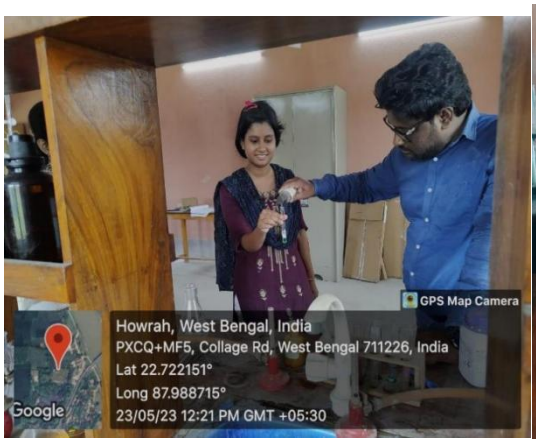
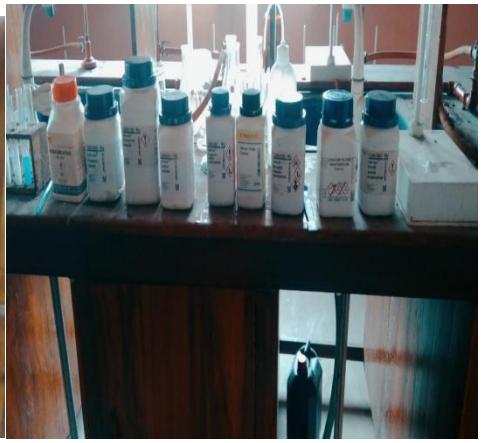
DEPARTMENT OF CHEMISTRY

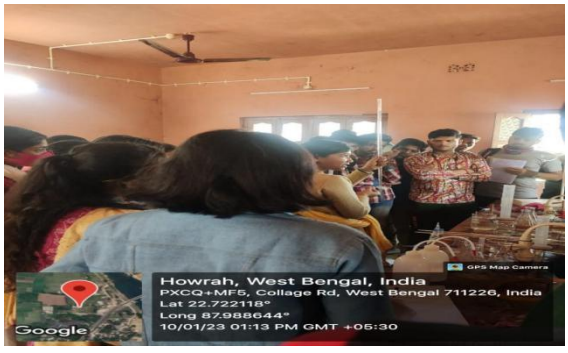
INTRODUCTION OF DEPARTMENT

The Department of Chemistry at Udaynarayanpur Madhabilata Mahavidyala offers a 3-year B.Sc course under Calcutta University, following both CBCS and CCF. Our objectives include achieving excellence in teaching through periodic class tests, seminars, and group discussions. We also emphasize the all-round development of students beyond classroom teaching. To enhance the practical understanding of theoretical concepts, the department organizes educational tours for students. These tours provide students with fresh ideas about other curriculum activities and the environment.

LABORATORY







FACULTY PROFILE

NAME	DESIGNATION	TEACHING EXPERIENCE	QUALIFICATION
Dr. AMIT MAITY	SACT	6 YEAR	M.Sc. , Ph.D
MRIDULA HUDATI	SACT	7YEAR	M.Sc ,

Lesson Plan (Chemistry)

Session-2023-2024, Semester-1

Theoretical program: CC1-T

Chapter	Syllabus	Hours for completion	Teaching method	Teacher name
Extra nuclear structure of atoms and periodicity	Wave-particle duality, de Broglie hypothesis, Heisenberg Uncertainty principle, Schrodinger equation, s,p,d,f orbitals, Aufbau Principle, Pauli's exclusion principle, Hund's rule, Slater's rule. Modern periodic table, atomic and ionic radii, ionisation energy, electron affinity, electro negativity, periodic trends, Electronegativity scales(Pauling, Mulliken and Allred-Rochow Scale), Inert pair effect.	15	lecturer	Amit Maity
Valence Bond Theory	Nomenclature of organic compounds, hybridisation, shapes and structure of molecules, DBE, Resonance, resonance energy.	2		Mridula Hudati
Electronic displacements	Inductive effect, Steric effect	1		Mridula Hudati
MO theory	Idea about HOMO, LUMO and SOMO, concept of	5		Mridula

