Lesson Plan – Honours(Theory) [Session 2018-2019]

Name: Ishita Saha

Department: Chemistry

Semester	Programme	Course and Name of the Paper	Topic	Teacher	No. Of hours
1	Hons	CC – 2	Rate Law, order and molecularity	IS	18
			Role of Temperature	IS	02
			Homogeneous catalysis	IS	
1	General	CC 1/GE 1			20
2	General	CC/GE 2			10

Year	Paper	Unit	Topic	No. of lectures	Session
2 Hons	**IIIA**	**CHT 23a Unit I**	Thermodynamics Discussion of laws and derivations Thermodynamic Equilibrium Equilibrium constants and condition of equilibrium	**15** **10** **Total 25**	**July to Pre-Puja**
		CHT 23a Unit II	Liquid state and viscosity of fluids	**7**	**post-Puja to Winter vacation.**

				Total 7	
		CHT 23b Unit II	Conductance and measurement of conductance, cell constant, specific conductance and molar conductance. Variation of specific and equivalent conductance with dilution for strong and weak electrolytes	**5**	**post-Winter Vacation to Test examination**
			Glass electrode and determination of pH of a solution. Potentiometric titrations: acid-base and redox	**5**	
	4			10	**July to Pre-Puja**
					post-Puja to Winter vacation.
					post-Winter Vacation to Test examination

Year	Paper	Unit	Topic	No. of lectures	Session
3 Hons	**5**				**July to Pre-Puja**
					post-Puja to Test examination)
	VIA	**CHT 33b Unit I**	Unit I. Phase equilibrium and colligative properties Definitions of phase, component and degrees of freedom. Phase rule and its derivations. Definition of phase diagram.	**12** **3**	**July to Pre-Puja**
		CHT 33b Unit II	Unit II. Statistical thermodynamics and the third law Macrostates and microstates, thermodynamic	**8** **4**	

			probability, entropy and probability, Boltzmann distribution formula (with derivation).	**4**	
				Total 34	
		CHT 32b Unit II	Unit II. Statistical thermodynamics and the third law	**5**	**post-Puja to Test examination)**
			Macrostates and microstates, thermodynamic	**3**	
		CHT 32c Unit I	probability, entropy and probability, Boltzmann distribution formula (with derivation).	**6**	
				6	
		CHT 32c Unit II	Unit I. Kinetics and photochemistry		
			Collision theory (detailed treatment); outline of Transition State theory. Primary	**3**	
			kinetic salt effect. Lindemann theory of unimolecular reaction.	**3**	
			Potential energy curves (diatomic molecules), Frank-Condon principle and	**3**	
				Total 29	
			vibrational structure of electronic spectra. Bond dissociation and principle of		
			determination of dissociation energy (ground state). Decay of excited states by radiative		
			and non-radiative paths. Fluorescence and phosphorescence,		
			Jablonsky diagram.		
			Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law		

	7		Unit II. Spectroscopy Rotational spectroscopy of diatomic molecules: rigid rotor model, selection rules, spectrum, characteristic features of spectral lines (spacing and intensity).		**July to Pre-Puja**
			Determination of bond length, effect of isotopic substitution. Vibrational spectroscopy of diatomic molecules: SHO model, selection rules, spectra; anharmonicity and its consequences on energy levels, overtones, hot bands. Raman Effect.		**post-Puja to Test examination)**
	8		Characteristic features and conditions of Raman activity with suitable illustrations. Rotational and vibrational Raman spectra. Rule of mutual exclusion with examples.		**July to Pre-Puja**
					post-Puja to Test examination)

Lesson Plan – Honours(Practical) [Session 2018-2019]

Name: Ishita Saha

Department: Chemistry

Practical

Semester	Programme	Course and Name of the Paper	Topic	Teacher	No. Of hours
1	Hons	CC-2-P	**Experiment 1**: Study of kinetics of decomposition of H_2O_2 **Experiment 2**: Study of kinetics of acid-catalyzed hydrolysis of methyl acetate **Experiment 3**: Study of viscosity of unknown liquid	IS	20

			(glycerol, sugar) with respect to water. **Experiment 4**: Study of the variation of viscosity with the concentration of the solution **Experiment 5**: Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator)		

Year	Paper	Unit	Topic	No. of lectures	Session
2 Hons	3		Qualitative Analysis of Single Organic Compound(s) Experiment A: Detection of special elements (N, Cl, and S) in organic compounds. Experiment B: Solubility and Classification (solvents: H_2O, dil. HCl, dil. NaOH) Experiment C: Detection of functional groups -NO_2, -NH_2, -COOH, carbonyl (-CHO, >C=O), -OH (phenolic) in solid organic compounds.	30	**July to Pre-Puja**
			Experiments A - C with unknown (at least 6) solid samples containing not more than two of the above types of functional groups should be done.		**post-Puja to Winter vacation.**
			Qualitative Analysis of Inorganic Mixtures: Experiments A: Preliminary Tests for Acid		**post-Winter Vacation to Test examination**

			and Basic radicals in given samples. Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Acid Radicals: Cl^-, Br^-, I^-, NO_2^-, S^{2-}, SO_4^{-2}, PO_4^{-3}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{+2}, Sr^{+2}, Ba^{+2}, Cr^{+3}, Mn^{+2}, Fe^{+3}, Ni^{+3}, Cu^{+2}, NH_4^+.		

