competitive Examinations- R.S. Agarwal, S. Chand Publications-2017.
2. Quantitative Aptitude: Quantitative Aptitude-Saurabh Rawat & Anushree Sah RawatSavera Publishing House, 1st edition-2016.
3. Logical Reasoning: Logical Reasoning and Data Interpretation for the CAT - Nishit KSinha, Pearson India; 5th edition-2016.
4. Logical Reasoning: Wiley's Verbal Ability and Reasoning - P A ANAND, Wiley-2016.
5. Verbal Aptitude: Oxford Guide to English Grammar- John Eastwood, OxfordUniversity Press-2003.
6. Verbal Aptitude: Fun with grammar- Suzanne W. Woodward Pearson EducationESL-1996.
7. Soft Skills: A Complete Kit for Group Discussion by S. Hundiwala; Arihantpublications; edition-2018.
8. Soft Skills: Basic Interviewing Skills by Raymond L. Gorden, Waveland Press, Inc.; 1edition-1998.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded inMoodle/Google drive. Refer to your course on SAP for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Chemistry**
Course Code	CHF201
Course Title	Environmental Science
Credits (L:T:P:C)	2:0:0:2
Contact Hours (L:T:P)	2:0:0
Prerequisites (if any)	None
Course Basket	Ability Enhancement

Course Objective

To impart basic knowledge about the environment and its allied problems and todevelop an attitude of concern for the environment. Further the course structure will create the awareness about environmental problems among students and motivate the students to participate in environment protection and environment improvement programs. The course aims to develop skills to help the concerned individuals inidentifying and solving environmental problems.

Course Outcome:

- At the end of the course, the student will be able to:
- Demonstrate depleting nature of Environmental Resources and Ecosystemconcepts.
- Able to identify the structure and functioning of natural ecosystems.
- Establish man-wildlife harmonious relationship.
- Adapt to 3R (Reuse, Recovery, Recycle). Identify the causes and controlmeasures related to Pollutions.
- Illustrate and analyze various Case Studies related to Environmental issues and Env. Legislation.

Curriculum Content

Unit 1: Basics of Environment and Natural Resources: 04 L

Definition and Concept of Environment, Multidisciplinary nature of environmentalstudies. Scope and importance of environmental studies, Need for public awareness, Environmental concerns and people. Introduction and classification of natural resources. Energy Resources, Water Resources, Land Resources, Forest Resources, Food Resources, Mineral Resources, Case studies related to over exploitation of resources and their impacts. Role of an individual in conservation of natural resources, Sustainable lifestyles.

Unit 2: Ecosystems: 04 L

Definition and concept of ecology, Structure and Function of an Ecosystem, Energy Flow in Ecosystems, Biogeochemical cycles (Nitrogen, Carbon, Phosphorus, Oxygen, Hydrological). Species interactions in ecosystems. Ecological succession and ecologicalpyramids. Characteristic features of grassland, pond, desert and forest ecosystems.Ecosystem services and conservation.

Unit 3: Biodiversity and its conservation: 04 L

Introduction and types of biodiversity. Bio-geographic classification of India, Value and significance of biodiversity, Biodiversity at global, national and local levels, India: A mega-diversity nation, Biodiversity hotspots, Threats to Biodiversity: Poaching and

man-wildlife conflicts, IUCN Red Data Book and endangered & endemic species of India. Biodiversity conservation strategies, Institutes and organizations.

Unit-4 Environmental Pollutions: 05 L

Introduction and Definition. Causes, consequences and control measures of: Air pollution, Water pollution, Noise pollution, Nuclear pollution, Soil pollution, Thermal and Marine pollution. Solid waste management, Bio-medical waste management. Disasters and its mitigation strategies, Global warming, Climate change, Acid rain, Ozone depletion and Smog. Pollution case studies. Role of an individual in pollution prevention.

Unit-5 Social Issues and Environment: 04 L

Sustainable Development: Concept and importance, Environmental Impact Assessment (EIA), GIS, Remote sensing. Water conservation and rain water harvesting. Resettlement and rehabilitation problems, Environmental audit, eco-labeling and eco- friendly business. Environmental Legislation in India, Population explosion and its impact on environment and human health, Value Education and environmental ethics.

Field work: 03 L

- Visit to a local area to document environmental asset:river/forest/grassland/hill/mountain
- Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural
- Study of common flora and fauna.
- Study of a common ecosystem-pond, river, hill slopes, etc.

TEXT BOOK [TB]:

1. Bharucha Erach, 2004. Textbook for Environmental Studies, University GrantsCommission, New Delhi.
2. Kaushik A & Kaushik C P. 2007. Perspectives in Environmental Studies, New AgeInternational Publ.
3. S. Deswal & A. Deswal 2015. A Basic Course in Environmental Studies. DhanpatRai & Co.

REFERENCES

1. Miller T.G. Jr. 2002. Environmental Science, Wadsworth Publishing Co. (TB).
2. De A.K.,1996. Environmental Chemistry, Wiley Eastern Ltd.
3. Sharma, P.D. 2005. Ecology and environment, Rastogi Publication.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Physics**
Course Code	PYF378
Course Title	Nanomaterials And Applications
Credits (L:T:P:C)	4:0:0:4
Contact Hours (L:T:P)	4:0:0
Prerequisites (if any)	None
Course Basket	Discipline Elective

Course Summary:

The course develops a strong background of nanoscale materials, concept of quantum confinement, synthesis and characterization techniques for nanoscale materials, optical properties and applications.

Course Objective:

This course introduces the fundamentals of nano-scale science and technology. Current and future applications of nanostructured materials will be reviewed with respect to their impactin commercial products and technologies.

Course Outcome

On successful completion of the course, students will be able to achieve the following:

1. Explain the fundamental principles of nanotechnology and their application to biomedical engineering.
2. Apply engineering and physics concepts to the nano-scale and non-continuumdomain.
3. Identify and compare state-of-the-art nanofabrication methods
4. Explore the characterization techniques for analysis of different properties ofnanomaterials
5. Study the applications of nanomaterials in different fields

Curriculum ContentUnit 1 **8 L**

Nanoscale Systems: Length scales in physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.

UNIT 2 **8 L**

Synthesis of Nanostructure Materials: Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots.

UNIT 3 **7 L**

Characterization: X-Ray Diffraction. Optical Microscopy. Scanning Electron Microscopy. Transmission Electron Microscopy. Atomic Force Microscopy. Scanning Tunneling Microscopy.

UNIT 4 **8 L**

Optical Properties: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative processes: General formalization- absorption, emission and luminescence. Optical properties of heterostrctures and nanostructures.

UNIT 5 **8 L**

Applications: Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS).

TEXT BOOK [TB]:

1. Nanotechnology: Principles & Practices, S.K. Kulkarni, 3rd edition, Capital Publishing Company, 2014
2. Introduction to Nanoscience and Technology, K.K. Chattopadhyay and A. N.Banerjee, PHI Learning Private Limited, 2009.

REFERENCE BOOKS [RB]:

1. Textbook of Nanoscience and Nanotechnology, Universities Press (India) PrivetLimited, 2014.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Physics
Course Code	PYF359
Course Title	Physics of Semiconductor Devices
Credits (L:T:P:C)	3:1:0:4
Contact Hours (L:T:P)	3:1:0
Prerequisites (if any)	None
Course Basket	Discipline Elective

Course Summary:

This course covers the knowledge of the semiconductors devices. It is appropriate for physics students who are interested to learn about semiconductors from a physics point of view. The course will also cover some basics of semiconductor devices, particularly emphasising the physical principles on which they function

Course Objective:

The objective of this course is to acquire knowledge of semiconductor physics and discuss working and applications of basic devices, including p-n junctions, BJTs and FETs.