	aromaticity,Huckel's rule			Hudati
Physical properties	Melting and boiling points and solubility of organic compounds, polarity and dipole moments	2		Mridula Hudati
Sterochemistry-1	Concept of asymmetry of organic compounds, Fischer, Sawhorse, flying wedge, Newman projection formula, concept of chirality, enantiomers, diastereomers, chiral centre	5		Mridula Hudati
Thermodynamics-1	Concept of system, State of a system, extensive and intensive properties, partial and exact differential, path and state function, concept of heat and work, Zerothb law of thermodynamics, 1st law of thermodynamics, internal energy, enthalpy, heat capacity, Cp and Cv and their relationship, adiabatic process and isothermal process, calculation of q, w, H, U, Hess's law, Kirchhof,s law	9		Amit Maity
Chemical Kinetics-1	Order and molecularity of a reaction, Rate law of zero, 1st and 2nd order reaction, determination of order of a reaction, RDS, opposing, consecutive, parallel reaction, Arrhenius equation	6		Amit Maity

Practical Program:CC1-P

Chapter	syllabus	Hours of completion	Teaching method	Name of the teacher
Basic	1) Calibration and use of	6	practical	Amit Maity

	apparatus 2) preparation of primary standard solution			
Acid-Base titration	3)Standardization of NaOH by standard oxalic acid solution 4)Estimation of acetic acid in commercial vinegar	6		Mridula Hudati
Oxidation-Reduction titrimetry	5)Standardization of KMnO4 by standard oxalic acid solution 6)Estimation of Fe(II) using standard KMnO4 solution	6		Amit Maity

Theoretical program: SEC and IDC

Chapter	syllabus	Hours for completion	Teaching method	Name of the teacher
Dairy products	Composition of milk, milk products, estimation of added water in milk, analysis of fat, minerals in milk and butter. Beverages: analysis of caffeine in coffe and tea, chicory in coffe, chloral hydrate in toddy, methyl alcohol in alcoholic beverages.	6	Lecturer	Mridula Hudati

Food additives, adulterants, contaminants	Food preservatives like benzoates, propionates, sorbates, disulphides, artificial sweeteners: Aspartame, sachharin, dulcin, sucralose, sodium cyclamate. Flavours: vanillin, alkyl esters, monosodium glutamate.	6		Amit Maity
Artificial food colorants	Coal tar dyes, analysis of pesticides in food, nonpermitted colors.	3		Mridula Hudati
Vitamins	Classification and nomenclature, sources, deficiency diseases, structure of vitamin A1, B1, C, D, E and K1.	5		Amit Maity
Oil and fats	Composition of edible oils, detection of purity, rancidity in fat and oils, adulterants test, Halphen test	5		Mridula Hudati
Soaps and detergents	Definition, classification, manufacturing of soaps, detergents, composition and and uses.	5		Amit Maity
Chemical and renewable energy sources	Principle and application of primary and secondary batteries, fuel cell, solar enrgy.	4		Amit Maity
Polymers	Basic concept, classification and characteristics of polymers, Application in electronics, automobile, medical and aerospace materials, plastic waste management, environment friendly polymers.	6		Amit Maity

Tutorial program: SEC and IDC

Chapter	Syllabus	No. of hours for completion	Teaching method	Name of the teacher
Estimation of vitamin C	Estimation of vitamin C	4	practical	Amit Maity
Determination of iodine number of oil	Determination of iodine number of oil	4		Mridula Hudati

Semester-II Session-2023-2024

Theoretical program:CC2-Th

Chapter	Syllabus	Hours of completion	Teaching method	Teacher Name
Kinetic theory and gaseous state	Concept of pressure and temperature from kinetic theory of gas, Maxwell speed distribution, kinetic energy, calculation of average, root mean square, most probable speed, collision of gas molecules, mean free path, wall collision and rate of collision, principle of equipartition of energy.	8	lecture	Mridula Hudati
Real gas and virial equation	Deviation of gases from ideal behaviour, compressibility factor, Boyle temperature, Andrew and Amagat plot, van der wall equation, critical state, critical constants, law of corresponding state, virial equation, intermolecular forces	6		Amit Maity
Chemical bonding-I	i) Ionic bond: General characteristics, lattice energy, Born-Lande equation, Born Haber cycle and its application, solvation energy, defects in solids, solubility	15		Amit Maity