Year	Paper	Unit	Topic	No. of lectures	Session
3 Hons	**5**		1. Titration of Na_2CO_3 + $NaHCO_3$ mixture vs HCl using phenolphthalein and methyl orange indicators. 2. Titration of HCl + CH_3COOH mixture vs NaOH using two different indicators to find the composition. 3. To find the total hardness of water by EDTA titration.		**July to Pre-Puja**
			4. To find the PH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein. 5. To determine the rate constant for the acid catalysed hydrolysis of an ester.		**post-Puja to Test examination)**
	6		6. Determination of the strength of the H_2O_2 sample. 7. To determine the solubility of a sparingly		**July to Pre-Puja**

			soluble salt, e.g. KHTa (one bottle)		
					post-Puja to Test examination)

Lesson Plan – General (theory) [Session 2018-2019]

Name: Dr. Ishita Saha

Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures	Session
2	**2**	CGT 21	Unit II. Basic physical chemistry II Chemical kinetics and catalysis: order and molecularity of reactions, rate laws and rate equations for first order and second order reactions (differential and integrated forms); zero order reactions.		**July to Pre-Puja**
			Unit I. Basic physical chemistry III Thermodynamics: Definition of thermodynamic terms: Intensive and extensive variables, isolated, closed and open systems. Cyclic, reversible and irreversible processes. Thermodynamic functions and their differentials. Zeroth law of thermodynamics, concept of heat (q) and work (w).		**post-Puja to Winter vacation.**
			First law of thermodynamics,Spontaneous processes, heat engine, Carnot cycle and its efficiency, Second law of thermodynamics, Chemical equilibrium: chemical equlibria of homogeneous and heterogeneous systems, derivation of expression of equilibrium constants; temperature, pressure and concentration dependence of equilibrium constants (K_P,		**post-Winter Vacation to Test examination**

			K_C, K_X); Le Chatelier's principle of dynamic equilibrium.		
Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
3	**IVA**	**CGT 31b Unit II**		**5** **5** **3** **3** **Total 16**	**July to Pre-Puja**
		CGT 31c Unit II		**3** **2** **2** **Total 7**	**post-Puja to Test examination)**

Lesson Plan – General (practical) [Session 2018-2019]

Name: Dr. Priyabrata Roy

Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures	Session
1	**3**	**CGP 23**	Qualitative Analysis of Single Organic Compound(s) Experiment A: Detection of special elements (N, Cl, and S) in organic compounds. Experiment B: Solubility and Classification (solvents: H2O, dil. HCl, dil. NaOH) Experiment C: Detection of functional groups -NO2, -NH2, -COOH, carbonyl (-CHO, >C=O), -OH (phenolic) in solid organic compounds.	**4X3** **3X1** **4X3**	**July to Pre-Puja**

				Total 27	
		CGP 23	Experiments A - C with unknown (at least 6) solid samples containing not more than two of the above types of functional groups.	**18(6X3)**	**post-Puja to Winter vacation.**
				18(6X3)	**post-Winter Vacation to Test examination**

Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
2	**3**	**CGT 21a**	Qualitative Analysis of Inorganic Mixtures: Experiments A: Preliminary Tests for Acid and Basic radicals in given samples. Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Acid Radicals: Cl^-, Br^-, I^-, $NO2^-$[1], S^{2-}, $SO4^{-2}$, $PO4^{-3}$, $BO3^{3-}$, H3BO3. Basic Radicals: Na^+, K^+, Ca^{+2}, Sr^{+2}, Ba^{+2}, Cr^{+3}, Mn^{+2}, Fe^{+3}, Ni^{+3}, Cu^{+2}, $NH4^+$.	**33(11X3)**	**July to Pre-Puja**
		CGT 21a	Analysis of at least 6 unknown samples by each student	**18(6X3)**	**post-Puja to Winter vacation.**
				18(6X3)	**post-Winter Vacation to Test examination**

Lesson Plan – Honours(Theory) [Session 2018-2019]

Name: Ishita Saha

Department: Chemistry

Semester	Programme	Course and Name of the Paper	Topic	Teacher	No. Of hours
1	Hons	CC – 2	Rate Law, order and molecularity	IS	18
			Role of Temperature	IS	02
			Homogeneous catalysis	IS	
1	General	CC 1/GE 1			20
2	General	CC/GE 2			10

Year	Paper	Unit	Topic	No. of lectures	Session
2 Hons	**IIIA**	**CHT 23a Unit I**	Thermodynamics Discussion of laws and derivations Thermodynamic Equilibrium Equilibrium constants and condition of equilibrium	**15** **10** **Total 25**	**July to Pre-Puja**
		CHT 22b Unit I	<u>Nitrogen compounds and Organometallics</u> Nitrogen compounds Organometallics	**7**	**post-Puja to Winter vacation.**

				7	
				Total 14	
		CHT 22b Unit II	Reactions: Rearrangements 1,2-shift: Rearrangement to electron-deficient carbon, Electron-deficient nitrogen, Electron-deficient oxygen. Aromatic rearrangements	**5** **3**	**post-Winter Vacation to Test examination**
				Total 8	
	4				**July to Pre-Puja**
					post-Puja to Winter vacation.
					post-Winter Vacation to Test examination

Year	Paper	Unit	Topic	No. of lectures	Session
3 Hons	**5**				**July to Pre-Puja**
					post-Puja to Test examination)
	VIA	**CHT 32a Unit I**	Carbanion chemistry and cyclic stereochemistry Carbanions Cyclic Stereochemistry Conformational analysis	 **6** **1** **6**	**July to Pre-Puja**
		CHT 32a Unit II	Spectroscopy UV, IR, NMR (elementary) UV Spectra IR Spectra PMR Spectra	 **3** **3** **3**	