Course Outcome

On successful completion of the course, students will be able to achieve thefollowing:

1. To explain the basic properties of semiconductors including the band gap, chargecarrier concentration, doping and charge carrier injection/excitation.
2. To explain the working, design considerations and applications of various semiconducting devices including p-n junctions, BJTs and FETs.
3. To describe the working and design considerations for the various photonic devices like photodetectors, solar-cells and LEDs

Curriculum ContentUnit 1 **10L**

Semiconductor, Bonds in Semiconductors, Energy band, Effect of temperatures on Semiconductor, Hole currents, Intrinsic & extrinsic semiconductor, carrier concentration and conductivity in intrinsic and extrinsic semiconductors and their temperature dependence, Energy bands in semiconductors.

UNIT 2 **10L**

p-n junction diode, Semiconductor diode, Crystal diode rectifiers, half wave rectifiers, Efficiency of half wave rectifier, Full wave rectifier, Centre tap full wave rectifier, Ripple factor, Filter Circuits, Voltage stabilization, Zener diode, Zener diode as Voltage stabilizer.

UNIT 3 10L

Transistors, Transistors connections, Common base connection, Common emitterconnection, common collector connection, Comparison of transistor connections, Transistor as an amplifier in CE arrangement. JEFT amplifying and switching, Pinch off and saturation, Gate control, I-V characteristics. MOSFET.

UNIT 4 **8L**

Photodiodes, photo detectors, solar cell, light emitting diodes, semiconductor lasers, lightemitting materials, Radiative transition, The transferred electron mechanism: The GUNN diode Emission spectra, Luminous efficiency and LED materials, Solar cell and photodetectors, Reverse saturation current in photodetector

TEXT BOOK [TB]:

1. Fundamentals of Semiconductor Devices by Joseph Lind Mayer, Charles Y. Wrigley,Litton Educational Publishing Inc.
2. Semiconductor Electronics by A.K. Sharma, New Age International (P) LimitedPublisher, New Delhi.

REFERENCE BOOKS [RB]:

1. Physics of Semiconductor Devices by S. M. Sze, John Wily & Sons, New Delhi.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	Humanities & Liberal Arts
Course Code	LAF281
Course Title	Introduction to Psychology
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will highlight the most interesting scientific findings and insights of psychology, discussing the implications of those for our understanding of the human mind and human behaviour. We will explore some of the cognitive abilities including memory, learning, attention, perception and consciousness. We will examine the trajectory of growth of psychological perspectives. By the end ofthis course you will have gained a fascinating understanding and appreciation of who you are and how you work and relate with others. And I can guarantee you that you'll learn things that you'll be telling your friends and family about, things that will fundamentally change the way you think of yourself and others.

Course Objectives

The purpose of this course provides coverage for the broad range of learning outcomes that may be taught in introductory psychology courses. With the goal of supporting faculty in the selection of content for their courses, we have organized this course around the 5 pillars, or domains, of psychology as recently recommended by the American Psychological Association: biological pillar, cognitive pillar, developmental pillar, and social and personality pillar, mental and physical health pillar.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Identify the various approaches, fields, and subfields of psychology along with their major concepts andimportant figures
2. Describe the strengths and weaknesses of descriptive, experimental, and correlational research
3. Explain how nature, nurture, and epigenetics influence personality and behaviour
4. Explain the physical, cognitive, and emotional development that occurs from infancy through childhood
5. Recognize aspects of social psychology, including the fundamental attribution error, biases, social roles,and social norms, in your daily life.

Curriculum Content

Introduction

Definition, Scope, Perspectives: biological, psychoanalytic, behavioural, cognitive, humanistic, Methods: experiment, case study

Cognitive Processes

Perception: Meaning, laws of perceptual organization, identifying perceptual errors; Techniques for improving our behaviors: Classical conditioning, Reinforcement theory & Modeling; CreativeThinking & Problem-Solving

Motivation and Emotion

Motivation: definition, self-motivation through goal setting, self-regulation, motivating employees, improving confidence; Emotion: definition, types, emotion and health, assessing emotional intelligence, body language

Human abilities

Self & Personality: definition, approaches for assessment, exploration through JOHARI Window; Understanding intelligence; Stress: meaning & coping; Conflict: definition & resolution;

TEXT BOOKS

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014)
2. Chadha, N.K. & Seth, S., The Psychological Realm: An Introduction. Pinnacle Learning, New Delhi. (2014)

REFERENCE BOOKS

1. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata Mc Graw Hill. (2008).
2. Glassman, W.F., Approaches to Psychology (3rd Ed.) Buckingham: Open University Press. (2000).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behaviour,McGraw-Hill Education, UK. (2008).

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	School of Liberal Arts & Management
Course Code	LAF381
Course Title	Positive Psychology and Living
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course provides an introduction to the science related to happiness, well-being, flourishing and the positive aspects of human experience. This course discusses research findings in the field of positive psychology. It also features practical applications of this science that you can put to use immediately to help you live a full and meaningful life.

Course Objectives

The purpose of this course is to provide increase awareness for relevance of positive emotions at workplace. Students will gain psychological skills to maximize happiness and virtues like compassion, love and wisdom through experiential, workshop based and interactive activities along with assigned lectures and reading. Students will have an opportunity to explore the concepts (e.g., biological, psychological, social, emotional), the research behind the concepts,and evidence-based experiential activities that enhance well-being. Students will engage in a detailed analysis and evidence-based positivity change process utilizing validated questionnaires and positive psychology and well-being enhancing interventions.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students learn about modern psychological knowledge of happiness.
2. Students acquire skills to cultivate positive emotions.
3. Measure and build individual, workplace and educational flourishing; plan, implement andassess positive psychology.
4. Students will gain an understanding of what contributes to well-being and how to build the enabling conditions of a life worth living.

Curriculum Content

Unit 1: What is positive psychology?

Introducing Positive Psychology: Definition, goals, assumptions, key concepts and relationships with health psychology, developmental psychology, social psychology and psychology of religion, Meaning and measure of Happiness: Hedonic and Eudemonic perspective, Yogic notion of bliss

Unit 2: Positive Emotions, Cognitive states and Well-being

What are positive emotions? The broaden and build theory, relevance of positive emotional states for physical, social & psychological resources, Positive emotions and well-being: Happiness and positive behavior, positive emotions and success, resilience, Self-efficacy, Optimism, Hope, Wisdom, Mindfulness and flourishing

Unit 3: How to enhance well-being?

Use of postures, breathing practices, Sounds, dietary consumption

Unit 4: Positive Psychology at work place

Maximizing achievement, conflict resolution, gratitude, positive leadership

TEXTBOOK(S)

1. Snyder (2011). Positive Psychology: The Scientific and Practical Explorations of Human Strengths. New Delhi: Sage.

REFERENCE BOOKS

1. Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.
2. Peterson, C. (2006). A Primer in Positive Psychology. New York: Oxford University Press.
3. Seligman, M.E.P. (2002). Authentic Happiness: Using the New Positive Psychology toRealize Your Potential for Lasting Fulfillment. New York: Free Press/Simon and Schuster.
4. Snyder, C.R., & Lopez, S. J. (2007). Positive psychology: The scientific and practicalexplorations of human strengths. Thousand Oaks, CA: Sage.
5. Snyder, C. R., & Lopez, S. (Eds.). (2002). Handbook of positive psychology. New York: Oxford University Press.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	School of Liberal Arts & Management
Course Code	LAF481
Course Title	Application of Psychology
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students about knowledge in the various domains of psychology and its applications. It also includes theories of self, work motivation, job satisfaction, attitude and stress and its management.

