Department of Applied Sciences

Course of Study, B.Sc. (H) Chemistry

2021-2024

SCHEME OF B.Sc. (HONS) CHEMISTRY 2021-24

Sem	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	Community Services	GP	Cont hrs	Credits
I	Effective Communication-I 2.5(2-0-1) CLL 101	Fundamentals of Mathematics 4(3-1-0) MAL 101N	Fundamentals of Physics 4(3-0-2) PYL 102N	Fundamentals of Chemistry 4(3-0-2) CHL 111	Introduction to Statistics 4(4-0-0) MAL 109	Environmental Studies 3(3-0-0) CHL100		CHS102 (70hrs)	CHR110 1(1-0-0)	24	22.5
II	Effective Communication-II 2.5(2-0-1) CLL 102	Stereochemistry 3(2-1-0) CHL 102	Biomolecules 3(2-1-0) CHL 601 CHL 103	Basics of Computer Programming 4(3-0-2) MAL 106N	Entrepreneurship 3(2-0-2) BSL 101	Human Values and Professional Ethics 2(2-0-0) CLL 120	Data Analysis 4(3-0-2) MAL 209	CHS102 (70hrs) (2 Crdt)	CHR120 1(1-0-0)	25	24.5
III	Inorganic Chemistry-I 4(3-0-2) CHL201	Organic Chemistry-I 4(3-0-2) CHL203	Physical Chemistry-I 4(3-0-2) CHL205	Prog . Elec. I 4(3-1-0)	Open Elective I 3(3-0-0)			CHS202 (70hrs)	CHR210 1(1-0-0)	22	20
IV	Inorganic Chemistry-II 4(3-0-2) CHL202	Organic Chemistry-II 4(3-0-2) CHL204	Physical Chemistry-II 4(3-0-2) CHL206	Prog .Elec. II 4 (3-1-0)	Open Elective II 3(3-0-0)	Foreign Language 3(1-2-0)		CHS202 (70hrs) (2 Crdt)	CHR220 1(1-0-0)	25	25
Summer Internship 3(0-0-6) CHT 208 (Including 70hrs of community service)											
V	Inorganic Chemistry-III 4(3-0-2) CHL301	Organic Chemistry-III 4(3-0-2) CHL303	Physical Chemistry-III 4(3-0-2) CHL305	Prog. Elec. III 4(3-1-0)	Open Elective III 3(3-0-0)	Project 4(0-0-8) CHD 311		CHS302 (70hrs)	CHR310 1(1-0-0)	22	24
VI	Inorganic Chemistry-IV 4(3-0-2) CHL302	Organic Chemistry-IV 4(3-0-2) CHL304	Prog. Elec. IV 4(3-1-0)	Open Elective IV 3(3-0-0)	Creativity and innovation outcome (1) CHL330	Project 4(0-0-8) CHD 312		CHS302 (70hrs) (2 Crdt)	CHR320 1(1-0-0)	17	23
		Total								135	142

The overall credits structure of B.Sc. (H) Chemistry

Credits Structure			
Category		**Credits**	**Total Credits**
Program Core (PC) + Compulsory Courses		**74 (62+12)**	**74**
Electives	**Program Electives (PE)**	**19**	**31**
	Open Electives (OE)	**12**	
Ability Enhancement Courses (AEC)		**11**	**11**
Skill Enhancement		**26**	**26**
	TOTAL	**142**	**142**

A. Program Core (PC) + Compulsory Courses

S N	Code	Course Name	L-T-P	Credits
1	CHL 101	Fundamentals of Chemistry	3-0-2	4
2	MAL 101N	Fundamentals of Math	3-1-0	4
3	PYL 102N	Fundamentals of Physics	3-0-2	4
4	CHL 102	Stereochemistry	2-1-0	3
5	CHL 103	Biomolecules	2-1-0	3
6	CHL 201	Inorganic Chemistry-I	3-0-2	4
7	CHL 203	Organic Chemistry-I	3-0-2	4
8	CHL 205	Physical Chemistry-I	3-0-2	4
9	CHL 202	Inorganic Chemistry-II	3-0-2	4
10	CHL 204	Organic Chemistry-II	3-0-2	4
11	CHL 206	Physical Chemistry-II	3-0-2	4
12	CHL 301	Inorganic Chemistry-III	3-0-2	4
13	CHL 303	Organic Chemistry-III	3-0-2	4
14	CHL 305	Physical Chemistry-III	3-0-2	4
15	CHL 302	Inorganic Chemistry-IV	3-0-2	4
16	CHL 304	Organic Chemistry-IV	3-0-2	4

17	**CHL 100**	**Environmental Studies**	**3-0-0**	**3**
18	**MAL 109**	**Introduction to Statistics**	**4-0-0**	**4**
19	**BSL 101**	**Entrepreneurship**	**2-0-2**	**3**
20	**CLL 120**	**Human Values and Professional Ethics**	**2-0-0**	**2**
		Total Credits		**74**

B. Program Electives (PE)

S. No.	Code	Course Name	L-T-P	Credits
PE-I				
1	CHL 207	Analytical Chemistry	3-1-0	4
2	CHL 209	Green Chemistry and technology	3-1-0	4
3	PYL306	Thin films and Nanomaterial's	3-0-2	4
PE-II				
4	CHL 212	Nano chemistry and Nano technology	3-1-0	4
5	PYL305	Experimental and Analytical Techniques	3-0-2	4
PE-III				
6	CHL 307	Quantum Chemistry	3-1-0	4
7	CHL 309	Physical Spectroscopy & Photochemistry	3-1-0	4
PE-IV				
8	CHL 306	Electrochemistry	3-1-0	4
9	CHL 308	Polymer Chemistry and Its Applications	3-1-0	4
Foreign Language Elective				
10	CLL 220	German	1-2-0	3
11	CLL 200	French	1-2-0	3
12	CLL 270	Spanish	1-2-0	3