		CHT 32b Unit I	Synthetic strategies and Asymmetric synthesis Retrosynthetic analysis Strategy of ring synthesis Asymmetric synthesis	 **4** **4** **4** **Total 34**	
		CHT 32b Unit II **CHT 32c Unit I** **CHT 32c Unit II**	Carbohydrate chemistry Monosaccharides Disaccharides Carbocycles and Heterocycles Polynuclear hydrocarbons Heterocyclic compounds Amino acids, peptides and nucleic acids Amino acids Peptides Nucleic acids	 **5** **3** **6** **6** **3** **3** **3** **Total 29**	**post-Puja to Test examination)**
	7				**July to Pre-Puja**
					post-Puja to Test examination)
	8				**July to Pre-Puja**
					post-Puja to Test examination)

Lesson Plan – Honours(Practical) [Session 2018-2019]

Name: Priyabrata roy

Department: Chemistry

Practical

Semester	Programme	Course and Name of the Paper	Topic	Teacher	No. Of hours
1	Hons	CC-1-P Organic (1A)	Separation based upon solubility	PR	15
		CC-2-P Organic (1B)	Determination of boiling point	PR	15
2	Hons	CC-3-P	Organic Preparations	PR	45

Year	Paper	Unit	Topic	No. of lectures	Session
2 Hons	3				**July to Pre-Puja**
					post-Puja to Winter vacation.
					post-Winter Vacation to Test examination
	4				**July to Pre-Puja**
					post-Puja to Winter vacation.
					post-Winter Vacation to Test examination

Year	Paper	Unit	Topic	No. of lectures	Session
3 Hons	**5**				**July to Pre-Puja**
					post-Puja to Test examination)
	6				**July to Pre-Puja**
					post-Puja to Test examination)
	VIIB	**CHP 34b**	Qualitative analysis of single solid organic compounds Organic preparations	**40** **40**	**July to Pre-Puja**
				Total 80	

		CHP 34a	Spectroscopic Analysis of Organic Compounds Assignment of labelled peaks in the ^{1}H NMR spectrum of the known organicvcompounds explaining the relative ∂ values and splitting pattern Assignment of labeled peaks in the IR spectrum of the same compound	**20** **20** **Total 40**	**post-Puja to Test examination)**
	8				**July to Pre-Puja**
					post-Puja to Test examination)

Lesson Plan – General (theory) [Session 2018-2019]

Name: Dr. Priyabrata Roy

Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures	Session
2	**2**				**July to Pre-Puja**
					post-Puja to Winter vacation.
					post-Winter Vacation to Test examination

Year	Paper	Unit	Topic	No. of lectures	Session
3	**IVA**	**CGT 31b Unit II**	Polymers, manufacture, physical properties and uses of natural rubber. Paints, Varnishes and Synthetic Dyes. Drugs and pharmaceuticals. Fermentation Chemicals.	**5** **5** **3** **3** **Total 16**	**July to Pre-Puja**
		CGT 31c Unit II	Fats-Oils-Detergents. Pesticides. Food Additives.	**3** **2** **2** **Total 7**	**post-Puja to Test examination)**

Lesson Plan – General (practical) [Session 2018-2019]

Name: Dr. Priyabrata Roy

Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures	Session
1	**3**	**CGP 23**	Qualitative Analysis of Single Organic Compound(s) Experiment A: Detection of special elements (N, Cl, and S) in organic compounds. Experiment B: Solubility and Classification (solvents: H2O, dil. HCl, dil. NaOH)	**4X3** **3X1**	**July to Pre-Puja**

			Experiment C: Detection of functional groups -NO2, -NH2, -COOH, carbonyl (-CHO, >C=O), -OH (phenolic) in solid organic compounds.	**4X3**	
				Total 27	
		CGP 23	Experiments A - C with unknown (at least 6) solid samples containing not more than two of the above types of functional groups.	**18(6X3)**	**post-Puja to Winter vacation.**
				18(6X3)	**post-Winter Vacation to Test examination**

Year	**Paper**	**Unit**	**Topic**	**No. of lectures**	**Session**
2	**3**	**CGT 21a**	Qualitative Analysis of Inorganic Mixtures: Experiments A: Preliminary Tests for Acid and Basic radicals in given samples. Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Acid Radicals: Cl^-, Br^-, I^-, $NO2^-$ [1], S^{2-}, $SO4^{-2}$, $PO4^{-3}$, $BO3^{3-}$, H3BO3. Basic Radicals: Na^+, K^+, Ca^{+2}, Sr^{+2}, Ba^{+2}, Cr^{+3}, Mn^{+2}, Fe^{+3}, Ni^{+3}, Cu^{+2}, $NH4^+$.	**33(11X3)**	**July to Pre-Puja**
		CGT 21a	Analysis of at least 6 unknown samples by each student	**18(6X3)**	**post-Puja to Winter vacation.**
				18(6X3)	**post-Winter Vacation to Test examination**