	energetics of dissolution process. ii) Covalent bond: Polarizing power and polarizability, Fazan's rule, valence bond theory, hybridisation, Bent's rule, dipole moments, VSEPR theory, shape of molecules and ions.			
Stereochemistry-II	Chirotopicity, stereogenicity, concept of pseuodoasymmetry for ABA type systems, R/S, threo/erythron and meso nomenclature of compounds, E/Z description of alkene, optical activity of chiral compounds, specific rotation, racemic compounds, racemisation, resolution of acids and bases, optical purity, enantiomeric excess.	8		Mridula Hudati
Reactive intermediates	Carbocations, nonclassical carbocations, carbanions, carbon radical, electrophilic/ nucleophilic behaviour of reactive intermediates.	2		Amit Maity
Reaction thermodynamics	Free energy and equilibrium, enthalpy and entropy factor, calculation of enthalpy change, intermolecular and intramolecular reactions	2		Mridula Hudati
Reaction kinetics	Rate constant and free energy of activation, free energy profile for first step, two step reactions, catalysed reactions, Hammond's postulate.	2		Mridula Hudati
Substitution reaction	Free radical substitution reaction, halogenation of alkanes, mechanism, Hammond's postulate.	2		Amit Maity

Practical program: CC2-P

Chapter	Syllabus	Hours of completion	Teaching method	Name of the Teacher
Basic Titration	Standardization of Na2S2O3 solution against standard K2Cr2O7 solution	4	practical	Amit Maity
Iodo/ Iodimetric titration	Estimation of vitamin C	4	practical	Mridula Hudati
Estimation of metal content in some selective sample	Estimation of Cu in brass	4	practical	Amit Maity

Lesson Plan (Chemistry)

Session-2023-2024, Semester-3

Theoretical program: CC3-T

Chapter	Syllabus	Hours for completion	Teaching method	Teacher name
AromaticSubstitution	**Electrophilicaromaticsubstitution** Mechanisms and evidences in favour of it including PKIE; orientation and reactivity; reactions: nitration,nitrosation,sulfonation,halogenation,Friedel-Craftsreaction;one-carbonelectrophiles(reactions:chloromethylation,Houben-Hoesch,Vilsmeier-Haack,Reimer-Tiemann,Kolbe-Schmidt);*Ipso*substitution. **Nucleophilicaromaticsubstitution**	12	lecturer	Mridula Hudati

	Addition-eliminationmechanismandevidencesinfavourofit;$S_N1$mechanism;*cine*substitution(benzynemechanism),structureofbenzyne. **BirchReductionofbenzenoidaromatics** Benzene,Alkylbenzene, Anisole,Benzoicacid(withmechanism).			
GeneralTreatmentofReactionMechanism–II	**Conceptof organic acidsand bases** ConceptofpK$_a$andpK$_{aH}$,effectofstructure,substituentandsolventonacidityandbasicity;protonsponge. **Tautomerism**: Basic difference between tautomerism and resonance, prototropy (keto-enol, phenol-keto); composition oftheequilibriumindifferentsystems(simplecarbonyl;1,2-and1,3-dicarbonylsystems,phenolsandrelatedsystems), factors affecting keto-enol tautomerism, basic ideas about valence tautomerism and ring-chaintautomerism.	8		Mridula Hudati
SubstitutionandEliminationReactions:	**Nucleophilicsubstitution reactions** Substitutionatsp^{3}centre[systems:alkylhalides,allylhalides,benzylhalides,alcohols,ethers,epoxides,α-halocarbonyls]:mechanisms (with evidence),relative rates& stereochemical features: S_N1, S_N2, S_N2', S_N1'(allylic rearrangement) and S_Ni; effects of solvent, substrate structure, leaving group and nucleophiles(including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP (with heteroatoms andphenylgroups). **Eliminationreactions** E1, E2, E1cB and Ei (pyrolytic *syn* eliminations); formation of alkenes and alkynes; mechanisms (withevidence),reactivity,regioselectivity(Saytzeff/Hofmann)andstereoselectivity;comparisonbetweensubstitutionandelimination reactions, comparisonbetween	12		Amit Maity

	nucleophilicityand basicity.			
Chemistryof alkenesanda lkynes	**Addition toC=C** Mechanism(with evidence wherever applicable), reactivity, regioselectivity (Markownikoff andanti-Markownikoffadditions)andstereoselectivity;reactions:hydrogenation,halogenation,hydrohalogenation,hydration,oxymercuration-demercuration,hydroboration-oxidation,epoxidation,*syn*and*anti*-hydroxylation,ozonolysis,additionofsingletandtripletcarbenes;Simmons-Smithcyclopropanationreaction;electrophilicadditionto 1,3-butadiene;conceptofkineticandthermodynamiccontrolofproducts;radicaladdition:HBraddition;mechanismofallylicandbenzylicbrominationincompetitionwithbrominationsacross C=C; use ofNBS; interconversionof *E*and*Z* alkenes. **AdditiontoC≡C(in comparison toC=C)** Mechanism,reactivity,regioselectivity(Markownikoffand anti-Markownikoffaddition)andstereoselectivity;reactions:hydrogenation,Hg(II)ioncatalysedhydration,hydroboration-oxidation,dissolvingmetal reductionof alkynes(Birch); reactions ofterminal alkynesbyexploringitsacidity.	12		Amit Maity

