



Ref.No.-.....

Session: 2022-2023

Date-30.07.2022

### Syllabus and Study Modules for the Department of Chemistry (odd semester)

#### 1st Semester (Hons.)

Course Title (Prac./Theo.)	Course Code	Subject Topics	Teacher's Name	Classes/week	Curriculum Delivery
Organic Chemistry-I (Theo)	CC-1	1. Valence Bond Theory 2. Electron displacement Stereochemistry	Dr.N.Saha	1	1. Theory classes 2. Practical classes 3. Internal Assessments are arranged for every course code. 4. ICT class on kinetic theory of gases
		3. MO theory 4. Physical properties 5. Mechanistic classification: 6. Reactive intermediates 7. Bonding geometries of carbon compounds and representation of molecules 8. Concept of chirality and symmetry 9. Relative and absolute configuration 10. Optical activity of chiral compounds	Prof.S. Marick	1	
Organic Chemistry-I (Prac)	CC-1	1. Separation Technique 2. Determination of boiling point 3. Identification of a Pure Organic Compound by Chemical Test(s)	Prof.S. Marick	4	

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Physical Chemistry-I (Theo)	CC-2	<ol style="list-style-type: none"> <li>1. Kinetic Theory of gases</li> <li>2. Maxwell's distribution of speed and energy</li> <li>3. Real gas and virial equation</li> <li>4. Zeroth and 1st law of Thermodynamics:</li> <li>5. Thermochemistry</li> <li>6. Second Law</li> <li>7. Thermodynamic relations</li> <li>8. Rate law, order and molecularity</li> <li>9. Role of Temperature and theories of reaction rate</li> <li>10. Homogeneous catalysis</li> <li>11. Autocatalysis</li> </ol>	Prof.R. Mondal	1
			Prof.A.De	1
Physical Chemistry-I (Prac)	CC-2	<ol style="list-style-type: none"> <li>1. Determination of pH of unknown solution (buffer), by color matching method;</li> <li>2. Determination of the reaction rate constant of hydrolysis of ethyl acetate in the presence of an equal quantity of sodium hydroxide;</li> <li>3. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate;</li> <li>4. Study of kinetics of decomposition of <math>H_2O_2</math> by KI;</li> <li>5. Determination of solubility product of <math>PbI_2</math> by titrimetric method.</li> </ol>	Prof.A.De	4

## 1st Semester (General)

Course Title (Prac./Theo.)	Course Code	Subject Topics	Teacher's Name	Classes /week	Curriculum Delivery
Generic Elective-1 (Theo.)	CC-1A/ GE-1	<ol style="list-style-type: none"> <li>1. Atomic Structure,</li> <li>2. Chemical Periodicity,</li> <li>3. Acids And Bases,</li> <li>4. Redox Reactions,</li> </ol>	Prof.A. De	1	<ol style="list-style-type: none"> <li>1. Theory classes</li> <li>2. Practical</li> </ol>

		<ol style="list-style-type: none"> <li>1. Fundamentals of Organic Chemistry</li> <li>2. Stereochemistry</li> <li>3. Nucleophilic Substitution and Elimination Reactions</li> <li>4. Aliphatic Hydrocarbons</li> <li>5. Alkanes, Alkenes, Alkynes</li> </ol>	<b>Dr.N.Saha</b>	<b>1</b>	<p>classes</p> <p>3. Internal Assessments are arranged for every course code.</p> <p>4. ICT class.</p>
<b>Generic Elective-1 (Prac.)</b>	<b>CC-1A/GE-1</b>	<ol style="list-style-type: none"> <li>1. Estimation of oxalic acid by titrating with <math>\text{KMnO}_4</math>.</li> <li>2. Estimation of Mohr's salt by titrating with <math>\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7</math>.</li> <li>3. Estimation of <math>\text{Fe}(\text{II})</math> ions by titrating with <math>\text{K}_2\text{Cr}_2\text{O}_7</math> using internal indicator.</li> </ol>	<b>Prof. S. Marick</b>	<b>2</b>	
		<p>Qualitative Analysis of Single Solid Organic Compound(s)</p> <ol style="list-style-type: none"> <li>1. Detection of special elements (N, Cl, and S) in organic compounds.</li> <li>2. Solubility and Classification (solvents: <math>\text{H}_2\text{O}</math>, dil. HCl, dil. NaOH)</li> <li>3. Detection of functional groups: Aromatic- <math>\text{NO}_2</math>, Aromatic- <math>\text{NH}_2</math>, <math>-\text{COOH}</math>, carbonyl (no distinction of <math>-\text{CHO}</math> and <math>&gt;\text{C}=\text{O}</math> needed), <math>-\text{OH}</math> (phenolic) in solid organic compounds.</li> </ol>	<b>Prof.A.De</b>	<b>2</b>	