PART(1+1+1 2016) REGULATION

Lesson Plan – Honours (theory) Session 2018-2019
Name: Dr. Anuva Samanta
Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures
2	**IIIB**	**CHT 23b Unit I**	Quantum Chemistry I Wave-particle duality, light as particles: photoelectric and Compton effects; electrons as waves and the de Broglie hypothesis. Elementary concepts of operators, eigenfunctions and eigenvalues. Linear operators. Commutation of operators, fundamental commutator and uncertainty relation (without proof). Expectation value. Hermitian operator. Schrodinger time-independent equation: nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function. Particle in a box: setting up of Schrodinger equation for one-dimensional box and its solution. Comparison with free particle eigenfunctions and eigenvalues. Properties of PB wave functions (normalisation, orthogonality, probability distribution). Expectation values of x, x2, px and px2 and their significance in relation to the uncertainty principle. Extension of the problem to two and three dimensions and the concept of degenerate energy levels.	**30**
		CHT 23b Unit II	Electrochemistry Conductance and measurement of conductance, cell constant, specific conductance and molar conductance. Variation of specific and equivalent conductance with dilution for strong and weak electrolytes. Kohlrausch's law of independent migration of ions, ion conductance and ionic mobility. Equivalent and molar conductance at infinite and their determination for strong and weak electrolytes. Ostwald's dilution law. Debye-Huckel model (physical idea only). Application of conductance measurement (determination of solubility product and ionic product of water). Conductometric titrations. Determination of transport number by moving boundary method. Types of electrochemical cells and examples, cell reactions, emf and change in free energy, ΔH and ΔS of cell reactions from emf measurements. Thermodynamic derivation of Nernst equation. Standard cells. Half-cells / electrodes, different types of electrodes (with examples). Standard electrode potential (IUPAC convention) and principles of its determination. Types of concentration cells.	**20**

			Liquid junction potential and its minimisation. Glass electrode and determination of pH of a solution. Potentiometric titrations: acid-base and redox.	
3	**PAPER VIIA**	**CHT 33a Unit I**	Properties of solids, interfaces and dielectrics Crystal, crystal planes, law of rational indices, Calculation of fraction occupied for simple cubic, bcc, and fcc. Miller indices. Bragg's law and its applications for the 16 determination of crystal structure for cubic system single crystal. Crystal structures of NaCl and KCl. Special features of interfaces compared to bulk. Surface dynamics: Physical and chemical adsorption. Freundlich and Langmuir adsorption isotherms; multilayer adsorption and BET isotherm (no derivation required). Gibbs adsorption isotherm and surface excess. Heterogeneous catalysis (single reactant). Colloids: lyophobic and lyophilic sols. Origin of charge and stability of lyophobic colloids. Coagulation and Schultz-Hardy rule. Zeta potential and Stern double layer (qualitative idea). Tyndall effect. Electrokinetic phenomenon (qualitative idea only). Electrical properties of molecules: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules. Clausius-Mosotti equation and Debye equation (both with derivation) and their application. Determination of dipole moments.	**30**
		Unit II	Quantum Chemistry – II Simple Harmonic Oscillator: setting up of the Schrodinger stationary equation, energy expression (without derivation), expression of wave function for n = 0 and n = 1 (without derivation) and their characteristic features. Stationary Schrodinger equation for the H-atom in polar coordinates, separation of radial and angular (θ, φ) parts. Solution of φ-part and emergence of quantum number 'm'; energy expression (without derivation), degeneracy. Hydrogenic wave functions up to n = 2 (expression only); real wave function. Concept of orbitals and shapes of s and p orbitals. C	**20**
		CHT 33c Unit II	Spectroscopy Rotational spectroscopy of diatomic molecules: rigid rotor model, selection rules, spectrum, characteristic features of spectral lines (spacing and intensity). Determination of bond length, effect of isotopic substitution. Vibrational spectroscopy of diatomic molecules: SHO model, selection rules, spectra; anharmonicity and its consequences on energy levels, overtones, hot bands. Raman Effect. Characteristic features and conditions of Raman activity with suitable illustrations. Rotational and vibrational Raman spectra. Rule of mutual exclusion with examples.	**20**

Lesson Plan – Honours (practical)
Name: Dr. Anuva Samanta
Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures
2	**IVB**	**CHP 24b**	Instrumental Estimations 1. Spectrophotometry: MnII; pKin . 2. Conductometry: HCl-AcOH mixture; dibasic acid. 3. Potentiometry: Halide ion. 4. pH-metry: HCl-AcOH mixture; dibasic acid. 5. Ion-exchanger: Cation content of a sample by cation exchanger	**3x20**
3	**VIIB**	CHP 35a	Experiments: 1. Determination of surface tension of a given solution by drop weight method using a stalagmometer, considering aqueous solutions of NaCl, acetic acid, ethanol etc, as systems. 2. Determination of viscosity coefficient of a given solution with Ostwald's viscometer considering aqueous solutions of cane-sugar, glycerol, ethanol, etc. 3. Determination of solubility of sparingly soluble salts in water and various Electrolyte medium by titrimetric method. KHTa as sparingly soluble salt in water, KCl, NaNO3 may be used. 4. Determination of partition coefficient of Iodine or Acetic acid in water and an immiscible organic solvent. 5. Determination of the rate constant for the first order acid catalyzed hydrolysis of an ester (V0 and V∞ be supplied). 6. Determination of rate constant of decomposition of H2O2 by acidified KI solution using clock reactions. A separate laboratory workbook should be maintained for these experiments.	**50**
	VIIIB	CHP 35b	Experiments: 1. To study the kinetics of inversion of sucrose using polarimeter. 2. To study the phase diagram of a binary system (Phenol + water) and the effect of impurities (e.g. NaCl). 3. Determination of ionization constant of a weak acid by conductometric method. 4. To study the kinetics of saponification of ester by conductometric method. 5. Determination of the equilibrium constant of the reaction KI + I2 = KI 3 by partition method (partition coefficient to be supplied). 6. Determination of E0 of Fe+3/Fe2 couple in the hydrogen scale by potentiometric titration of ferrous ammonium sulfate solution using KMnO4, or, K2Cr2O7 as standard. 7. Determination of concentration of (i) AgNO3 solution and (ii) solubility product of AgCl by potentiometic titration of standard KCl solution against AgNO3 solution. 8. Determination of pK values of weak monobasic, dibasic and polybasic acid by pHmetric method (e.g. using, acetic acid, succinic acid, oxalic acid, phosphoric acid, etc.). 9. Study of the kinetics of the reaction I- + S2O8 2- by colorimetric method.	**80**