Practical Program:CC3-P

Chapter	syllabus	Hours of completion	Teaching method	Name of the teacher
IdentificationofPure SingleorganicCompound	Oxalicacid,tartaricacid,citricacid,succinicacid,resorcinol, urea,glucose,canesugar,benzoicacidandsalicylic acid	12	practical	Mridula Hudati
IdentificationofPure SingleorganicCompound	Formicacid,aceticacid,ethylalcohol,acetone,aniline, dimethylaniline,benzaldehyde,chloroformandnitrobenzene	12		Mridula Hudati

Semester-4 Session-2023-2024

Theoretical program:CC4-Th

Chapter	Syllabus	Hours of completion	Teaching method	Teacher Name
Chemicalbonding-II:	**Molecularorbitalconceptofbonding** The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorialapproach): sigma and pi bonds and delta interaction, multiple bonding. Orbital designations: gerade,ungerade,HOMO, LUMO.Orbitalmixing,.MOdiagramsofH_2,Li_2,Be_2, B_2,C_2,N_2,O_2,F_2,andtheirions wherever possible; Heteronuclear molecular orbitals: CO, NO, NO^+, CN^-, HF, BeH_2, CO_2 and H_2O. Bondproperties:bond orders,bond lengths. **MetallicBond** Qualitativeideaofvalencebondandbandtheories. Semiconductorsandinsulators,defectsinsolids. **WeakChemicalForces** Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions,Halogenbonds. Effects of chemicalforce,melting and boilingpoints.	20	lecture	Amit Maity
Acidsand bases	**Acid-Baseconcept** Arrhenius concept, theory of solvent system (in H_2O, NH_3, SO_2 and HF), Bronsted-Lowry's concept, LuxFlood concept, Lewis concept, group characteristics of Lewis acids, solvent levelling and differentiatingeffects.Relative strengthofacids, Pauling's rules.HSABprinciple. **Thermodynamicacidityparameters** Drago-Waylandequation.Superacids,Gasphaseacidityandprotonaffinity.	10		Mridula Hudati

	Acid-baseequilibriainaqueoussolution Protontransferequilibriainwater,pH,buffer.Acid-baseneutralizationcurves;indicator,choiceofindicators.			
Theoreticalprinciplesofinorganicqualitative analysis	Basic principles involved in analysis of cations and anions and solubility products, common ion effect.Principleinvolvedinseparationofcationsintogroupsandchoiceofgroupreagents.Interferinganions(fluoride,borate, oxalateandphosphate)and needto remove themafter GroupII.	8		Amit Maity

Practical program: CC4-P

Chapter	Syllabus	Hours of completion	Teaching method	Name of the Teacher
Qualitativesemimicroanalysisofmixturescontainingthreeradicals.Emphasisshouldbegiventotheunderstanding ofthechemistryofdifferent reactions:	**CationRadicals** Na^+,K^+,Ca^{2+},Sr^{2+},Ba^{2+},Al^{3+},Cr^{3+},Mn^{2+}/Mn^{4+},Fe^{3+},Co^{2+}/Co^{3+},Ni^{2+},Cu^{2+},Zn^{2+},Pb^{2+},Cd^{2+},Bi^{3+},Sn^{2+}/Sn^{4+},As^{3+}/As^{5+},$Sb^{3+/5+}$, NH^+, Mg^{2+}.	10	practical	Amit Maity
Qualitativesemimicroanalysisofmixturescontainingthreeradicals.Emphasisshouldbegiventotheunderstanding ofthechemistryofdifferent	**AnionRadicals** **F^-,Cl^-,Br^-,BrO_3^-,I^-,IO_3^-,SCN^-,S^{2-},SO^{2-},NO_3^-,NO_2^-,PO^{3-},AsO^{3--},BO_3^{3-},CrO^{2-}/CrO^{2-},$Fe(CN)_6^{4-}$,** $Fe(CN)_6^{3-}$.	10	practical	Amit Mait

reactions:				y
Qualitativesemimicroanalysisofmixturescontainingthreeradicals.Emphasisshouldbegiventotheunderstanding ofthechemistryofdifferent reactions:	**InsolubleMaterials** Al_2O_3(ig),Fe_2O_3(ig),Cr_2O_3(ig),SnO_2,$SrSO_4$,$BaSO_4$,CaF_2,$PbSO_4$.	6	practical	Amit Maity