C. Ability Enhancement Courses (AEC)

Code	Course Name	L-T-P	C
CLL101	Effective Communication – I	1-0-2	2.5
CLL102	Effective Communication – II	1-0-2	2.5
CHL 110	General Proficiency - I	1-0-0	1
CHL120	General Proficiency – II	1-0-0	1
CHL 210	General Proficiency – III	1-0-0	1
CHL 220	General Proficiency – IV	1-0-0	1
CHL 310	General Proficiency – V	1-0-0	1
CHL 320	General Proficiency – VI	1-0-0	1
	Total Credits		**11**

D. Skill Enhancement

Code	Course Name	L-T-P	C
MAL 106N	Basics of Computer Programming	3-0-2	4
MAL 301	Data Analysis	3-0-2	4
CHT208	Summer Internship	0-0-6	3
CHD311	Project-I	0-0-8	4
CHD312	Project-II	0-0-8	4
CHL 330	Creativity and Innovation Outcome	0-0-1	1
CHS 102	Community Services	1-0-0	-
CHS 102	Community Services	1-0-0	2
CHS 202	Community Services	1-0-0	-
CHS 202	Community Services	1-0-0	2
CHS 302	Community Services	1-0-0	-
CHS 302	Community Services	1-0-0	2
	Total Credits		**26**

Outline of Choice based credit system (CBCS):

1. **Program Core:** A course, which should compulsorily be studied by a student as a core requirement is termed as a program core course.
2. **Program Elective:** Elective courses may be offered by the main discipline/subject of study is referred to as Program Elective. The University may also offer Program related elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
3. **Generic (or Open) Elective:** An elective course generally chosen from an unrelated discipline/subject, with an intension to seek exposure is called a Generic (or Open) Elective.

4. **Ability Enhancement Courses (AEC):** These are the courses based upon the content that leads to knowledge enhancement. They are English/Communication courses.

5. **Skill Enhancement/Project/Dissertation:** The Project work/ Dissertation based on application of Mathematics, Computer applications, Research project and new innovative ideas.

Short Syllabus for B.Sc. (H) Chemistry Courses (w. e. f. 2021-24)

Program Core Courses

CHL 201 Inorganic Chemistry -I (3-0-2) 4 credits 45 Lectures

Atomic Structure and Chemical Bonding

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's uncertainty principle and its significance, Schrödinger's wave equation, Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations, 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, Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids. Weak Chemical forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, Brönsted- Lowry concept of acid-base reaction, solvated proton, relative strength of acids, types of acid-base reactions.

Chemistry Lab:

1. Preparation of solutions of different Molarity/Normality of titrants
2. Estimation of carbonate and hydroxide present together in mixture.
3. Estimation of carbonate and bicarbonate present together in a mixture.
4. Estimation of free alkali present in different soaps/detergents.
5. Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.
6. Estimation of oxalic acid and sodium oxalate in a given mixture.
7. Estimation of Fe (II) with K2Cr2O7 using internal (diphenylamine, anthranilic acid) and external indicator.

Course outcomes

After completing the course, student will be able to course

1.To develop an understanding of the atomic structure.

2.To develop an understanding of the Ionic structure.

3.To develop an understanding of the covalent structure.

4.To develop an understanding of the Metallic structure.

5.To develop an understanding of the Acid & bases.

CHL 202 Inorganic Chemistry -II (3-0-2) 4 credits 45 Lectures

s- & p- block elements, Periodicity

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s & p- block, Chemistry of s and p block elements, Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group, Study of the important compounds with emphasis on structure, bonding, preparation, properties and uses, Occurrence, properties & uses, rationalization of inertness of noble gases, inorganic polymers and comparison with organic polymers.

Chemistry Lab:

1. Estimation of Cu (II) and K2Cr2 O7 Using sodium thiosulphate solution (Iodimetrically).
2. Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically
3. Estimation of available chlorine in bleaching powder iodometrically..
4. Preparation of Cuprous Chloride, Cu2Cl2
5. Preparation of Manganese (III) phosphate, MnPO4.H2O
6. Preparation of Aluminium Potassium sulphate KAl(SO4)2.12H2O (Potash alum) or Chrome alum.

Course outcomes

After completing the course, student will be able to

1.To develop expertise relevant to the Periodicity of elements.

2.To develop an understanding of the range and chemistry of elements in the periodic table and their compounds

3.To develop expertise relevant to the chemistry of s & p block elements.

4.To develop expertise relevant to the chemistry of s & p block elements.

5.To develop expertise relevant to the noble gases.

6.To develop expertise relevant to the inorganic polymers.

CHL 301 Inorganic Chemistry -III (3-0-2) 4 credits 45 Lectures

Coordination compounds, Lanthanides, Actinides, Transition elements

Coordination Chemistry**,** Werner's theory, valence bond theory, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds, General group trends in transition lelements with special reference to electronic configuration, lanthanoids and actinoids, lanthanide contraction.

Chemistry Lab:

1. Complexometric estimation of (i) Mg2+ (ii) Zn2+ using EDTA.
2. Estimation of total hardnesss of water samples
3. Estimation of Ca2+ in solution by (substitution method) using Erio-chrome black-T as indicator.
4. Estimation of Ca/Mg in drugs and Biological samples.
5. Estimation of Cl^- by Mohr's method.
6. Paper Chromatographic separation of Ni (II) and Co(II).
7. Paper Chromatographic separation of Cu(II) and Cd (II).