Course Objectives

The purpose of this course is to develop a broad base of knowledge in the various domains of psychology and its applications. This course is also about to synthesis and demonstrates of useful skills in the field of psychology namely areas of organization, society, stress management etc.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The students will be able to understand basic concepts of psychology in major domains.
2. The students will be able to apply the fundamentals of psychology in order to solve reallife problems.
3. The students will Use scientific reasoning to interpret psychological phenomena.
4. To apply ethical standards to evaluate psychological science and practice

Curriculum Content

Unit 1: Role of Psychology in Understanding the Self

Three Stages – Self-awareness, Self-acceptance and Self-realization; Exploration through JOHARI Window; Development of Self-Mead & Cooley

Unit 2: Application of Psychology at Work Place

Work Motivation: Theories and applications: Maslow, Herzberg, Goal Setting, Emotion: Emotional Quotient & Job Satisfaction, Early approaches to leadership, contemporary
approaches to Leadership-Transformational & Transactional Leadership, styles of leadership

Unit 3: Application of Psychology in Personal & Professional Excellence

Achieving Success: Creativity & Innovation; Role of attitude; Role of competence; Role of Self-confidence; Time management; Role of Human Values

Unit 4: Role of Psychology in Health & Fitness

Stress & Coping Strategies: Meaning, Types, Sources, Effects of stress on health, and coping strategies;Characteristics of a healthy personality

TEXTBOOK(S)

1. R. Bayne, and I. Horton, Applied Psychology, Sage publications, 2003.
2. A. Furnham, The Psychology of Behaviour at Work, Psychology Press, 1997.
3. D. Harris, Engineering Psychology and Cognitive Ergonomics, Aldershot: Ashgate, 1997

Reference Books

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014).
2. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata McGraw Hill. (2008).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behavior, McGraw-Hill Education, UK. (2008).
4. R. Gifford, (Ed.), Applied psychology: Variety and opportunity, Allyn and Bacon, 1991.
5. M.L. Blum, and J.C. Naylor, Industrial Psychology, CBS Publishers & Distributors, 1984.
6. D.M. Pestonjee, Stress and Coping: The Indian Experience, 2nd ed., Sage Publications, 1999.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	School of Liberal Arts & Management
Course Code	LAF284
Course Title	Principles of Management
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summ

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

Course Objectives

The objective of this course is to familiarize B.Tech. Students with the roles, responsibilities, and skills required of modern managers. This course will be present the concepts of management as it applies to current thinking in the workplace.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. To present the topics in management, management theories, while at the same time focusing on practical applications in the real world especially for engineers.
2. Evaluate the global context for taking managerial actions of planning, organizing and controlling.
3. Assess global situation, including opportunities and threats that will impact management of an organization.
4. Integrate management principles into management practices.

Curriculum Content

Unit 1 Overview of management

Definition-Management-Role of Managers-Organization and the internal and environmental factors –Trends and Challenges of Management in India.

Directing – delegation –span of control– communication, ControllingUnit 2 Management Information

Introduction to functional areas of management, Operations management, Human resources management, Marketing management, Financial management

Unit 3 Planning Approach to Organizational Analysis

Design of organization structure; job design and enrichment; job evaluation and merit rating

Unit 4 Motivation and Productivity

Theories of motivation, Leadership styles and Managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control; Few Cases on current management issues in India

TEXT BOOKS:

1. Schermerhorn, Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4. A V Rau: Management Science, BSP, Hyderabad
5. Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6. Stephan R Robbins Fundamental of Management, Pearson

REFERENCE BOOKS

1. Koontz, H., and Weihrich, H., Essentials of Management: An International Perspective, 8th ed., McGraw Hill, 2009.
2. Hicks, Management: Concepts and Applications, Cengage Learning, 2007.
3. Mahadevan, B., Operations Management, Theory and Practice, Pearson Education Asia, 2009
4. Kotler, P., Keller, K.L, Koshy, A., and Jha, M., Marketing Management, 13th ed., 2009.
5. Khan, M.Y., and Jain, P.K., Financial Management, Tata-Mcgraw Hill, 2008.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	**School ofLiberal Arts &Management**
Course Code	LAF482
Course Title	Intellectual Property Rights
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

The course offers a comprehensive intellectual property subject that is easy to understand forstudents. The intellectual property rights syllabus comprises topics ranging from patent registration to copyrights and trademarks, and examples are based on familiar situations that the studentsencounter in their day-to-day lives. Topics would include the major aspects of IPR, which include analysing an idea, patent search techniques, which also helps them to boost their career withadditional industry-relevant skills.

Course Objectives

The purpose of this course is to provide the basic understanding of intellectual property rights, the rationale behind making provision for these rights and the recent concerns in the field. The main objective of the course is to increase the attention of students to protect their IP though legal provision and also teach the students how they can reduce the imitation rate. This course also helpsto teach the students the understanding their involvement in technology transfer and commercialization.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The students will be able to understand the importance of IPRs in academic field.
2. The student gets idea how they can protect their IP through IPRs regime.
3. The student gets more incentive towards technology transfer and commercialization
4. Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyse the social impact of intellectual property law and policy

Curriculum ContentUnit 1: Introduction to IP

Public Funded Research and Its Implications in an Economy; Public Funded Research and Economic Development; Research & Development and Industrial Development

Unit 2: Historical Perspectives of IPRs

History and concept of Property; Introduction to intellectual property rights (IPRs); Patent, Industrial design; Copyrights, Trademarks, Geographical Indications; Trade Secrets; International aspect of IPRs; Development at International level regarding IPRs

Unit 3: Polices on IPRs in India

The debate: Copyright vs Copy left; Research ethics; role of IPRs in economic development in developed and developing economies; Overview of Various Policies on IPRs in India; Success Story of Bayh Dole Act of IPRs in USA

Unit 4: IPRs and Technology Commercialization

Technology Transfer and Commercialization; Key Determinants and Participants of Technology Transfer and Commercialization; Types of Technology Transfer and Commercialization; Technology Transfer and Commercialization in India and Other Developing Economies

TEXTBOOK(S)

1. Cornish, W.R. and L. David. 2010. 7th Edition. Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights. Sweet and Maxwell.
2. Narayan, P. 2002. Intellectual Property, Law in India, 3rd Ed. New Delhi, Delhi Law House.
3. Ganguli, P. 2001. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw Hills.
4. Watal, J. 2001. Intellectual Property Rights in the WTO and Developing Countries. New Delhi: Oxford University Press.

REFERENCE BOOKS

1. Singh A.K., Ashraf S.N. and Acharya S.R. 2017. Viability of Bayh Dole Act of USA in the context of India: Critical evidence from review of literature, in Sasi Misra.
2. Sunil Shukla and Ganapathi Batthini (Eds). Proceedings of the 12th Biennial Conference on Entrepreneurship Organized by EDII Ahmedabad (pp. 235-252). Bookwell Publishing House: New Delhi.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	**Humanities & Liberal Arts**
Course Code	LAF382
Course Title	Engineering Economics
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

The course is devoted to teach basic concept of economics to the student of engineering. This includes basic concept of demand and supply of goods and services. Break-even point and evaluation is also included in this subject. Project evaluation and depreciation of physical assets are also key contribution in this subject. Finally, few concepts of banking system, inflation and business cycle are also the vital topics in this subject.

Course Objectives

1. To provide the basic overview of economics in engineering perspectives.
2. To increase the understanding of students to solve the engineering problems through economictheories.
3. To increase the understanding of students to use economics theories in project investment of industries

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will be able to apply economic principles and calculations to solve engineering projects.
2. To students will be efficient to get the idea of production activities and its applications in industries.
3. Students will be competent to estimate the present and future value of money on their various investment plans.
4. Develop the ability to account for time value of money using engineering economy factors and formulas, as well as the implications and importance of considering taxes, depreciation, and inflation.