### 3rdSemester(Hons.)

Course Title (Prac./Theo.)	Course Code	Subject Topics	Teacher's Name	Classes /week	Curriculum Delivery
Physical Chemistry-II (Theo)	CC-5	1. Fick's law 2. Viscosity 3. Conductance and transport number 4. Transport number 5. Partial properties and Chemical potential 6. Chemical Equilibrium 7. Nernst's distribution law 8. Chemical potential and other properties of ideal substances 9. Beginning of Quantum Mechanics 10. Wavefunction 11. Concept of Operators 12. Particle in a box 13. Simple Harmonic Oscillator	Prof. A. De	1	1. Theory classes 2. Practical classes 3. Internal Assessments are arranged for every course code. 4. Project work taken on transport process and quantum mechanics. 5. ICT classes on Nuclear reaction and conductance.
		Prof. R. Mondal	1		
Physical Chemistry-II (Prac)	CC-5	1. Study of viscosity of unknown liquid (glycerol, sugar) with respect to water. 2. Determination of partition coefficient for the distribution of I <sub>2</sub> between water and CCl <sub>4</sub> . 3. Determination of K <sub>eq</sub> for KI + I <sub>2</sub> ⇌ KI <sub>3</sub> , using partition coefficient between water and CCl <sub>4</sub> . 4. Conductometric titration of an acid (strong, weak/monobasic, dibasic) against strong base. 5. Study of saponification reaction conductometrically. 6. Verification of Ostwald's dilution law and determination of K <sub>a</sub> of weak acid.	Prof. R. Mondal	4	
Inorganic Chemistry-II (Theo)	CC-6	1. Ionic bond: 2. Covalent bond 3. Molecular orbital concept of bonding 4. Metallic Bond: 5. Weak Chemical Forces 6. Nuclear stability and nuclear binding energy 7. Nuclear Reactions 8. Radiochemical methods	Prof. P. Halder	2	

<b>Inorganic Chemistry-II (Prac)</b>	<b>CC-6</b>	<ol style="list-style-type: none"> <li>1. Estimation of Cu(II).</li> <li>2. Estimation of Vitamin C.</li> <li>3. Estimation of arsenite by iodometric method.</li> <li>4. Estimation of Cu in brass.</li> <li>5. Estimation of Cr and Mn in Steel.</li> </ol>	<b>Prof.P. Halder</b>	<b>4</b>	
<b>Organic Chemistry-III (Theo)</b>	<b>CC-7</b>	<ol style="list-style-type: none"> <li>1. Chemistry of alkenes and alkynes</li> <li>2. Aromatic Substitution</li> <li>3. Carbonyl and Related Compounds</li> <li>4. Organometallics</li> </ol>	<b>Dr.N.Saha</b>	<b>1</b>	
			<b>Prof.S. Marick</b>	<b>1</b>	
<b>Organic Chemistry-III (Prac)</b>	<b>CC-7</b>	<p>Qualitative Analysis of Single Solid Organic Compounds</p> <ol style="list-style-type: none"> <li>1. Detection of special elements (N, S, Cl, Br) by Lassaigne's test</li> <li>2. Solubility and classification (solvents: H<sub>2</sub>O, 5% HCl, 5% NaOH and 5% NaHCO<sub>3</sub>)</li> <li>3. Detection of the following functional groups by systematic chemical tests:</li> <li>4. aromatic amino (-NH<sub>2</sub>), aromatic nitro (-NO<sub>2</sub>), amido (-CONH<sub>2</sub>, including imide), phenolic -OH, carboxylic acid (-COOH), carbonyl (-CHO and &gt;C=O); only one test for each functional group is to be reported.</li> <li>5. Melting point of the given compound</li> <li>6. Preparation of one derivative of the given sample</li> </ol>	<b>Dr.N.Saha</b>	<b>4</b>	
<b>Basic analytical chemistry</b>	<b>SEC-1</b>	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Analysis of soil</li> <li>3. Analysis of water</li> <li>4. Analysis of food products</li> <li>5. Chromatography</li> <li>6. Ion-exchange</li> <li>7. Analysis of cosmetics</li> </ol>	<b>Prof.P. Halder</b>	<b>1</b>	