Course Outcomes

After completing the course, student will be able to

1. To provide experience in some scientific methods employed in inorganic chemistry.
2. To develop an understanding of the range and chemistry of organometallic compounds.
3. To establish an appreciation of the role of metal carbonlys.
4. To develop an understanding of the role of the Metal Alkyls.
5. To provide an understanding of Catalysis by Organometallic Compounds.

CHL 302 Inorganic Chemistry -IV (3-0-2) 4 credits 45 Lectures

Organometallic chemistry

Theoretical Principles in Qualitative Analysis, Definition and classification of organometallic compounds, Concept of hapticity of organic ligands, 18 electron rule, Preparation, properties, structure and bonding of mononuclear carbonyls, Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds, Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation), Study of the industrial processes and their mechanism.

Chemistry Lab:

1. Cation/Anion analysis in salt mixture (salt 1).
2. Cation/Anion analysis in salt mixture (salt 2).
3. Estimation of nickel (II) using Dimethylglyoxime as the precipitant.
4. Estimation of copper as CuSCN
5. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)3 (aluminium oxinate)..
6. Inorganic Preparation of Tetraammine copper (II) sulphate, [Cu(NH3)4]SO4 H2O
7. Inorganic Preparation of Potassium trisoxalatochromate (III), K3[Cr(C2O4)3]
8. Spectrophotometric estimation of Ferrous ions by using 1,10 phenanthroline.

Course Outcomes

After completing the course, student will be able to

1. Understanding of Chemistry of Nitrogen Containing Functional Groups
2. Understanding of Chemistry of Polynuclear Hydrocarbons
3. Understanding of Basics of Heterocyclic Compounds
4. Understanding of Chemistry of Alkaloids
5. Understanding of Terpenes

CHL 203 Organic Chemistry -I (3-0-2) 4 credits 45 Lectures

Basics of Organic Chemistry and Hydrocarbons

Basics of Organic Chemistry, Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements. Homolytic and Heterolytic fission 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.Aliphatic Hydrocarbons, Aromatic Hydrocarbons, Stereochemistry, Carbon-Carbon sigma bonds , Carbon-Carbon pi bonds, Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups, Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

Chemistry Lab:

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol c. Alcohol-Water
3. Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol c. Alcohol-Water
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method) Chromatography
6. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
7. Separation of a mixture of two sugars by ascending paper chromatography

8. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

Couse Outcomes

After completing the course, student will be able to

1. Understanding of Basics of Organic Chemistry
2. Understanding of Chemistry of Aliphatic Hydrocarbons
3. Understanding of Basics of Aromatic Hydrocarbons
4. Understanding of Basics of stereochemistry

CHL 204 Organic Chemistry -II (3-0-2) 4 credits 45 Lectures

Oxygen containing functional groups, Halogenated compounds, Sulphur compounds

Alkyl halides: Methods of preparation, nucleophilic substitution reactions Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Organometallic compounds of Mg and Li – Use in synthesis of organic compounds. Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3°. alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement; Phenols, Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions; Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate. Preparation, physical properties and reactions of monocarboxylic acids: Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangement.

Chemistry Lab:

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
2. Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method: a. Using conventional method. b. Using green approach.
3. Benzolyation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and one of the following phenols (β-naphthol, resorcinol, pcresol) by Schotten-Baumann reaction.
4. Oxidation of ethanol/ isopropanol (Iodoform reaction).
5. Bromination of any one of the following: a. Acetanilide by conventional methods b. Acetanilide using green approach (Bromate-bromide method)

6. Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate).
7. Selective reduction of meta dinitrobenzene to m-nitroaniline.
8. Reduction of p-nitrobenzaldehyde by sodium borohydride.
9. Hydrolysis of amides and esters.
10. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
11. S-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid
12. Aldol condensation using either conventional or green method. xii. Benzil-Benzilic acid rearrangement

Course Outcomes

After completing the course, student will be able to

1. Understanding of Basics of Organic Chemistry
2. Understanding of Chemistry of Aliphatic Hydrocarbons
3. Understanding of Basics of Aromatic Hydrocarbons
4. Understanding of Basics of stereochemistry

CHL 303 Organic Chemistry -III (3-0-2) 4 credits 45 Lectures

Aromatic compounds and Heterocyclic chemistry

Preparation and important reactions of nitro and compounds, nitriles and isonitriles. Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, arbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid. Diazonium Salts: Preparation and their synthetic applications. Reactions of naphthalene phenanthrene and anthracene Structure, preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons. Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom. 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. Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and α-terpineol.

Chemistry Lab:

1. Detection of extra elements.
2. Functional group test for nitro, amine and amide groups
3. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds)

Course Outcomes

After completing the course, student will be able to

1. Understanding of Chemistry of Nitrogen Containing Functional Groups
2. Understanding of Chemistry of Polynuclear Hydrocarbons
3. Understanding of Basics of Heterocyclic Compounds
4. Understanding of Chemistry of Alkaloids
5. Understanding of Terpenes

CHL 304 Organic Chemistry -IV (3-0-2) 4 credits 45 Lectures

Organic Spectroscopy

General principles Introduction to absorption and emission spectroscopy. UV Spectroscopy: Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers. IR Spectroscopy: 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. NMR Spectroscopy: 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. Applications of IR, UV and NMR for identification of simple organic molecules. Carbohydrates. Dyes.

Chemistry Lab:

1. Extraction of caffeine from tea leaves
2. Preparation of sodium polyacrylate.
3. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
4. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols etc.

5. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
6. Preparation of methyl orange.

Course Outcomes

After completing the course, student will be able to

1. Understanding of Organic Spectroscopy
2. Understanding of Chemistry of Carbohydrates
3. Understanding of chemistry of Dyes

CHL 205 Physical Chemistry -I (3-0-2) 4 credits 45 Lectures

States of Matter and Ionic Equilibrium:

Gaseous state: Kinetic molecular model of gas, collision frequency, variation of viscosity with temperature and pressure. Behaviour of real gases.

Liquid State: Qualitative treatment of the structure of the liquid state, Physical properties of liquids, Explanation of cleansing action of detergents.

Solid State: Nature of solid state, Miller indices, symmetry elements and symmetry operations, Braggs Law.

Ionic equilibrium: Strong, moderate and 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 of mono-, di-and triprotic acids (exact treatment).

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

Chemistry Lab:

1. Surface tension measurements.

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.

2. Viscosity measurement using Ostwald’s viscometer.

a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.

b. Study the variation of viscosity of sucrose solution with the concentration of solute.

3. Indexing of a given powder diffraction pattern of a cubic crystalline system.

pH metry

a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.

b. Preparation of buffer solutions of different pH

i. Sodium acetate-acetic acid

ii. Ammonium chloride-ammonium hydroxide

c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.

d. Determination of dissociation constant of a weak acid.

Course Outcomes

After completing the course, student will be able to

1.To identify the basic concepts of gaseous state, molecular model of gases, behaviour of real gases in different state.

2.To get the knowledge of qualitative treatment of the structure of liquid state of matter.

3.To understand the crystal structure and XRD pattern of the solid state of matter and their different symmetry and lattices.

4.To understand properties of different electrolytes, acid base character, ionic effects in solution.

5.To get the knowledge on solubility and solubility product its applications.

CHL 206 Physical Chemistry -II (3-0-2) 4 credits 45 Lectures

Chemical Thermodynamics and its applications, Chemical Equilibrium

Chemical Thermodynamics: Intensive and extensive properties, Mathematical expressions of first law, second law and third law of thermodynamics.

Thermochemistry: Heat of reactions, enthalpy of combustion and explosion temperature.

Free Energy Functions: Gibbs Helmholtz equations, Maxwell relation, Joule Thomson Coefficient.

Chemical Equilibrium: Criteria of thermodynamic equilibrium, degree of advancement of reaction, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

Solutions and Colligative Properties:

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

Chemistry Lab:

1. 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 or enthalpy of neutralization).

2. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Calculation of the enthalpy of ionization of ethanoic acid.
4. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
5. Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.
6. Determination of enthalpy of hydration of copper sulphate.
7. Study of the solubility of benzoic acid in water and determination of ΔH.

Course Outcomes

After completing the course, student will be able to

1.To identify the basic concepts of gaseous state, molecular model of gases, behavior of real gases in different state.

2.To get the knowledge of qualitative treatment of the structure of liquid state of matter.

3.To understand the crystal structure and XRD pattern of the solid state of matter and their different symmetry and lattices.

4.To understand properties of different electrolytes, acid base character, ionic effects in solution.

5.To get the knowledge on solubility and solubility product its applications.

CHL 305 Physical Chemistry -III (3-0-2) 4 credits 45 Lectures

Phase Equilibrium, Chemical Kinetics, Catalysis

Catalysis: Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surface, Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Chemical Kinetics: 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, Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism.

Phase Equilibria: Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria, Three component systems, water-chloroform-acetic acid system, triangular plots.

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

Chemistry Lab:

1. Study the kinetics of the following reactions.

a. Initial rate method: Iodide-persulphate reaction

b. Integrated rate method:

(i). Acid hydrolysis of methyl acetate with hydrochloric acid.

(ii). Saponification of ethyl acetate.

2.Compare the strengths of HCl and H2SO4 by studying kinetics of hydrolysis of methyl acetate.

3.Distribution of acetic/ benzoic acid between water and cyclohexane.

Study the equilibrium of at least one of the following reactions by the distribution method:

$$\text{(i) } I_2(aq) + I^- \rightarrow I_3^-(aq)^{2+}$$

$$\text{(ii) } Cu^{2+}(aq) + n NH_3 \rightarrow Cu(NH_3)_n$$

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 using cooling curves or ignition tube method:

a. simple eutectic and

b. congruently melting systems.

Course Outcomes

After completing the course, student will be able to

1. To understand the functioning of catalytic systems for chemical synthesis, with particular emphasis on catalysis at surfaces as it pertains to industrial reactions.

2.To understand the concept of rate of change associated with chemical change, recognizing that the rate of change and how it can be measured.

Determine rate law of chemical change based on experimental data.

Be able to identify the reaction order for a chemical change

3.Understand the concept of an activation energy in the context of the transition state and be able to calculate the activation energy given some experimental data.

4.To understand the features and principles of unary systems, binary and ternary phase diagrams

5.To understand the graphical representation of phase equilibria in real materials systems and to understand the thermodynamic stabilities of phases.

MAL 101N Fundamentals of Mathematics (3-1-0) 4 credits 45 Lectures

Matrices: Vectors in Rn and Cn, Algebra of Matrices, Elementary operations of matrices, Inverse of a matrix, Rank of a matrix, elementary transformations, elementary matrices, inverse using elementary transformations, normal form of a matrix, linear dependence and independence of vectors, consistency of linear system of equations, linear and orthogonal transformations, eigenvalues and eigenvectors, properties of eigenvalues, Cayley - Hamilton theorem and its applications, diagonalization of matrices, similar matrices, minimal polynomial, derogatory and non derogatory matrices.