Curriculum Content

Unit 1 General Overview of Economics

Nature and Scope of Economics in engineering perspective; **Theory of Demand Analysis:** Meaning andTypes, Law of demand, Exceptions to the Law of Demand, Elasticity of Demand; **Theory of Supply Analysis:** Law of Supply and Elasticity of Supply; Mathematical Explanation on cost, revenue and profit function

Unit 2 Production Function and Its Applications

Production Function: Short-run and long-run Production Function; **Mathematical Explanation:** Laws of Returns to Scale & Law of Diminishing Returns Scale; **Concept of Cost and Its Types:** Total cost, fixed cost, variable cost, average variable cost, average fixed cost, marginal cost, explicit and implicit cost; **Break-Even-Analysis:** Importance and graphical presentation, mathematical problems

Unit 3 Time Value of Money and Project Evaluation

Time Value of Money: Simple and Compound, Uniform Series Compound Interest Formula, Present Worth Analysis, Future Worth Analysis, Future Value through Annuity, Rate of Return Analysis, Cash flow diagrams; **Depreciation**: Introduction, Straight Line and Declining Balance Method of Depreciation; **Project Evaluation Techniques:** Present Worth Method, Future Worth Method, Annual Worth Method; Benefit Cost Analysis: Conventional and Modified B/C Ratio with PW method

Unit 4 Banking and Finance

Banking Sector: Functions of the Commercial Bank and Central Bank, Financial Institutions; **Financial Market:** Money Market and Capital Market; **Monetary and Fiscal Policy:** Objectives, Instruments, Tools in Indian Economy; **Inflation:** Causes, Effects and Methods to Control it, Measurement of Inflation- Consumer Price Index and Whole Price Index; Deflation and Stagflation; **Business Cycles:** Various phases, Control and Measurement, Impact on business cycles on economic activities

TEXT BOOKS TEXT BOOKS

1. Pravin Kumar (2015). Fundamental of Engineering Economics. Raj Kamal Press, New Delhi.
2. Riggs J.L., Dedworth, Bedworth D.B., and Randhawa, S.U. (1996). Engineering Economics. McGraw Hill International, New Delhi
3. Panneer Selvam R. (2001). Engineering Economics. Prentice Hall of India Ltd, New Delhi.

REFERENCE BOOK

1. L.M. Bhole (2007). Financial Institutions and Markets. Tata McGraw Hill, New Delhi.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	Humanities & Liberal Arts
Course Code	LAF287
Course Title	Sustainable Development
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

COURSE SUMMARY

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

COURSE OBJECTIVES

To provide the overview of sustainable and its needs to the students.

To provide the importance and components of sustainable development to the students. To provide the association of social and economic development to the students

COURSE OUTCOMES

1. Students will get the importance of natural resource in economic development.
2. Students also would be able to sophisticated concept of sustainable development.
3. Students would be able to contribute significant efforts towards sustainable development.

Curriculum Content

Unit 1: Overview of Sustainable Development

History and emergence of the concept of Sustainable Development, Components of SD i.e., Economic, Social, Human, Institutional, Technological and Environmental development; Definitions, Sustainability in Ecosystem Services; natural resource degradation, greenhouse gases, factors affecting SD (i.e., Industrialization, urbanization, population growth, globalization, etc.).

Unit 2: Polices on Sustainable Development at international level

Government Policies for SD in India; Socio-economic policies for sustainable development in India, Sustainable development through trade, Carrying Capacity, global policies for sustainable development.

Unit 3: Sustainable Development and International Contribution

SDGs and MDGs, Complexity of growth and equity, International Summits, Conventions, Agreements, Initiations of international organizations like WHO, UNDP, WTO, FAO and World Bank towards sustainable development.

Unit 4: Measurement of Sustainable Development

Role of developed and developing countries in the sustainable development, Demographic dynamics and sustainability, integrated approach for resource protection and management; Index based estimation of SD i.e., Environmentally Sustainable Development Index and sustainable development, and another index.

TEXT BOOKS:

1 The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New SocietyPublishers, 2005.

REFERENCE BOOKS

1 The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New SocietyPublishers, 2005.
2 Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERIfor MoEF, 2011.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department offering the course	Humanities & Liberal Arts
Course Code	LAF286
Course Title	Youth Psychology
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students about the youth, identity and development related issues. The course explores the risk factors of a youth such as education. It explores the development of youth in the society. The course will through study of text, also analyse the practical aspect of it.

Course Objectives

To help students understand the notion of youth, youth across cultures, the factors influencing youth identity and sensitivity to issues concerning the youth of today.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will get to know about concepts of youth, youth identity.
2. Students will learn about the process of youth development and relationship.
3. Students will learn to how a youth could develop on his own.
4. Students will learn about relevance of positive virtues during young age.

Curriculum Content

Unit 1: Introduction

Defining youth; Youth across cultures**;** Formulation of youth identity**;** Concerns of youth in Indian context.

Unit 2: Youth development and Relationships

Relationship with family members and friends**;** Romantic relationships**;** Youth culture: Influence of globalization, identity crisis

Unit 3: Today's Youth: Issues and challenges

Youth and risk behaviours; Employment and education

Unit 4: Developing Youth

Positive youth development**;** Building resources: Hope, Optimism and Resilience

TEXTBOOK(S)

1. Robbins, S. P. & Judge, T.A. (2008). Essentials of Organizational Behavior.9th Edition.New Delhi: Prentice Hall of India.
2. Adler, N.J. (1997). Global leaders: Women of influence. In G. N. Powell (Ed.),Handbook of Gender and Work, (239-261). Thousand Oaks, CA, US: Sage Publications, Inc.

REFERENCE BOOKS

1. Adler, N.J. (1997). Global Leaders: A Dialogue with future history. Journal of International Management, 2, 21-33.
2. Chadha, N.K. (2007). Organizational Behavior (1st Edition). Galgotia Publishers: New Delhi.
3. Greenberg, J. & Baron, R.A. (2007). Behaviour in Organizations (9th Ed.). India: DorlingKindersley
4. Griffin, R.W. & Moorhead, G. (2009). Organizational Behavior: Managing People &Organizations (11th Edition). Biztantra publishers.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	School of Liberal Arts &Management
Course Code	LAF383
Course Title	Introduction to Linguistics
Credits (L:T:P:C)	2:0:2:3
Contact Hours (L:T:P)	2:0:2
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

The student will be able to comprehend foundational linguistic concepts and their relation with the human mind. They will understand how research in linguistics can be used to address real world problems.

Course Objectives

1. To introduce the basic concepts in areas of linguistics, syntax, morphology, phonetics, and phonology and the interaction between them.
2. To provide an understanding of the main communicative functions of language, and the formal ways to achieve them.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The student will be able to apply the basic concepts of linguistics, syntax, morphology,phonetics, and phonology
2. The student will be able to appreciate the use of basic concept of linguistics.

Curriculum Content

Unit 1: (10)

Linguistics and its Scope, Branches of Linguistics, Some basic concepts in Linguistics,Language and Communication

Unit 2 (16)

Phonetics and Phonology; Phoneme, Allophone, Human Speech Mechanism,
Vowels and Consonants in English Syllable structure, Phonemic Transcription, Supra-segmental features, Neutralization of MTI

Unit 3 (15)

Language Structure Sassure's concept of Linguistic sign, Langue and Parole; Syntagmatic and Paradigmatic relations, Synchronic and Diachronic studies; Chomsky – Competence and Performance; Language Variation and Language Change

UNIT 4 (11)

Morphology and Syntax; Morpheme, Word Formation Processes in English, Roots, prefix & suffix

Learning Outcome

At the end of this course -

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

TEXT BOOK [TB]:

1. Halliday, Michael A.K.; Jonathan Webster (2006). On Language and Linguistics. Continuum International Publishing Group. p. vii. ISBN 978-0-8264-8824-4.
2. Rens Bod (2014). A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present. Oxford University Press. ISBN 978-0-19-966521.