### 3rdSemester(General)

Course Title (Prac./Theo.)	Course Code	Subject Topics	Teacher's Name	Classes /week	Curriculum Delivery
Generic Elective-3 (Theo)	CC-1C/ GE-3	1. Chemical Energetics 2. Chemical Equilibrium 3. Ionic Equilibria	Prof. R. Mondal	1	1. Theory classes 2. Practical classes 3. Internal Assessments are arranged for every course code. 4. ICT class on aromatic hydrocarbon.
		1. Aromatic Hydrocarbons 2. Organometallic Compounds 3. Aryl Halides 4. Alcohols, Phenols and Ethers 5. Carbonyl Compounds	Prof. S. Marick	1	
Generic Elective-3 (Prac)	CC-1C/ GE-3	1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH meter and compare it with the indicator method. 2. Preparation of buffer solutions and find the pH of an unknown buffer solution by colour matching method 3. Study of the solubility of benzoic acid in water.	Prof. R. Mondal	2	
		1. Solid compounds: oxalic acid, succinic acid, resorcinol, urea, glucose, benzoic acid and salicylic acid. 2. Liquid Compounds: acetone, aniline and nitrobenzene.	Prof. S. Marick	1	

## 5thSemester(General)

Course Title (Prac./Theo.)	Course Code	Subject Topics	Teacher's Name	Classes /week	Curriculum Delivery
Basics & Application of Computer in Chemistry	SEC-3	1. Fundamentals 2. Uncertainty in measurement 3. Differential calculus 4. Computer Programming	Prof.R. Mondal	1	1. Theory classes 2. Practical classes 3. Internal Assessments are arranged for every course code. 4. ICT class.
DSE-1A(Theo)	DSE-1A	1. Transition Elements(3d series) 2. Coordination Chemistry 3. Crystal Field Theory	Prof.P. Halder	1	
		1. Error Analysis and Computer Applications 2. Industrial Chemistry	Prof.S. Marick	1	
DSE-1A(Prac)	DSE-1A	1. Gravimetric and Complexometric estimation of metals ions 2. Preparation of any two of the following complexes and measurement of their conductivity 3. Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl <sub>2</sub> and LiCl <sub>3</sub> . 4. Titration of Na <sub>2</sub> CO <sub>3</sub> and NaHCO <sub>3</sub> mixture vs. HCl using phenolphthalein and methyl orange indicators. 5. Titration of HCl and CH <sub>3</sub> COOH mixture vs. NaOH using two different indicators to find the composition. 6. Estimation of the total hardness of water sample by EDTA titration. 7. Estimation of available oxygen in pyrolusite.	Dr.N.Saha	2	



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Date-12.04.2023

### Syllabus and Study Modules for the Department of Chemistry (even semester)

#### 2<sup>nd</sup> Semester (General)

Course Title (Prac./Theo.)	Course Code	Subject Topics	Teachre's Name	Classes / Week	Curriculum Delivery
<b>Generic Elective -2: States of Matter &amp; chemical Kinetics, Chemical Bonding &amp; Molecular Structure, P-Block Elements (Theo)</b>	<b>CC-1B/GE-2 (T)</b>	<b>Inorganic Chemistry</b> 1. Chemical Bonding and Molecular Structure 2. Comparative study of p-block elements	<b>Prof. S. Marick</b>	1	1. Theory classes 2. Practical classes 3. Internal Assessments were arranged for every course code 4. ICT class on comparative study on p-block
		<b>Physical Chemistry</b> 1. Kinetics Theory of Gases and Real gases 2. Liquids 3. Solids 4. Chemical Kinetics	<b>Prof. R. Mondal</b>	1	
<b>Generic Elective -2: States of Matter &amp; chemical Kinetics, Chemical Bonding &amp; Molecular Structure, P-Block Elements (Prac)</b>	<b>CC-1B/GE-2 (Prac)</b>	<b>Inorganic Chemistry</b> Qualitative semi-micro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.	<b>Prof. S. Marick</b>	2	
		<b>Physical Chemistry</b> 1. Surface tension measurement (use of organic solvents excluded) 2. Viscosity measurement (use of organic solvents excluded)	<b>Prof. R. Mondal</b>	2	