Sequences and Series: Convergence of sequences of real numbers, Comparison, root and ratio tests for convergence of series of real numbers.

Differential calculus: Functions of one and two variables,Limits, continuity and differentiability of functions of one and two variables. Rolle's theorem, mean value theorem, Taylor's theorem, indeterminate forms, maxima and minima of functions of one and two variables.

Course Outcomes

After completing the course, student will be able to

1.Students will be able to solve system of equations using matrix theory. After studying eigenvalues and eigenvectors, students will present solutions to problems in other fields of Science and Technology effectively. Learn basics of matrix theory which is a prerequisite for many advanced level courses.

2.Students will be able to use various convergence tests to determine convergence or divergence of series

3.Students will be able to utilize the derivative in applied contexts, including function approximation, to find maximum, minimum, or otherwise "optimal" input values for equations important in science and engineering.

PYL 102N Fundamentals of Physcis (3-0-2) 4 credits 45 Lectures

Fermat's Principle :- Optical Path. Fermat's Principle of Least Time or Extremum Path. Lenses :- Transverse Magnification of a Spherically Refracting Surface. Lagrange and Helmholtz Laws of Magnification, Graphical Construction of Image using Cardinal Points. Thick Lenses. Focal Length of a Thick Lens, Nature of Light: Huygens Principle of Secondary Wavelets. Coherence, Interference : Division of Amplitude and Division of Wavefront, Phase Change on Reflection : Stoke's treatment.. Interference in Thin Films, Fringes of Equal Inclination (Haidinger Fringes) and Fringes of Equal Thickness (Fizeau Fringes). Newton's Rings, Michelson'sInterferometer, Fresnel and Fraunhoffer diffraction, Zone plate. Fraunhoffer Diffraction due to (1) a Single Slit (2) aPlane Transmission Grating. Rayleigh's criterion of resolution. Resolving Power and Dispersive Power of a Plane Diffraction Grating. Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Numerical aperture of optical fiber, types of fibres (Concept and Definition Only), Planar Optical Wave Guides. Phase and Group Velocity of the Guided Waves. Field Energy and Power Transmission and lasers.

Physics Lab: (0-0-2) 1 credit

List of Experiments

1. To find the wavelength of sodium light by Newton's Ring experiment.
2. To find the wavelength of sodium light by Fresnel's Biprism experiment.
3. To find the wavelength of various colors of white light with the help of a plane transmission diffraction grating.
4. To study the degree of polarization of light reflected from a glass plate at various angles of incidence to verify Brewster's Law & Law of Malus.
5. To determine the Numerical Aperture of a given multimode fibre from the measurements on the far field technique.
6. To find wavelength of He-Ne laser with the help of diffraction through a single slit.

Course Outcomes

After completing the course, student will be able to

1.To have in-depth knowledge of interference and its applications in research and industries.

2.To have basic and advance idea of different types of diffraction, resolving and dispersive power of grating and its applications.

3.To understand the concept of holography being widely used in security and decoration which is useful for the mankind

4.To understand polarization and its applications in industries.

5.To distinguish between different types of optical fibres and their applications.

6.To distinguish between different types of lasers and their industrial applications.

CHL 111 Fundamentals of Chemistry (3-0-2) 4 credits 45 Lectures

Basic concepts of Organic Chemistry, Different effects in organic compounds, Bioinorganic compounds and its importance, Essential and trace elements of life, Hardness and its determination by EDTA method, alkalinity of water, Softening and desalination of water. Chemistry of Polymeric Materials (PVC, Bakelites, Thermosets, Thermoplasts and Composites), Properties and classification of lubricants, Surface chemistry, Adsorption, Absorption, Beer Lambart law, Principal, Instrumentation and application of UV spectroscopy, IR, TGA, DTA, Conductometric titration, pH meter.

Chemistry Lab:

1. Determination of metal ion causing for hardness of water sample by EDTA method
2. To determine the alkalinity of a given water sample by volumetric method
3. To prepare Phenol – Formaldehyde (PF) and Urea – Formaldehyde (UF) resins
4. To find out the saponification value of coconut oil.

5. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution using pH meter.
6. To find out the strength of the given hydrochloric acid solution by titrating it against Sodium Hydroxide solution Conductometrically.
7. To determine the concentration of $KMnO_4$ solution using UV – Spectrophotometer
8. Purification of liquids and solids (crystallization and distillation process)

Course Outcomes

After completing the course, student will be able to

1.To identify the basic concepts of organic chemistry, stereochemistry, structural presentation and nomenclature.

2.To understand the main essential inorganic compounds available in nature.

3.To understand the technologies for wastewater treatment to make it suitable for human consumption and industrial application.

4.To understand the different types of lubricants, oil and their viscosity index and saponification number, and adsorption phenomena of materials.

5.Explain various types of polymeric materials and application in various fields.

6.Understand the methodology for quantitative and qualitative analysis of material.

CHL 102 Stereochemistry (2-1-0) 3 Credits 30 Lectures

Concepts of Stereochemistry, Classification of Isomers, Nomenclature, Geometrical Isomerism, Optical Isomerism, Structure Isomerism, Conformations Analysis, Conformations, Configurations

Course Outcomes

After completing the course, student will be able to

1.To identify the basic concepts of stereochemistry, structural presentation and nomenclature.

2.To understand the main concept of Geometric and Optical Isomerism.