REFERENCE BOOKS [RB]:

1. Delany, Sheila. The Naked Text: Chaucer's Legend of Good Women. Berkeley: University of California Press, 1994.
2. Mc Alpine, Monica. The Genre of Troilus and Criseyde. Ithaca: Cornell University Press, 1978.
3. Brooks, Cleanth. The Language of Paradox: 'The Canonization' John Donne: A Collection of Critical Essays. Ed. Helen Gardner. Englewood Cliffs, N. J.: Prentice Hall, 196

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department offering the course	School of Liberal Arts & Management
Course Code	LAF381
Course Title	Positive Psychology and Living
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course provides an introduction to the science related to happiness, well-being, flourishing and the positive aspects of human experience. This course discusses research findings in the field of positive psychology. It also features practical applications of this science that you can put to use immediately to help you live a full and meaningful life.

Course Objectives

The purpose of this course is to provide increase awareness for relevance of positive emotions at workplace. Students will gain psychological skills to maximize happiness and virtues like compassion, love and wisdom through experiential, workshop based and interactive activities along with assigned lectures and reading. Students will have an opportunity to explore the concepts (e.g., biological, psychological, social, emotional), the research behind the concepts,and evidence-based experiential activities that enhance well-being. Students will engage in a detailed analysis and evidence-based positivity change process utilizing validated questionnaires and positive psychology and well-being enhancing interventions.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students learn about modern psychological knowledge of happiness.
2. Students acquire skills to cultivate positive emotions.
3. Measure and build individual, workplace and educational flourishing; plan, implement andassess positive psychology.
4. Students will gain an understanding of what contributes to well-being and how to build the enabling conditions of a life worth living.

Curriculum Content

Unit 1: What is positive psychology?

Introducing Positive Psychology: Definition, goals, assumptions, key concepts and relationships with health psychology, developmental psychology, social psychology and psychology of religion, Meaning and measure of Happiness: Hedonic and Eudemonic perspective, Yogic notion of bliss

Unit 2: Positive Emotions, Cognitive states and Well-being

What are positive emotions? The broaden and build theory, relevance of positive emotional states for physical, social & psychological resources, Positive emotions and well-being: Happiness and positive behavior, positive emotions and success, resilience, Self-efficacy, Optimism, Hope, Wisdom, Mindfulness and flourishing

Unit 3: How to enhance well-being?

Use of postures, breathing practices, Sounds, dietary consumption

Unit 4: Positive Psychology at work place

Maximizing achievement, conflict resolution, gratitude, positive leadership

TEXTBOOK(S)

1. Snyder (2011). Positive Psychology: The Scientific and Practical Explorations of Human Strengths. New Delhi: Sage.

REFERENCE BOOKS

1. Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.
2. Peterson, C. (2006). A Primer in Positive Psychology. New York: Oxford University Press.
3. Seligman, M.E.P. (2002). Authentic Happiness: Using the New Positive Psychology toRealize Your Potential for Lasting Fulfillment. New York: Free Press/Simon and Schuster.
4. Snyder, C.R., & Lopez, S. J. (2007). Positive psychology: The scientific and practicalexplorations of human strengths. Thousand Oaks, CA: Sage.
5. Snyder, C. R., & Lopez, S. (Eds.). (2002). Handbook of positive psychology. New York: Oxford University Press.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	School of Liberal Arts & Management
Course Code	LAF481
Course Title	Application of Psychology
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students about knowledge in the various domains of psychology and its applications. It also includes theories of self, work motivation, job satisfaction, attitude and stress and its management.

Course Objectives

The purpose of this course is to develop a broad base of knowledge in the various domains of psychology and its applications. This course is also about to synthesis and demonstrates of useful skills in the field of psychology namely areas of organization, society, stress management etc.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The students will be able to understand basic concepts of psychology in major domains.
2. The students will be able to apply the fundamentals of psychology in order to solve reallife problems.
3. The students will Use scientific reasoning to interpret psychological phenomena.
4. To apply ethical standards to evaluate psychological science and practice

Curriculum Content

Unit 1: Role of Psychology in Understanding the Self

Three Stages – Self-awareness, Self-acceptance and Self-realization; Exploration through JOHARI Window; Development of Self-Mead & Cooley

Unit 2: Application of Psychology at Work Place

Work Motivation: Theories and applications: Maslow, Herzberg, Goal Setting, Emotion: Emotional Quotient & Job Satisfaction, Early approaches to leadership, contemporary
approaches to Leadership-Transformational & Transactional Leadership, styles of leadership

Unit 3: Application of Psychology in Personal & Professional Excellence

Achieving Success: Creativity & Innovation; Role of attitude; Role of competence; Role of Self-confidence; Time management; Role of Human Values

Unit 4: Role of Psychology in Health & Fitness

Stress & Coping Strategies: Meaning, Types, Sources, Effects of stress on health, and coping strategies;Characteristics of a healthy personality

TEXTBOOK(S)

1. R. Bayne, and I. Horton, Applied Psychology, Sage publications, 2003.
2. A. Furnham, The Psychology of Behaviour at Work, Psychology Press, 1997.
3. D. Harris, Engineering Psychology and Cognitive Ergonomics, Aldershot: Ashgate, 1997

REFERENCE BOOKS

1. Baron, R.A. and Misra, G., Psychology (Indian Subcontinent Edition). Person Education Ltd. (2014).
2. Ciccarelli, S.K. & Meyer, G.E., Psychology (South Asian Edition). New Delhi: Tata McGraw Hill. (2008).
3. Passer, M.W., Smith, R.E., Holt, N. and Bremmer, A., Psychology: The Science of Mind and Behavior, McGraw-Hill Education, UK. (2008).
4. R. Gifford, (Ed.), Applied psychology: Variety and opportunity, Allyn and Bacon, 1991.
5. M.L. Blum, and J.C. Naylor, Industrial Psychology, CBS Publishers & Distributors, 1984.
6. D.M. Pestonjee, Stress and Coping: The Indian Experience, 2nd ed., Sage Publications, 1999.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	**School ofLiberal Arts &Management**
Course Code	LAF284
Course Title	Principles of Management
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

Course Objectives

The objective of this course is to familiarize B.Tech. Students with the roles, responsibilities, and skills required of modern managers. This course will be present the concepts of management as it applies to current thinking in the workplace.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. To present the topics in management, management theories, while at the same time focusing onpractical applications in the real world especially for engineers.
2. Evaluate the global context for taking managerial actions of planning, organizing and controlling.
3. Assess global situation, including opportunities and threats that will impact management of an organization.
4. Integrate management principles into management practices.

Curriculum Content

Unit 1 Overview of management

Definition-Management-Role of Managers-Organization and the internal and environmental factors –Trends and Challenges of Management in India.

Directing – delegation –span of control– communication, ControllingUnit 2 Management Information Introduction to functional areas of management,Operations management, Human resources management, Marketing management, Financial management

Unit 3 Planning Approach to Organizational Analysis

Design of organization structure; job design and enrichment; job evaluation and merit rating

Unit 4 Motivation and Productivity Theories of motivation, Leadership styles and Managerial grid. Co-ordination, monitoring and control inorganizations. Techniques of control; Few Cases on current management issues in India

TEXT BOOKS:

1. Schermerhorn, Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4. A V Rau: Management Science, BSP, Hyderabad
5. Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6. Stephan R Robbins Fundamental of Management, Pearson

REFERENCE BOOKS

1. Koontz, H., and Weihrich, H., Essentials of Management: An International Perspective, 8th ed., McGraw Hill, 2009.
2. Hicks, Management: Concepts and Applications, Cengage Learning, 2007.
3. Mahadevan, B., Operations Management, Theory and Practice, Pearson Education Asia, 2009
4. Kotler, P., Keller, K.L, Koshy, A., and Jha, M., Marketing Management, 13th ed., 2009.
5. Khan, M.Y., and Jain, P.K., Financial Management, Tata-Mcgraw Hill, 2008.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	School of Liberal Arts &Management
Course Code	LAF482
Course Title	Intellectual Property Rights
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

The course offers a comprehensive intellectual property subject that is easy to understand forstudents. The intellectual property rights syllabus comprises topics ranging from patent registration to copyrights and trademarks, and examples are based on familiar situations that the studentsencounter in their day-to-day lives. Topics would include the major aspects of IPR, which include analysing an idea, patent search techniques, which also helps them to boost their career withadditional industry-relevant skills.