Lesson Plan – General (theory)
Name: Dr. Anuva Samanta
Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures
2	**IIA**	**CGT 21a Unit I**	Gaseous state: Gas laws, kinetic theory of gas, collision and gas pressure, derivation of gas laws from kinetic theory, average kinetic energy of translation, Boltzmann Constant and absolute scale of temperature, Maxwell's distribution law of molecular speeds (without derivation), most probable, average and root mean square speed of gas molecules, principle of equipartition of energy (without derivation). Mean free path and collision frequencies. Heat capacity of gases (molecular basis); viscosity of gases. Real gases, compressibility factor, deviation from ideality, van der Waals equation of state, critical phenomena, continuity of states, critical constants. Liquid state: physical properties of liquids and their measurements: surface tension and viscosity.	**7**
		CGT 22a Unit I	Thermodynamics: Definition of thermodynamic terms: Intensive and extensive variables, isolated, closed and open systems. Cyclic, reversible and irreversible processes. Thermodynamic functions and their differentials. Zeroth law of thermodynamics, concept of heat (q) and work (w). First law of thermodynamics, internal energy (U) and enthalpy (H); relation between Cp and Cv, calculation of w, q, ΔU and ΔH for expansion of ideal gas under isothermal and adiabatic conditions for reversible and irreversible processes including free expansion. Joule-Thomson Coefficient and inversion temperature. Application of First law of thermodynamics: standard state, standard enthalpy changes of physical and chemical transformations: fusion, sublimation, vaporization, solution, dilution, neutralization, ionization. Hess's law of constant heat summation. Bond-dissociation energy, Born haber cycle for calculation of lattice energy. Kirchhoff's equation, relation between ΔH and ΔU of a reaction.	**7**
		CGT 22a Unit II	Basic physical chemistry IV Chemical equilibrium: chemical equlibria of homogeneous and heterogeneous systems, derivation of expression of equilibrium constants; temperature, pressure and concentration dependence of equilibrium constants (KP, KC, KX); Le Chatelier's principle of dynamic equilibrium. Colloids: colloids and crystalloids, classification of colloids, preparation and purification of colloids: ferric hydroxide sol and gold sol. Properties of colloids: Brownian motion, peptization, dialysis, Tyndal effect and its applications.	**4**

			Protecting colloids, gold number, isoelectric points, coagulation of colloids by electrolytes, Schulze-Hardy rule.	
		CGT 22b Unit II	Basic physical chemistry VI Electrode potential: Electrode potentials, Nernst Equation, reference electrodes: normal hydrogen electrode and calomel electrodes, Emf of electrochemical cells and its measurement, electrode potential series and its applications. Solutions of non-electrolytes: Colligative properties of solution, Raoult's Law, relative lowering of vapor pressure, osmosis and osmotic pressure; elevation of boiling point and depression of freezing point of solvents.	**4**

Year	**Paper**	**Unit**	**Topic**	**No. of lectures**
3	**IVA**	**CGT 31c Unit II**	Industrial chemistry III Fats-Oils-Detergents: Fats and oils, natural fat, edible and inedible oil of vegetable origin. Common fatty acids, glycerides. Hydrogenation of unsaturated oil, production of vanaspati and margarine. Production of toilet and washing soaps, Enzymebased detergents, detergent powder, liquid soaps. Pesticides: Common pesticides: Production, applications and residual toxicity of gammaxane, aldrin, parathion, malathion, DDT, paraquat, decamethrin. Food Additives: Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers and edible foaming agents, sequesterants – uses and abuses of these substances in food beverages.	**15**
		CGT 31a Unit II	Error analysis and computer applications Accuracy and precision of quantitative analysis, determinate-, indeterminate-, systematic- and random-errors. Methods of least squares and standard deviations. General introduction to computers, different components of a computer, hardware and software, input and output devices, binary numbers and arithmetic. Introduction to computer languages, programming and operating systems.	