3.To understand the conformation analysis

CHL 103 Biomolecules (2-1-0) 3 Credits 30 Lectures

Nucleic Acids, Amino Acids, Peptides and Proteins, Enzymes, Lipids, Concept of Energy in Biosystems**.**

Course Outcomes

After completing the course, student will be able to

1.Understanding of chemistry of Nucleic Acids

2.Understanding of Chemistry of Amino Acids, Peptides and Proteins

3.Understanding of chemistry of Enzymes

4.Understanding of chemistry of Lipids

5.Understanding of Chemistry of Concept of Energy in Biosystems

Compulsory Courses

CHL 100 Environmental Studies (3-0-0) 3 Credits 45 Lectures

Definition, scope and importance, Need for Public awareness, Renewable and non-renewable resources: Natural resources and associated problems, Forest resources: Use and overexploitation: deforestation, case studies, Timber exploitation, mining, dams and their effects and forests tribal people, Water resources: Use and overutilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems, Ecosystem, Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Biodiversity and its conservations, Role of an individual in prevention of pollution, Pollution case studies, Social issues and the Environment, Human population and the Environment, Field Work.

Course Outcomes

After completing the course, student will be able to

1.Application of knowledge gained to generate awareness for environmental protection so as to sensitize the student community towards environmental management and becoming Green Citizens and to apply the knowledge gained in sustaining various resources by using green Technologies.

2.To apply the concepts learnt in maintaining balance in natural ecosystems and it covers all aspects of life and contributes in constructive decision-making keeping environment in view.

3.Development of understanding of pollution and to develop an understanding of Environmental management to enable them in becoming green engineers and green managers. To become green citizens and contribute in the sustainable development of the society, country and the world.

4.To apply the concepts learnt in earning resources for their organizations by using green technologies.

5.It encapsulates sound theoretical base of all the environmental aspects coupled with practical and projects.

BSL 101 Entrepreneurship (2-0-2) 3 Credits 30 Lectures

This course aims to provide students with an understanding of the nature of enterprise and entrepreneurship and introduces the role of the entrepreneur, innovation and technology in the entrepreneurial process. It is not about small business or life style businesses but instead the development of growth oriented businesses -w h e t h e r f o r - p r o f it o r n o t - f o r - p r o f it. Entrepreneurship is both a way of thinking and of doing. It involves "building something from nothing" and successful entrepreneurs know how to manage and mitigate uncertainty and risk. The course content is relevant to those individuals thinking about starting a business or who are already in business - large or small, those who are interested in commercializing their own innovations or of others, and those who

advise entrepreneurs or engage in policy making in the entrepreneurship area. The course provides step by step process of writing a business plan for the operation of a successful small business. The content of the course will include all aspects of start-up of a small business, sales, finance, personnel, marketing, budgets, insurances, customer target and possibly a different alternative to business either start up or purchase of small business.

CLL 120 Human Values and Professional Ethics (2-0-0) 2 Credits 30 Lectures

Human values – Morals, Indian views on Education, Understanding harmony in self, family, society and the existence; Self-exploration, Introduction to ethics, Ethical and Servant Leadership, Corporate Social Responsibility, Corporate governance – need and importance.

Course Outcomes

After completing the course, student will be able to

1.Demonstrate an ability to empathize/concern for societal issues.

2.Combine technical competence with the right approach to life, profession, and society.

3.Ability to handle professional and personal dilemmas effectively i.e. the right course of action in a given situation.

4.Applying professional values, ethics and attitude to complex work assignments and making decisions

MAL 109 Introduction to Statistics (4-0-0 = 4 credits) 60 Lectures

This course attempts at inculcating in students the knowledge in the area of statistics. The main topics covered are various measures of central tendency and measures of dispersion, probability theory, correlation and regression analysis, introduction to sampling theory and sampling distributions.

Course Outcomes

After completing the course, student will be able to

1.Students will able to understand the uses of different measures of central tendencies and dispersion.

2 Students will able to understand the concept and applications of probability methods in modern science.

3 Students will able to understand and apply the concept of Random Variable and Distribution Functions.

4 Students will able to apply the knowledge the various probability distributions in practical applications.

Program Elective Courses

CHL 207 Analytical Chemistry (3-1-0) 4 Credits 45 Lectures

Evaluation of analytical data, errors, accuracy and precision, methods of their expression, UV-Visible Spectrometry: Basic principles of instrumentation, Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, Choice of flame and Burner designs. Techniques of atomization and sample introduction, Thermal method of analysis, Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC, Stereo isomeric separation and analysis.

Course Outcomes

After completing the course, student will be able to

1.To explain the fundamentals of analytical chemistry and steps of a characteristic analysis.

2. To evaluate the analytical data in terms of statistics.

3. To identify quality of experimental measurements.

4. To define the different gravimetric methods.

5. To express the titrimetric analysis methods.

6. To interpret aqueous solution chemistry.

CHL 209 Green Chemistry and Technology (3-1-0) 4 Credits 45 Lectures

Introduction and principles of green technology. Fundamental of catalytic science and engineering, biocatalyst, green methodologies, Implications of Green Technology in day to day life (such as Dry Cleaning of cloths, Hydrogen peroxide as a bleaching agent, Green solution to turn turbid water clear), biofuels and different fields Polymer, Organic electronics (such as OLED, Organic sensors, Green mobile phones, conductive paper), IT CSE and Civil. Project work and case studies.

Course Outcomes

After completing the course, student will be able to

1.Students would be able to correlate the application of Green technology to industries

2.Students will able to implicate the principles of Green Technology in industries

3.Students would be able to develop an aptitude for innovative green methodologies that will minimize the toxicity and other hazards.

4.Successful students will be able to communicate with other engineers for application of appropriate technology to match a green engineering problem

5.Students would be innovative thinkers and will be able to implicate Green Technology in daily life applications.