Course Objectives

The purpose of this course is to provide the basic understanding of intellectual property rights, the rationale behind making provision for these rights and the recent concerns in the field. The main objective of the course is to increase the attention of students to protect their IP though legal provision and also teach the students how they can reduce the imitation rate. This course also helpsto teach the students the understanding their involvement in technology transfer and commercialization.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The students will be able to understand the importance of IPRs in academic field.
2. The student gets idea how they can protect their IP through IPRs regime.
3. The student gets more incentive towards technology transfer and commercialization
4. Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyse the social impact of intellectual property law and policy

Curriculum ContentUnit 1: Introduction to IP

Public Funded Research and Its Implications in an Economy; Public Funded Research and Economic Development; Research & Development and Industrial Development

Unit 2: Historical Perspectives of IPRs

History and concept of Property; Introduction to intellectual property rights (IPRs); Patent, Industrial design; Copyrights, Trademarks, Geographical Indications; Trade Secrets; International aspect of IPRs; Development at International level regarding IPRs

Unit 3: Polices on IPRs in India

The debate: Copyright vs Copy left; Research ethics; role of IPRs in economic development in developed and developing economies; Overview of Various Policies on IPRs in India; Success Story of Bayh Dole Act of IPRs in USA

Unit 4: IPRs and Technology Commercialization

Technology Transfer and Commercialization; Key Determinants and Participants of Technology Transfer and Commercialization; Types of Technology Transfer and Commercialization; Technology Transfer and Commercialization in India and Other Developing Economies

TEXTBOOK(S)

1. Cornish, W.R. and L. David. 2010. 7th Edition. Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights. Sweet and Maxwell.
2. Narayan, P. 2002. Intellectual Property, Law in India, 3rd Ed. New Delhi, Delhi Law House.
3. Ganguli, P. 2001. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw Hills.
4. Watal, J. 2001. Intellectual Property Rights in the WTO and Developing Countries. New Delhi: Oxford University Press.

REFERENCE BOOKS

1. Singh A.K., Ashraf S.N. and Acharya S.R. 2017. Viability of Bayh Dole Act of USA in the context of India: Critical evidence from review of literature, in SasiMisra.
2. Sunil Shukla and GanapathiBatthini (Eds). Proceedings of the 12th Biennial Conference on Entrepreneurship Organized by EDII Ahmedabad (pp. 235-252). Bookwell Publishing House: New Delhi.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	Humanities & Liberal Arts
Course Code	LAF382
Course Title	Engineering Economics
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

The course is devoted to teach basic concept of economics to the student of engineering. This includes basic concept of demand and supply of goods and services. Break-even point and evaluation is also included in this subject. Project evaluation and depreciation of physical assets are also key contribution in this subject. Finally, few concepts of banking system, inflation and business cycle are also the vital topics in this subject.

Course Objectives

1. To provide the basic overview of economics in engineering perspectives.
2. To increase the understanding of students to solve the engineering problems through economictheories.
3. To increase the understanding of students to use economics theories in project investment of industries

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will be able to apply economic principles and calculations to solve engineering projects.
2. To students will be efficient to get the idea of production activities and its applications in industries.
3. Students will be competent to estimate the present and future value of money on their various investment plans.
4. Develop the ability to account for time value of money using engineering economy factors and formulas, as well as the implications and importance of considering taxes, depreciation, and inflation.

Curriculum Content

Unit 1 General Overview of Economics

Nature and Scope of Economics in engineering perspective; **Theory of Demand Analysis:** Meaning andTypes, Law of demand, Exceptions to the Law of Demand, Elasticity of Demand; **Theory of Supply Analysis:** Law of Supply and Elasticity of Supply; Mathematical Explanation on cost, revenue and profit function

Unit 2 Production Function and Its Applications

Production Function: Short-run and long-run Production Function; **Mathematical Explanation:** Laws of Returns to Scale & Law of Diminishing Returns Scale; **Concept of Cost and Its Types:** Total cost, fixed cost, variable cost, average variable cost, average fixed cost, marginal cost, explicit and implicit cost; **Break-Even-Analysis:** Importance and graphical presentation, mathematical problems

Unit 3 Time Value of Money and Project Evaluation

Time Value of Money: Simple and Compound, Uniform Series Compound Interest Formula, Present Worth Analysis, Future Worth Analysis, Future Value through Annuity, Rate of Return Analysis, Cash flow diagrams; **Depreciation**: Introduction, Straight Line and Declining Balance Method of Depreciation; **Project Evaluation Techniques:** Present Worth Method, Future Worth Method, Annual Worth Method; Benefit Cost Analysis: Conventional and Modified B/C Ratio with PW method

Unit 4 Banking and Finance

Banking Sector: Functions of the Commercial Bank and Central Bank, Financial Institutions; **Financial Market:** Money Market and Capital Market; **Monetary and Fiscal Policy:** Objectives, Instruments, Tools in Indian Economy; **Inflation:** Causes, Effects and Methods to Control it, Measurement of Inflation- Consumer Price Index and Whole Price Index; Deflation and Stagflation; **Business Cycles:** Various phases, Control and Measurement, Impact on business cycles on economic activities

TEXT BOOKS TEXT BOOKS

1. Pravin Kumar (2015). Fundamental of Engineering Economics. Raj Kamal Press, New Delhi.
2. Riggs J.L., Dedworth, Bedworth D.B., and Randhawa, S.U. (1996). Engineering Economics. McGraw Hill International, New Delhi
3. Panneer Selvam R. (2001). Engineering Economics. Prentice Hall of India Ltd, New Delhi.

REFERENCE BOOK

1. L.M. Bhole (2007). Financial Institutions and Markets. Tata McGraw Hill, New Delhi.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department offering the course	**Humanities & Liberal Arts**
Course Code	**LAF287**
Course Title	**Sustainable Development**
Credits (L:T:P:C)	**3:0:0:3**
Contact Hours (L:T:P)	**3:0:0**
Prerequisites (if any)	**NIL**
Course Basket	**Humanities & Liberal Arts**

Course Summary

This course will introduce students about the basic Principles needed for management. It also includes case studies where a student can get idea about the actual working of the management field. Topics include Overview of Management, Management Information, and Planning Approach to Organizational Analysis, Motivation and Productivity.

Course Objectives

To provide the overview of sustainable and its needs to the students.

To provide the importance and components of sustainable development to the students. To provide the association of social and economic development to the students

Course Outcomes

1. Students will get the importance of natural resource in economic development.
2. Students also would be able to sophisticated concept of sustainable development.
3. Students would be able to contribute significant efforts towards sustainable development.

Curriculum Content

Unit 1: Overview of Sustainable Development

History and emergence of the concept of Sustainable Development, Components of SD i.e., Economic, Social, Human, Institutional, Technological and Environmental development; Definitions, Sustainability in Ecosystem Services; natural resource degradation, greenhouse gases, factors affecting SD (i.e., Industrialization, urbanization, population growth, globalization, etc.).

Unit 2: Polices on Sustainable Development at international level

Government Policies for SD in India; Socio-economic policies for sustainable development in India, Sustainable development through trade, Carrying Capacity, global policies for sustainable development.

Unit 3: Sustainable Development and International Contribution

SDGs and MDGs, Complexity of growth and equity, International Summits, Conventions, Agreements, Initiations of international organizations like WHO, UNDP, WTO, FAO and World Bank towards sustainable development.