Lesson Plan – General (practical)
Name: Dr. Anuva Samanta
Department: Chemistry

Year	Paper	Unit	Topic	No. of lectures
2	**IIIB**	**CGP 24**	Qualitative Analysis of Inorganic Mixtures: Experiments A: Preliminary Tests for Acid and Basic radicals in given samples. Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Acid Radicals: Cl^-, Br^-, I^-, NO_2^{1-}, S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	**3x10**
		CGP 24	Analysis of at least 6 unknown samples by each student	**3x10**

Year	Paper	Unit	Topic	No. of lectures
3	**IVB**	**CGP 32**	Experiments: 1. Titration of Na2CO3 + NaHCO3 mixture vs HCl using phenolphthalein and methyl orange indicators. 2. Titration of HCl + CH3COOH mixture vs NaOH using two different indicators to find the composition. 3. To find the total hardness of water by EDTA titration. 4. To find the PH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein. 5. To determine the rate constant for the acid catalysed hydrolysis of an ester. 6. Determination of the strength of the H_2O_2 sample. 7. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)	**3x8**

CBCS

Semester	Progra -mme	Course and Name of the Paper	Topic	No. Of hours
1	Hons	CC1-2-TH: PHYSICAL CHEMISTRY-1, ORGANIC CHEMISTRY-1B	Kinetic Theory and Gaseous state	20
	Gen	CC1/GE1 TH	Kinetic Theory of Gases and Real gases	7
			Liquids	6
		CC1/GE1 P	1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of oxalic acid by titrating it with $KMnO_4$. 3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$. 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$. 6.Estimation of Fe(II) and Fe(III) in a given mixture using $K_2Cr_2O_7$ solution.	45
2	Gen	CC/GE 2	Chemical Equilibrium:	7
			Solutions	5
			Phase Equilibria	5
			Solids	5
		CC/GE 2 P	1. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate 2. Study of kinetics of decomposition of H_2O_2 (Clock Reaction) 3. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water. 4. Determination of solubility of sparingly soluble	45

			salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator) 5. Preparation of buffer solutions and find the pH of an unknown buffer solution by colour matching method 6. Determination of surface tension of a liquid using Stalagmometer	
			2.Spectroscopy	

Lesson Plan for 2018-19; Teacher: Dr. Soumavo Ghosh, Department of Chemistry

1st year: Semester-1 and semester-2 (Under CBCS):

Semester	Progra-mme	Course and Name of the Paper	Topic	Session	No. Of lectures
1	Hons	CC1-1-TH: INORGANIC CHEMISTRY-1,	Acid-Base reactions: Thermodynamic acidity parameters, Drago-Wayland equation. Superacids, Gas phase acidity and proton affinity; HSAB principle.Acid-base equilibria in aqueous solution (Proton transfer equilibria in water), pH, buffer. Acid-base neutralisation curves; indicator, choice of indicators.	Jul-Dec	6
			Redox reactions		14
		Total number of hours for CC 1-1 (Theory+Practical) Jul- Dec			20T + 0P
	Gen	CC1/GE1 TH	Chemical Periodicity	Jul-Dec	7
			Acids and bases		3
		CC1/GE1 P	1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of oxalic acid by titrating it with $KMnO_4$. 3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$. 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$. 6.Estimation of Fe(II) and Fe(III) in a given mixture using $K_2Cr_2O_7$ solution.	Jul-Dec	22.5
		Total number of hours for CC-1/GE-1 (Theory+Practical) Jul- Dec			10T + 22.5P
2	Hons	CC-2-4-TH INORGANIC CHEMISTRY-2	Chemical Bonding-I	Jan-Jun	20
			Radioactivity		10
		Total number of hours for CC 2-4 (Theory+Practical) Jan-Jun			30T + 0P
	Gen	CC/GE 2 TH	Error Analysis and Computer Applications	Jan-Jun	10
			Redox reactions		10
		CC/GE 2 P	1. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate 2. Study of kinetics of decomposition of H_2O_2 (Clock Reaction) 3. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water. 4. Determination of solubility of sparingly soluble salt in water, in electrolyte with	Jan-Jun	22.5

			common ions and in neutral electrolyte (using common indicator) 5. Preparation of buffer solutions and find the pH of an unknown buffer solution by colour matching method 6. Determination of surface tension of a liquid using Stalagmometer		
		Total number of hours for CC-2/GE-2 (Theory+Practical) Jan-Jun			20T + 22.5P

2nd and 3rd year (Honours) Theory (under 1+1+1 2016 system); Session 2018-19; Dr. Soumavo Ghosh

Year	Paper	Unit	Topic	No. of lectures	Session
2(H)	**IVA**	**CHT 21a Unit I**	General trends of variation of electronic configuration, elemental forms, metallic nature, magnetic properties (if any),catenation and catalytic properties (if any), oxidation states, inert pair effect (if any), aqueous and redox chemistry in common oxidation states, properties and reactions of important compounds such hydrides, halides, oxides, oxyacids(if any), complex chemistry (if any) in respect of the following elements: (i) s-block elements: Li-Na-K, Be-Mg-Ca-Sr-Ba. (ii) p-block elements: B-Al-Ga-In-Tl, C-Si-Ge-Sn-Pb, N-P-As-Sb-Bi, O-S-Se-Te, F-Cl-Br-I, He-Ne-Ar-Kr-Xe	**5** **15** **Total 20**	**July to Pre-puja**
		CHT 21b Unit II	Solubility product principle, common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulfides, phosphates, carbonates, sulfates and halides. Ion-electron method of balancing equation of redox reaction. Elementary idea on standard redox potentials withsign conventions, Nernst equation (without derivation). Influence of complex formation, precipitation and change ofpH on redox potentials; formalpotential.	**7** **8** **Total 15**	**post-Puja to Winter vacation**
			Feasibility of a redox titration, redox potential at the equivalence point, redox indicators. Redox potential diagram(Latimer and Frost diagrams) of common elements and their applications. Disproportionation and comproportionation reactions (typical examples).	**15** **Total 15**	**post-Winter Vacation to Test exam-ination**