CHL 210 Nanochemistry and Nano technology (3-1-0) 4 Credits 45 Lectures

Nanodimensional Materials, Properties of Nanoscale Materials, Nanomaterials Synthesis and Thin Film Deposition, Characterization of Nanomaterials and Thin Films, Applications of Nanomaterials.

CHL 307 Quantum Chemistry (3-1-0) 4 Credits 45 Lectures

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box", 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. Qualitative treatment of simple harmonic oscillator model of vibrational motion.

Angular Momentum: Commutation rules, quantization of square of total angular momentum and z-component. Rigid rotator model of rotation of diatomic molecule. Schrödinger equation.

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression).

Chemical Bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals. Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Qualitative MO theory and its application to AH_2 type molecules.

Course Outcomes

After completing the course, student will be able to

1.Foundations of quantum mechanics to remind the difference between classical and quantum world

2.See how operator algebra can be used to solve simple eigenvalue problems. Understand what is meant by the orbital concept

3.The role of rotational and spin angular momenta in chemistry

4.Be able to use approximate methods in solving molecular problems

5.To master molecular orbital theory in diatomic and polyatomic molecules

CHL 309 Physical Spectroscopy & Photochemistry (3-1-0) 4 Credits 45 Lectures

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation. Rotation spectroscopy, Vibrational spectroscopy, Vibration-rotation spectroscopy, Raman spectroscopy, Vibrational Raman spectra, Electronic spectroscopy, Electron Spin Resonance (ESR) spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, interpretation of PMR spectra of organic molecules.

Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions,

quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence

Course Outcomes

After completing the course, student will be able to

1.Able to recognize different regions for different spectroscopy.

2.To understand the qualitative treatment of vibrational Raman spectra by rotational Raman effect.

3.To understand the transitions through electronic spectroscopy

4.To understand the shifting and spin spin coupling of molecules

5.To explain the concept of photochemistry and study Beer-Lambert law. To describe and explain photochemical and photophysical processes using Jablonski diagramand their quantum yield expressions.

CHL 306 Electrochemistry (3-1-0) 4 Credits 45 Lectures

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules. Ionic velocities.

Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

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. 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. Electrical and Magnetic Properties of Atoms and Molecules

Course Outcomes

After completing the course, student will be able to

1.To understand the difference between voltaic/galvanic and electrolytic electrochemical, cells.

2.To get the knowledge that how the standard states used for E° and ΔG° are defined for gase, solids, liquids and solutes.

3.To be able to write balanced half reactions determine overall cell reactions calculate the standard reduction potential and predict the direction of electron anion and cation flow based on a sketch of an electrochemical cell or the description of an electrochemical cell given in shorthand notation.

4.To understand the relationship between chemical energy (Gibbs free energy change for a redox reaction) and electrical energy (electromotive force or cell potential) in an electrochemical cell.

5.To be able to use standard reduction potentials to predict the strength of oxidizing and reducing agents

CHL 308 Polymer chemistry and Technology (3-1-0) 4 Credits 45 Lectures

Fundament of polymer materials, mechanism of polymerization, classification of composites, natural fibres (jute, cellulose), carbon fibres, resins, characterization methods of polymer and composites such as (TGA, DTA, IR, NMR, UV-visible), Mechanical properties of polymer and composites (tensile strength, modulus, shear strength etc). Application of Polymer Composite in various industries; Textile, Automobile, Aerospace, Building and Construction. Project work and case studies.

PYL 305 Experimental and analytical techniques (3-0-2) 4 Credits 45 Lectures

Crystalline Semiconductors: Growth, Diffusion, ion implantation, oxidation, microlithography, plasma etching, thin film deposition, Introduction to compound semiconductors.

UV-VIS/IR spectrophotometer, Raman spectroscopy, X-ray diffraction, LCR meter, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Tunneling Microscopy (STM), Scanning Force Microscopy (SFM), Atomic Force Microscopy (AFM), Z-Scan.

Lab:

1. Deposition of semiconducting thin film by spin coating.
2. To study the surface morphology of semiconducting film by SEM.
3. To study absorption of semiconducting thin film.
4. To study the IV measurement of grown sample.
5. Measurement of impedence of grown thin film.

Course Outcomes

After completing the course, student will be able to

1.Students will be able to have indepth knowledge of crystals and XRD

2.Students will be understanding growth of crystalline semi-conductors.

3.Students will be applying the knowledge of analytical techniques for material characterization. in industries

4.The spectroscopic techniques will be well understood and can be implemented in industry and in medical applications.

PYL 306 Thin films and nanomaterials (3-0-2) 4 Credits 45 Lectures

Quantum Physics, Nanomaterials, Properties of Nanomaterials, Synthesis of Nanomaterials, Characterization Techniques, Applications

Course outcomes

After completing the course, student will be able to

1.To understand the basics of nanomaterials by simple concepts of Quantum mechanics.

2.To categories different types of nanomaterials and its applications.

3.To gain good knowledge of properties of nanomaterials.

4.To explore the different techniques for synthesis of nanomaterials.

5.To have indepth knowledge of characterization techniques of various nanomaterials.

Ability Enhancement Courses

CLL 101 Effective Communication- I (2-0-1) 2.5 Credits

Vocabulary-1, Word building and enriching vocabulary Essentials of Grammar-1 Errors pertaining to Nouns, Pronouns, Verbs, Adverbs and Adjectives Writing Skills-1 Business Correspondence, Reading Skills-1 Theme detection, Literal comprehension Speaking Skills-1: Introducing oneself mini presentation, collaborative task, Listening Skills-1: Listening specific information, theme detection, gap filling.