Unit 4: Measurement of Sustainable Development

Role of developed and developing countries in the sustainable development, Demographic dynamics and sustainability, integrated approach for resource protection and management; Index based estimation of SD i.e., Environmentally Sustainable Development Index and sustainable development, and another index.

TEXT BOOKS:

1 The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New SocietyPublishers, 2005.

REFERENCE BOOKS

1 The Sustainability Revolution: Portrait of a Paradigm Shift by Edwards, Andres R., New SocietyPublishers, 2005.
2 Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERIfor MoEF, 2011.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering theCourse	Humanities & Liberal Arts
Course Code	LAF286
Course Title	Youth Psychology
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students about the youth, identity and development related issues. The course explores the risk factors of a youth such as education. It explores the development of youth in the society. The course will through study of text, also analyse the practical aspect of it.

Course Objectives

To help students understand the notion of youth, youth across cultures, the factors influencing youth identity and sensitivity to issues concerning the youth of today.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will get to know about concepts of youth, youth identity.
2. Students will learn about the process of youth development and relationship.
3. Students will learn to how a youth could develop on his own.
4. Students will learn about relevance of positive virtues during young age.

Curriculum Content

Unit 1: Introduction

Defining youth; Youth across cultures**;** Formulation of youth identity**;** Concerns of youth inIndian context.

Unit 2: Youth development and Relationships

Relationship with family members and friends**;** Romantic relationships**;** Youth culture: Influenceof globalization, identity crisis

Unit 3: Today's Youth: Issues and challenges

Youth and risk behaviours; Employment and education

Unit 4: Developing Youth

Positive youth development**;** Building resources: Hope, Optimism and Resilience

TEXTBOOK(S)

1. Robbins, S. P. & Judge, T.A. (2008). Essentials of Organizational Behavior.9th Edition.New Delhi: Prentice Hall of India.
2. Adler, N.J. (1997). Global leaders: Women of influence. In G. N. Powell (Ed.),Handbook of Gender and Work, (239-261). Thousand Oaks, CA, US: Sage Publications, Inc.

REFERENCE BOOKS

1. Adler, N.J. (1997). Global Leaders: A Dialogue with future history. Journal of International Management, 2, 21-33.
2. Chadha, N.K. (2007). Organizational Behavior (1st Edition). Galgotia Publishers: New Delhi.
3. Greenberg, J. & Baron, R.A. (2007). Behaviour in Organizations (9th Ed.). India: Dorling Kindersley
4. Griffin, R.W. & Moorhead, G. (2009). Organizational Behavior: Managing People & Organizations (11th Edition). Biztantra publishers.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

1. Department offering the course	**School of Liberal Arts &Management**
2. Course Code	**LAF383**
3. Course Title	**Introduction to Linguistics**
4. Credits (L:T:P:C)	**2:0:2:3**
5. Contact Hours (L:T:P)	**2:0:2**
6. Prerequisites (if any)	**NIL**
7. Course Basket	**Humanities & Liberal Arts**

Course Summary

The student will be able to comprehend foundational linguistic concepts and their relation with the human mind. They will understand how research in linguistics can be used to address real world problems.

Course Objectives

1 To introduce the basic concepts in areas of linguistics, syntax, morphology, phonetics, and phonology and the interaction between them.

2 To provide an understanding of the main communicative functions of language, and the formal ways to achieve them.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1 The student will be able to apply the basic concepts of linguistics, syntax, morphology, phonetics, and phonology

2 The student will be able to appreciate the use of basic concept of linguistics.

Curriculum Content

Unit 1: (10)

Linguistics and its Scope, Branches of Linguistics, Some basic concepts in Linguistics,Language and Communication

UNIT 2 (16)

Phonetics and Phonology; Phoneme, Allophone, Human Speech Mechanism,
Vowels and Consonants in English Syllable structure, Phonemic Transcription, Supra-segmental features, Neutralization of MTI

UNIT 3 (15)

Language Structure Sassure's concept of Linguistic sign, Langue and Parole; Syntagmatic and Paradigmatic relations, Synchronic and Diachronic studies; Chomsky – Competence and Performance; Language Variation and Language Change

UNIT 4 (11)

Morphology and Syntax; Morpheme, Word Formation Processes in English, Roots, prefix & suffix

Learning Outcome

At the end of this course -

TEXT BOOK [TB]:

1. Halliday, Michael A.K.; Jonathan Webster (2006). On Language and Linguistics. Continuum International Publishing Group. p. vii. ISBN 978-0-8264-8824-4.
2. Rens Bod (2014). A New History of the Humanities: The Search for Principles and Patterns from Antiquity to the Present. Oxford University Press. ISBN 978-0-19-966521.

REFERENCE BOOKS [RB]:

1. Delany, Sheila. The Naked Text: Chaucer's Legend of Good Women. Berkeley: University of California Press, 1994.
2. Mc Alpine, Monica. The Genre of Troilus and Criseyde. Ithaca: Cornell University Press, 1978.
3. Brooks, Cleanth. The Language of Paradox: 'The Canonization' John Donne: A Collection of Critical Essays. Ed. Helen Gardner. Englewood Cliffs, N. J.: Prentice Hall, 196

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Computer Science and Engineering**
Course Code	CSF102
Course Title	Data Structures
Credits (L:T:P:C)	3:0:2:4
Contact Hours (L:T:P)	3:0:2
Prerequisites (if any)	Programming for problem solving
Course Basket	Generic Elective

Course Summary

The course is a foundation level course and requires the knowledge of the C programming language. The course outlines the detailed architecture and implementation of basic data structures such as Stacks, Queues, Linked Lists, Trees, and Graphs. It also covers the time and space complexity analysis of different searching and sorting techniques. Some of the searching methods include Linear Search, Binary Search, and sorting mechanism includes Bubble sort, Insertion sort, Selection sort, Quick sort, Merge sort, and Heap Sort. The course also incorporates different hashing techniques, designing hash functions, hash table implementation, and collision resolution technique.

Course Objectives

The main objective of this course is to introduce the concept of data structure, how to choose a particular data structure, and how the choice of a data structure impacts the performance of programs. The other objective may include, how to select the appropriate data structure model specific to some application. Solve problems using data structures like Stacks, Queues, Linked Lists, Trees, Graphs, and writing programs for these solutions using C code. Introduce the concept of algorithm writing, analyzing algorithms, converting pseudocode to appropriate C code, and showing how one solution is better than others by analyzing their computational complexities.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. The student will develop an ability to read, write, and analyze the time and spacecomplexity of any algorithms.
2. Able to describe the properties, behavior, and implementation of basic data structures like Stacks, Queues, Linked List, Trees, and Graphs.
3. Able to convert pseudocode to its appropriate C code implementation.
4. Able to compare different searching and sorting techniques in terms of their memory usage and time consumption.
5. Able to design and implement different hash functions, analyze the collision effect, andhash table implementations.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Curriculum Content

Unit 1: Introduction to Algorithms & Data Structure (8 L)

Introduction: Data types, Abstraction, Abstract Data Type (ADT), Concept of data structure, Types of data structures, Operations on Data Structures, Introduction to Algorithms, Writing Pseudocodes, Algorithm analysis, Complexity of algorithms and Time space trade-off, Searching: Linear and Binary Search Techniques and their complexity analysis.

Unit 2: Arrays, Stacks, and Queues (7 L)

Arrays: Introduction to Array, Applications of Array, Operations on Arrays: Traverse, Insert,Delete etc. Stacks: Introduction to Stacks, Array representation of Stack, Operations on Stack: Push, Pop, etc. Applications of Stacks: Infix and Postfix Conversion, Evaluations of Infix and Postfix expressions. Queue: Introduction to Queue, Array representation and implementation of queues, Operations of Queue, Applications of Queue, Types of Queue: Circular Queue, Priority Queue, Double ended Queue. Operations on each type of Queue and their Applications.