Year	Paper	Unit	Topic	No. of lectures	Session
3	**V**	**CHT 31b Unit I**	18-electron rule and its applications to carbonyls (including carbonyl hydrides and carbonylates), nitrosyls, cyanides, and nature of bonding involved therein. Simple examples of metal-metal bonded compounds and metal clusters. Metal-olefin complexes: Zeises salt (preparation, structure and bonding), Ferrocene (preparation, structure and reactions). Hapticity(η) of organometallic ligands, examples of mono tri and penta-hapto cyclopentadienyl complexes. Simple examplesof fluxional molecules. Coordinative unsaturation: oxidative addition and insertionreactions. Homogeneous catalysis by organometallic compounds: hydrogenation, hydroformylation and polymerization of alkenes (Ziegler-Natta catalysis).	**5** **5** **5**	**July to Pre-puja**
		CHT 31b Unit II	Elements of life: essential major, trace and ultratrace elements. Basic chemical reactions in the biological systems and the role of metal ions (specially Na^{+}, K^{+}, Mg^{2+}, Ca^{2+}, $Fe^{3+/2+}$, $Cu^{2+/+}$ and Zn^{2+}). Metal ion transport across biological membrane: Na^{+}-ionpump, ionophores. Biological functions of hemoglobin and myoglobin, cytochromes and ferredoxins, carbonate bicarbonate bufferingsystem and carbonic anhydrase. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II.	**3** **6** **Total 24**	
			Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examplesonly), metal dependent diseases.	**2**	**Post Puja to Winter vacation**
		CHT 31c Unit I	Electrochemical methods: Conductometry, Potentiometry, pH-metry. Electrogravimetry, Coulometry. Spectrophotometry: Lambert-Beer law, Limits to Beer'slaw, Principle of spectrophotometric estimation of iron, manganese and phosphorous. Principles and instrumentations of atomic	**3** **2** **3**	

			absorption andatomic emission spectrometry; estimation of sodium and potassium in water samples. Ion exchange resins and their exchange capacities, principle and simple applications of ionexchange separation. Chromatographic separations: General description and classification of chromatographic methods, thin layer, paperand column chromatographic techniques and their simple applications, Rf-values and their significance, elution in column chromatography, migration rates of solutes, band broadening and column efficiency, column resolution.	**5** **Total 15**	
		CHT 31c Unit II	Errors in chemical analysis: Accuracy and precision of measurements, determinate indeterminate, systematic and random errors in chemical analysis with examples, absolute and relative errors; source, effect and detection of systematicerrors; distribution of random errors, normal error curve, standard deviations, standard deviation of calculated results-sum or difference, product or quotient, significant figures, rounding and expressing results of chemical computations. Principles for determination of BOD, COD, DO, TDS, in water samples. Detection and estimation of As, Hg, Cd, Pb, NH^{4+}, and F^{-}, NO^{3-}, NO^{2-} in water sample. Detection, collection and principles of estimation of CO, NOx, SO_2, H_2S and SPMin air samples.	**8** **7** **Total 15**	**post-Winter vacation to Test exam-ination**

2^{nd} and 3^{rd} year (Honours) Practical (under 1+1+1 2016 system); Session 2018-19; Dr. Soumavo Ghosh

Year	Paper	Unit	Topic	No. of lectures	Session
2	**IVB**	**CHP 24a**	1. Iodometry/iodimetry: Vitamin C. 2. Permanganometry: Fe^{III} and Mn^{II} in a mixture. 3. Dichromatometry: Fe^{III} and Cu^{II} in a mixture; Fe^{III} andCr^{III} in a mixture. 4. Complexometry (EDTA): $CaCO_3$ and $MgCO_3$ in mixture;Mg^{II} and Zn^{II} in mixture.	**3x10**	**July to Pre-puja**
		CHP 24a	Analysis of at least 6 unknown samples by each student	**3x10** **Total 60**	
		-		**0**	**post-Puja to Test examination**

Year	Paper	Unit	Topic	No. of lectures	Session
3	-	-		**0**	**July to Pre-puja**
		-		**0**	**post-Puja to Test examination**

2nd and 3rd year (General) Theory (under 1+1+1 2016 system); Session 2018-19; Dr. Soumavo Ghosh

Year	Paper	Unit	Topic	No. of lectures	Session
2	**IIA**	**CGT 22b Unit I**	Acids-bases and solvents: Modern aspects of acids and bases: Arrhenius theory , theory of solvent system, Bronsted and Lowry's concept, Lewis concept with typical examples, applications and limitations. Strengths of acids and bases (elementary idea). Ionization of weak acids and bases in aqueous solutions, application of Ostwald's dilution law, ionization constants, ionic product of water, pH-scale, buffer solutions and their pH values, buffer actions; hydrolysis of salts. Solutions of electrolytes: Electrolytic conductance, specific conductance, equivalent conductance and molar conductance of electrolytic solutions. Influence of temperature and dilution on weak electrolytes.	**15** **5** **Total 20**	**July to Pre-puja**
		-	-	**0**	**post-Puja to Winter vacation**
		-	-	**0**	**post-Winter vacation to Test exam-ination**