Course Outcomes

After completing the course, student will be able to

1.Demonstrate the use of basic and advanced writing techniques using enriched vocabulary and grammar in various forms of writing.

2.Exhibit excellence in writing effectively.

3.Communicate effectively by overcoming the different barriers to communication.

4.Apply generic conventions and formats to memoranda, notices and business correspondence

5.Display confidence in conversational skills.

CLL 102 Effective Communication- II (2-0-1) 2.5 Credits

Vocabulary-2 Technical vocabulary, foreign expressions.Essentials of Grammar-2 Errors pertaining to Articles, Prepositions, Non-finites and conjunctions.Writing Skills-2 Resume Writing, Reports and Proposals. Reading Skills-2 Analytical reading, Reading for cohesion and proof reading Speaking Skills-2 Group Discussion, Role playing activities, Public speaking, Simulated conversation, Facing Interview, Presentation skills, Business etiquette. Listening Skills-2 Listening short pieces for gist and analytical comprehension.

Course Outcomes

After completing the course, student will be able to

1.Communicate effectively in social and professional situations and convey the intended message with clarity and conciseness

2.Compose concrete and correct formal correspondence texts viz. namely formal letters, business reports and proposals.

3.Effective participation using language &interpersonal skills during group discussions, debates, oral presentations and social conversations and make informed, ethical opinions on relevant global issues.

4.Enhanced acquisition of vocabulary & correct language structures for effective expression.

5.Ability to think logically and critically: use this skill in written & spoken expression.

6.An interest in reading of different kinds of works of renowned authors.

Foreign Language Electives

CLL 220 German-I (1-2-0) 3 Credits

Greetings, Self-introduction, Learning alphabets, start a conversation, numbers from 0 to 1000, order in a restaurant and pay the bill, asking questions ,verbs in present tense, articles in nominative, use of dictionary, articles in accusative, verbs in accusative, negation, nouns: singular and plural, listen to umlauts and speak, speak about cities and tourist features, about countries and languages spoken there, to indicate the geographical location, the past tense of the verbs, accent in questions and statements, time data- clock time/ week days, To fix up appointments, to excuse oneself on being late, prepositions related to time.

Course Comes

After completing the course, student will be able to

1.Understand and use familiar, everyday expressions and simple sentences.

2.Introduce themselves and others as well as ask others simple questions, for instance, where they live, whom they know, what they own etc.

3.Communicate in a simple manner, about their family, express likes and dislikes, order food in a restaurant, answer the phone, invite someone and write a simple e-mail.

CLL 200 French-I (1-2-0) 3 Credits

Introduce oneself and a friend/colleague or any other person, hobbies, leisure activities and daily routines, ask directions, to ask and to give personal information, give instructions , ask and tell time, understand a short and simple written passage, to organize ,to accept or to refuse an outing/an invitation, leaving a message on the answering machine, place an order and pay in a restaurant, to speak about a near future plan and able to read a program.

Course Outcomes

After completing the course, student will be able to

1.Understands and use familiar, everyday expressions and simple sentences.

2.Introduce themselves and others and able to ask/answer simple questions. For example, where they live/add…

3.Communicate in a simple manner, about their family, talk about their likes and dislikes, invite someone and write a simple e-mail.

CLL270 Spanish-I (1-2-0) 3 Credits

Personal information, exchange greetings, understanding conjugations, using the verbs “to have”, “to be”, learn numbers 1-100, nationalities, professions, express intentions/interests, explain reasons for actions, use of Present Indicative, use of prepositions, description of places and countries, talk about climate, use of superlatives, expressing agreement, doubt, future and past tenses, gender and number of adjectives, identification of objects, expression of needs, asking prices/products, give and ask for information about someone, knowledge about the company, number of employees, ability to talk about the post or job of someone in a company, read a technical drawing with dictionary, Irregular verbs .

Course Outcomes

After completing the course, student will be able to

1.Present him/herself, talk about his daily activities, ask for and give information, give advice, tell the time.

2.Understand short articles on the internet, understand online discussions, organize meetings, leave messages, order a meal in a restaurant, read a small advertisement
Read simple texts and answer questions on them

3.Make a curriculum vitae and write application letters, write and understand sms
Have monologues and dialogues about the immediate environment

Skill Enhancement Courses

MAL 106N Basics of Computer Programming (3-0-2 = 4 Credits) 45 Lectures

Fundamental and overview of C language, Variable in C language, Data types, Operators and Enums, Decision making of C language, loop Control, Array, string, Function, string functions, Pointer and file Input/ output.

Course Outcomes

After completing the course, student will be able to

1.Understand the basic terminology used in computer programming

2.Write, compile and debug programs in C language.

3.Use different data types in a computer program.

4.Design programs involving decision structures, loops and functions.

5.Explain the difference between call by value and call by reference

6.Understand the dynamics of memory by the use of pointers, Understand the dynamics of memory by the use of pointers

MAL 301 Data Analysis (3-0-2 = 4 Credits) 45 Lectures

Data types and sources, visualizing and exploring data, organizational Interfaces, precondition for data analysis, comparison among several samples, linear combinations &multiple comparisons of means, linear regression: a model for the mean, multiple regression and inferential tools.

Course Outcomes

After completing the course, student will be able to

1.Students should be able to understand introduction and basics of statistics, sources and types of.

2.Students should be able to visualize data through charts and graphs and learn how to explore data.

3.Students should be able to understand how to apply organizational Interfaces.

4.Students should understand to perform data preconditioning.

5.Students should be able to perform linear combinations and multiple comparisons of means.

6.Students should be able to apply linear correlation, independent and dependent variables and the types of correlation.