Lesson Plan (Chemistry)

Session-2023-2024, Semester-5

Theoretical program: CC5-T

Chapter	Syllabus	Hours for completion	Teaching method	Teacher name
Thermodynamics-II	**SecondLaw** NeedforaSecondlaw;statementofthesecondlawofthermodynamics;Conceptofheatreservoirsandheatengines;Carnotcycle;Carnotengineandrefrigerator;Kelvin–PlanckandClausiusstatementsand equivalence of the two statements with entropic formulation; Carnot's theorem; Values of §dQ/T andClausius inequality; Physical concept of Entropy; Entropy is a measure of the microscopic disorder of thesystem. Entropy change of systems and surroundings for various processes and transformations; Entropyandunavailablework; Temperature – Entropydiagram. UsefulworkandTheGibbsandHelmholtzfunction.ChangesatconstantT,P.Applicationtoelectricwork.Criteria for spontaneity and equilibrium. Gibbs- Helmholtz equation, The Gibbs Function and useful workinBiological systems.Gibbsfreeenergyand spontaneousphasetransition.	18	lecturer	Mridula Hudati

	Maxwell'srelations;Joule-Thomsonexperimentanditsconsequences;inversiontemperature;Joule-Thomsoncoefficient foravan der Waals gas; General heat capacityrelations **SystemsofVariableCompositions** State functions for system of variable compositions. Criteria of equilibriumand spontaneity in systems ofvariable composition. Partial molar quantities, dependence of thermodynamic parameters on composition;Chemicalpotentialasanescapingtendency.Gibbs-Duhemequation,EntropyandGibbsfunctionformixingofidealgases,thechemicalpotentialofidealmixtures.TheFugacityfunctionofapurerealgas.Calculationof the fugacity of a van der Waals gas using compressibility factor. Definitionsof Activitiesand activitycoefficients.Choiceof standard states			
ApplicationsofThermodynamics – I	**ChemicalEquilibrium** Thermodynamicconditionsforequilibrium,degreeofadvancement;van'tHoff'sreactionisotherm(deduction from chemical potential); Variation of free energy with degree of advancement; Equilibriumconstant and standard Gibbs free energy change; Van't Hoff's reaction isobar and isochore from differentstandardstates; LeChatelier'sprincipleanditsderivation,variationofequilibriumconstantunderdifferentconditionsNernst's distribution law;Solvent Extraction.	8		Amit Maity
ELECTROCHEMISTRY-I:	**(i) Conductance** Ion conductance; Conductance and measurement of conductance, cell constant, specific conductance andmolar conductance; Variation of specific and equivalent conductance with dilution for strong and weakelectrolytes; Kohlrausch's law of independent migration of ions; Equivalent and molar conductance atinfinite dilution and their determination for strong and weak electrolytes; Debye-Huckel limiting law-briefqualitative description. Estimation of activity coefficient for electrolytes using Debye-Huckel limiting	14		Amit Maity

	law.Ostwald'sdilutionlaw;Ionicmobility;Applicationofconductancemeasurement(determinationof solubility product and ionic product of water); Conductometric titrations. Transport number, Principles ofMoving-boundarymethod' **Ionic Equilibrium:** Strong, moderateandweakelectrolytes,degree ofionization, factorsaffecting degreeof ionization,ionizationconstantandionicproductofwater.Ionizationofweakacidsandbases,pHscaleSalthydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.Determination ofhydrolysisconstantconductometrically.Buffersolutions;derivationofHendersonequationanditsapplications;buffer capacity, buffer range, buffer action. Theory of acid–base indicators; selection ofindicatorsand theirlimitations.			