Year	Paper	Unit	Topic	No. of lectures	Session
3	**IVA**	**CGT 31a Unit I**	Gravimetric Analysis: Solubility product and commonion effect. Requirements of gravimetry. Gravimetric estimation of chloride, sulphate, lead, barium, nickel, copper and zinc. Volumetric Analysis: Primary and secondary standardsubstances, principles of acid-base, oxidation – reduction, and complexometric titrations; acid-base, redox and metal-ion indicators. Principles of estimation of mixtures of $NaHCO_3$ and Na_2CO_3(by acidimetry); iron, copper, manganese, chromium (by redox titration); zinc, aluminum, calcium,magnesium (by complexometric EDTA titration).	**5** **5** **3** **Total 16**	**July to Pre-puja**
			Chromatographic methods of analysis: columnchromatography and thin layer chromatography.	**3**	**post-Puja to Winter vacation**
		CGT 31a Unit II	Accuracy and precision of quantitative analysis, determinate-, indeterminate-, systematic- and random-errors. Methods of least squares and standard deviations.	**3** **2** **Total 8**	
			General introduction to computers, different components of a computer, hardware and software, input and output devices, binary numbers and arithmetic. Introduction to computer languages, programming and operating systems.	**6** **Total 6**	**post-Winter vacation to Test exam-ination**

2nd and 3rd year (General) Practical (under 1+1+1 2016 system); Session 2018-19; Dr. Soumavo Ghosh

Year	Paper	Unit	Topic	No. of lectures	Session
2	**IIIB**	**CGP 24**	Qualitative Analysis of Inorganic Mixtures: Experiments A: Preliminary Tests for Acid and Basic radicals in given samples. Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Acid Radicals: Cl^-, Br^-, I^-, NO_2^{1-}, S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	**11x3** **Total 33**	**July to Pre-puja**
		CGP 24	Analysis of at least 6 unknown samples by each student	**6x3** **Total 18**	**post-Puja to Winter vacation**
		CGP 24	Analysis of at least 6 unknown samples by each student	**6x3** **Total 18**	**post-Winter vacation to Test examination**
3	-	-	-	**0**	**July to Pre-puja**
		-	-	**0**	**post-Puja to Winter vacation**
		-	-	**0**	**post-Winter vacation to Test examination**

Lesson Plan: Department of Chemistry 2018-2019
Dr. Sharmila Bhattacharya

Semester/B. Sc. (1 +1+1)	Programme	Course and Name of the Paper	Topic	No. Of hours
Sem-1	Hons	CC1-1-TH: INORGANIC CHEMISTRY -1	**Extra nuclear Structure of atom** **Acid-Base reactions**	**14** **6**
		CC1-1-P	**INORGANIC CHEMISTRY: I (1) LAB: Acid and Base Titrations and Oxidation-Reduction Titrations**	**30**
	Gen		Total number of hours for CC1-1 (Theory+Practical)	20T + 30P
		CC1/GE1 TH	Atomic Structure Acids and bases	7 3
			Total number of hours for CC1-GE1 (Theory+Practical)	10
Sem-2	Hons		**Chemical Bonding-II**	**30**
		CC-2-4-P	**Iodo-/ Iodimetric Titrations, Estimation of metal content in some selective samples**	**45**
			Total number of hours for CC 2-4 (Theory+Practical)	30T + 45P

Year	Paper	Unit	Topic	No. of lectures	Session
3 Hons	**V CHT 31a**	**I**	**Chemistry of coordination compounds**	**20**	**July to pre-puja**
		II	**Chemistry of d- and f-block elements**	**4**	
	CHT 31d	**I**	**Gravimetric and titrimetric method of analysis**		**Post-puja to Text Examination**
		II	**Thermodynamics of dissolution**	**8**	
2 Hons	**IVA CHT 21a**	**II**	**Other types of bonding**	**4**	**July to pre-puja**
	CHT 21b	**I**	**Other types of bonding and Chemistry of s and p block elements** **Chemistry of s and p**		**Post-puja to Winter recess** **Post winter recess to Test**

			block elements		**Examination**
	IVB CHP 24a	**I**	**(i) Iodometric/Iodimetry: Vitamine C** **(ii) Permanganometry: Fe^{3+} and Mn^{2+} in a mixture** **(iii) Dichromatometry: Fe^{3+} and Cu^{2+} in a mixture; Fe^{3+} and Cr^{6+} in a mixture** **(iv) Complexometry (EDTA): $CaCO_3$ and $MgCO_3$ in a mixture; Mg^{2+} and Zn^{2+} in a mixture**	**4** **8** **16**	**July to pre-puja** **Post puja to winter recess** **Post winter recess to Test Examination**
3 Gen	**IVA CGT 31c** **CGP 32**	**I**	**Environmental chemistry** **Environmental chemistry** **(i) Estmation of Na_2CO_3 and $NaHCO_3$ in a mixture** **(ii) Estmation of HCl and CH_3COOH in a mixture** **(iii) Determination of total hardness of water by EDTA titration** **(iv) To find the pH of an unknown solution by comparing**		**July to pre-puja** **Post-puja to Test Examination** **July to Test Examination**

			colour (v) Determination of rate constant for the acid catalysed hydrolysis of an ester (vi) Determination of strength of H_2O_2 sample (vii) Determination of solubility of a sparingly soluble salt		
2 Gen	**CGT 21b**	**I**	**Principles of qualitative inorganic analysis**	**4**	**July to pre-puja**
		II	**Basic inorganic chemistry**	**4**	**Post-puja to winter recess**
	CGP 24	**III**	**Qualitative analysis of inorganic mixture**	**60**	**July to Test Examination**