Unit 3: Linked Lists and Trees (8 L)

Linked Lists: Introduction to Dynamic Memory Allocation, Representation and Implementation of Single, Double, and Circular Linked Lists, Operations on Linked List: Insert, Delete, Traverse etc. Applications of Linked List, Linked List representation of Stack and Queue. Trees: Basic Tree terminologies, Types of Trees: Binary Tree, Binary Search Tree (BST), AVL Tree, B-Tree, and Heap. Representation and Implementations of different types of trees, Tree Traversal algorithms, Operation on trees: Insert, Delete, etc., Applications of Tress.

Unit4: Graphs (7 L)

Graphs: Introduction to Graph and their Terminologies, Types of Graph, Representations of Graph, Graph traversal algorithms, Topological Sorting, Minimum Spanning Tree, Shortest Path Algorithms: Single Source Shortest Path like Bellman-Ford, Dijkstra and All Pair Shortest Path like Floyd-Warshall.

Unit- 5: Sorting &Hashing: (9L)

Sorting Algorithms and their Analysis: Selection Sort, Bubble sort, Insertion sort, Quick sort, Merge sort, Heap Sort. Performance Analysis and Comparison of all sorting techniques. Hashing: Hash Functions and its type, Hash Table construction, Collision Resolution, Universal Addressing, Open Hashing.

TEXTBOOK(S)

1. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, Data Structures using C Pearson.1st Edition.2019
2. Schaum's outline series, Data structures with C, McGraw Hill Education; 1st edition (July 2017)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

REFERENCE BOOKS

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication,2nd Edition. 2008.
2. Robert Kruse, Data Structures and Program Design in C PHI.2nd Edition.2006.
3. Willam J. Collins, Data Structure and the Standard Template library –2003, T.M.H.1st Edition.
4. Kyle Loudon, Mastering Algorithms with C, O’Reily Publication, 1st Edition, 1999

TEACHING AND LEARNING STRATEGY

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to your course in Moodle for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Humanities & Liberal Arts**
Course Code	LAF282
Course Title	Human Values
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students to the nature of the individual and the relationshipbetween the self and the community. It includes Principles of Interdependence between individuals and society and role of material values in promoting human well-being. It also includes psychological and spiritual values through topics like Humanistic Psychology, religion, concept of Dharma and Spirituality morality, Professional values and developing an open and balanced mind.

Course Objectives

To inculcate the skills of ethical decision making and then to apply these skills to the real andcurrent challenges of the Engineering profession. The main objective of the course is to enable the students to understand the need and importance of value-education and education for Human Rights. It also aims to develop them inter personal and leadership skills and empower them to develop into evolved human beings.

Course Outcomes

On successful completion of the course, students will be able to achieve the following:

1. Students will become more sensitive to their surroundings including both peopleand nature, with commitment towards what they believe in (human values).
2. Be able to understand how universal values can be uncovered by different means, including scientific investigation, historical research, or public debate and deliberation (what some philosophers call a dialectic method).
3. They will become more aware of their self and their relationships and have better reflective and discerning ability.
4. Be able to understand and discuss the idea of moral relativism and the challenges it poses to universal values.

Curriculum Content

Unit 1 Introduction

Nature of Value-Crisis in the contemporary Indian society, Meaning, Nature & Types of Values; Sources of Value Formation, Foundational Human Values – Integrity, Freedom, Creativity, Morals, Love and Wisdom, Case Studies Case Studies on the above aspects

Unit 2 Societal Values & Material Values

Definition of Society, Units of Society, and Social Consciousness. Concepts & Principles of Interdependence, Conceptualizing 'Good Society' and 'Social Goods' and Corporate Social Responsibility, Role of Material Values in promoting Human Well-being. Role of Science and Technology; Problems of Material Development, Case Studies Case Studies on the above aspects

Unit 3 Psychological & Spiritual Values

Humanistic Psychology; Concept of Intelligence, Emotional Intelligence & Mental health; Cognitive Dissonance & Ego Defense, Maslow's Hierarchy of Human Need; Characteristics of 'Self-Actualizing' persons; Understanding Common Religion & Concept of Dharma and Spirituality; Case Studies Case Studies on the above aspects

Unit 4 Psychological & Spiritual Values

Bases for moral Judgments: Customary Morality, Religious Morality, Reflective Morality. Concept of Professional values: Competence, Confidence, Devotion to Duty, Efficiency, Accountability, Respect for learning / Learned, Willingness to Learn, Open and Balanced mind; Team spirit; Willingness for Discussion, Aims, Effort,Avoidance of Procrastination and Slothfulness, Alertness, IEEE; Case Studies Case Studies on the above aspects

TEXTBOOK(S)

1. Human Values - Prof. A.N. Tripathi New Age International, 2009

REFERENCE BOOKS

1. Human Values and Professional Ethics - Jayshree, Suresh and B.S. Raghwan , S.Chand Publication, 2011-12

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded in Moodle. Refer to yourcourse in Moodle for details.

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

Department Offering the Course	**Humanities & Liberal Arts**
Course Code	LAF283
Course Title	Literature, Language & Society
Credits (L:T:P:C)	3:0:0:3
Contact Hours (L:T:P)	3:0:0
Prerequisites (if any)	NIL
Course Basket	Humanities & Liberal Arts

Course Summary

This course will introduce students about the literature, language & society. It also includes the overview of aspects of literature and language with its impact on the society. The course explores the dimensions of literature, its nature and its functions with its approaches to the study of society. It explores the role of language and literature in the society. The course will through study of text, also analyse the practical aspect of it.

Course Objectives

The main objective of the course is to focus is on the interaction between literature & Society, and Literature and visual culture. This course is also about how Literature reacts to major changes in society. This course offers the students to experience differentdimension of literature and language.

Course Outcomes

On successful completion of the course, students will be able to achieve thefollowing:

1. Students will read critically from a variety of genres, specifically poetry, drama,non-fiction, and fiction.
2. Students will read literature more carefully and meaningfully, practicing close-reading skills.
3. Students will understand the relation between historical and cultural contexts.
4. The students will develop a critical understanding of how literature can bothuphold and resist existing structures of power.

Curriculum Content

Unit 1:

Nature and Functions of Literature, Literature and Society with special reference to Indian Literature and Indian Society, Literary Forms, Poetry, Drama, Fiction, Essay, Autobiography

Unit 2:

Approaches to the Study of Literature, Reader response to the study of Literature, Interpretation, Appreciation, Evaluation, Special problems in understanding Modern Literature.

Unit 3:

Social dimension of language. problems of multilingual communities, dominance and conflict, shift and attrition, language and the state, language and nation, Indian multilingualism, language variation, language and identity, linguistic prejudice and inequality, standardization, linguistic determinism, critical discourse analysis, and methodological issues.

Unit 4:

Jerome K Jerome: Three Men on a Bummel (selection), Martin Amis: Last Days of Muhammad Atta, Li Ho: A Girl Comb her hair, R.K. Narayan: Malgudi Days (selection)

COURSE STRUCTURE & SYLLABUS OF B.SC. (HONS) CHEMISTRY
APPLICABLE FOR BATCH: 2022-25

TEXTBOOK(S)

1. Jerome K Jerome: Three Men on a Bummel (selection), Arrow smithPublications.
2. R.K. Narayan: Malgudi Days (selection), Indian Thought Publications.

REFERENCE BOOKS

1. Martin Montgomery, An Introduction to Language and Society (Studies inCulture and Communication) Routledge; 2 editions (December 22, 1995).
2. Robe Pope, *An Introduction to Language Literature and Culture*. Routledge,2005.

Teaching and Learning Strategy

All materials (ppts, assignments, labs, etc.) will be uploaded on online platform.