Practical Program:CC5-P

Chapter	syllabus	Hours of completion	Teaching method	Name of the

				teacher
PhysicalChemistryPracticals	1. DeterminationofrateconstantofthereactionbetweenH_2O_2andacidifiedKIsolutionusingClock reaction. 2. Determinationoftherateconstant forthedecompositionofH_2O_2using$FeCl_3$ascatalyst. 3. Determinationoftherateconstantforthefirstorderacidcatalyzedhydrolysisofan ester. 4. Tostudythe kineticsofthe inversionofcanesugar usingapolarimeter.	20	practical	Mridula Hudati and Amit Maity

Semester-6 Session-2023-2024

Theoretical program:CC6-Th

Chapter	Syllabus	Hours	Teac	Teac

		of completion	hing method	her Name
Stereochemistry–III	**Conformation** Conformational nomenclature: eclipsed, staggered, gauche, syn and anti; dihedral angle, torsion angle;energybarrierofrotation,conceptoftorsionalandstericstrains;relativestabilityofconformersonthebasisofstericeffect,dipole-dipoleinteractionandH-bonding;butanegaucheinteraction;conformationalanalysisofethane,propane, *n*-butane,and 2-methylbutane;1,2-dihaloalkanesandethyleneglycol	6	lecture	Amit Maity
Chemistry ofcarbonyl Compounds	**NucleophilicAddition to C=O** Structure andreactivity of carbonyl compounds; mechanism (with evidence), reactivity, equilibrium andkineticcontrol;formationofhydrates,cyanohydrinsand bisulphiteadduct;nucleophilicaddition-eliminationreactionswithalcohols,thiolsandnitrogen-basednucleophiles;reactions:benzoincondensation, Cannizzaro and Tischenko reactions, reactions with ylides: Wittig and Corey-Chaykovskyreaction; Rupe rearrangement, oxidations and reductions: Clemmensen, Wolff-Kishner, $LiAlH_4$, $NaBH_4$,MPVO redox equilibrium, acyloin condensation; oxidation of alcohols with PDC and PCC;periodic acidandlead tetraacetateoxidation of 1,2-diols. **Exploitation of acidityof α-Hof C=O** Formationofenolsandenolates;kineticandthermodynamicenolates;reactions(mechanismwithevidence):halogenationofcarbonylcompoundsunderacidicandbasicconditions, Hell-Volhard-Zelinsky(H.V.Z.)reaction,nitrosation,SeO_2 diethylmalonateandethylacetoacetate;specificenolequivalents(lithiumenolates,enaminesandsilylenolethers)inconnection withalkylation, acylationand aldol typereaction.	24		Mridula Hudati and Amit Maity

	Nucleophilicadditiontoα,β-unsaturatedcarbonylsystem General principle and mechanism (with evidence); direct and conjugate addition, addition of enolates(Michaelreaction), Robinson annulations reaction. **Substitutionatsp^{2}carbon(C=Osystem)** Mechanism (with evidence): $B_{AC}2$, $A_{AC}2$, $A_{AC}1$, $A_{AL}1$ (in connection to acid and ester); acid derivatives:amides,anhydrides&acylhalides(formation and hydrolysis includingcomparison).			
Organometallics	Grignard reagents , Gilman cuprates: preparation and reactions (mechanism with evidence); addition ofGrignard to carbonyl compounds; substitution on -COX; Conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behaviour of Grignard reagents; comparison of reactivity among Grignard, andorganocopperreagents;Reformatskyreaction; concept of umpolung.	4		Amit Maity

Practical program: CC6-P

Chapter	Syllabus	Hours of completion	Teaching method	Name of the Teacher
Qualitativeanalysisofsinglesolidorganiccompound	1. Detectionofspecialelements(N,S,Cl)byLassaigne'stest 2. Solubilityandclassification(solvents:H_2O,5%HCl,5%NaOHand5% NaHCO3) 3. Detectionofthefollowingfunctionalgroupsbysystematicchemicaltests:aromaticamino(Ar-NH2),aromaticnitro(-NO2),amido(-	20	practical	Mridula Hudati

	CONH2,includingimide),phenolic–OH,carboxylicacid(-COOH),carbonyl (distinction between -CHO and >C=O); only one test for each functional group is to be reported.Eachstudent,duringlaboratorysession,isrequiredtocarryoutqualitativechemicaltestsforallthe specialelementsand thefunctional groups inknownandunknown(**at leastsix)**organiccompounds.			

FUTURE PLANS

1 . Improvement of chemistry laboratory

2 . To introduce chemistry Honours

3 . To setup departmental library

4 . Arrange seminar