		3. Study the kinetics of the following reactions			
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**4<sup>th</sup> Semester (Hons.)**

<b>Course Title (Prac./ Theo.)</b>	<b>Course Code</b>	<b>Subject Topics</b>	<b>Teachre's Name</b>	<b>Classe s/ Week</b>	<b>Curriculum Delivery</b>
<b>Physical Chemistry- III (Theo)</b>	<b>CC-8</b>	1.Application of Thermodynamics - II 2.Electrical Properties of molecules 3.Quantum Chemistry	<b>Prof. R. Mondal</b>	<b>1</b>	1. Theory classes 2. Practical classes 3. Internal Assessments were arranged for every course code. 4. Project taken on colligative properties and spectroscopy. 5. ICT class on Coordination Chemistry-I
			<b>Prof. A.K.De</b>	<b>1</b>	
<b>Physical Chemistry- III (Prac)</b>	<b>CC-8</b>	.List of Practical 1. Determination of solubility of sparinglysoluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator). 2. Potentiometric titration of Mohr's saltsolution against standard K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> solution. 3. Determination of K <sub>sp</sub> for AgCl by potentiometric titration of AgNO <sub>3</sub> solutionagainst standard KCl solution. 4. Effect of ionic strength on the rate of Persulphate - Iodide reaction. 5. Study of phenol-water phase diagram.	<b>Prof. R. Mondal</b>	<b>2</b>	
			<b>Prof. A.K.De</b>	<b>2</b>	
<b>Inorganic Chemistry-III (Theo)</b>	<b>CC-9</b>	1.General Principles of Metallurgy 2.Chemistryof s and p Block Elements3.Noble Gases 4. Inorganic Polymers 5. Coordination Chemistry-I	<b>Prof. P. Halder</b>	<b>2</b>	
<b>Inorganic Chemistry-III (Prac)</b>	<b>CC-9</b>	1. Complexometric titration 2. Inorganic preparations	<b>Prof. A.K.De</b>	<b>4</b>	
<b>Organic Chemistry- IV (Theo)</b>	<b>CC-10</b>	1.Nitrogen compounds2.Rearrang ements3.The Logic of Organic Synthesis 4.Organic Spectroscopy	<b>Dr. N. Saha</b>	<b>1</b>	
			<b>Prof. S. Marick</b>	<b>1</b>	
<b>Organic Chemistry- IV (Prac)</b>	<b>CC-10</b>	1.List of Practical 1. Estimation of glucose by titration using Fehling's solution	<b>Prof. S. Marick</b>	<b>2</b>	

		<ol style="list-style-type: none"> <li>2. Estimation of vitamin-C (reduced)</li> <li>3. Estimation of aromatic amine (aniline) by bromination (Bromate-Bromide) method</li> <li>4. Estimation of phenol by bromination (Bromate-Bromide) method</li> <li>5. Estimation of formaldehyde (Formalin)</li> <li>6. Estimation of acetic acid in commercial vinegar</li> <li>7. Estimation of urea (hypobromite method)</li> <li>8. Estimation of saponification value of oil/fat/ester.</li> </ol>	<b>Dr. N. Saha</b>	<b>2</b>	
<b>Pharmaceutical Chemistry</b>	<b>SEC-2</b>	<ol style="list-style-type: none"> <li>1. Drugs &amp; Pharmaceuticals</li> <li>2. Fermentation</li> </ol>	<b>Dr. N. Saha</b>	<b>1</b>	

Course Title (Prac./ Theo.)	Course Code	Subject Topics	Teacher's Name	Classes/ Week	Curriculum Delivery
Generic Elective -4: Solutions, Phase Equilibria, Conductance, Electrochemistry & Analytical and Environmental Chemistry (Theo)	CC-1D	<b>Physical Chemistry</b> 1. Solutions 2. Phase Equilibria 3. Conductance 4. Electromotive force	Prof. A.K.De	1	1. Theory classes 2. Practical classes 3. Internal Assessments were arranged for every course code. 4. Project taken on solution. 5. ICT class on conductance.
		<b>Analytical and Environmental Chemistry</b> 1. Chemical Analysis 2. Environmental Chemistry	Dr. N. Saha	1	
Generic Elective -4: Solutions, Phase Equilibria, Conductance, Electrochemistry & Analytical and Environmental Chemistry (Prac)	CC-1D	<b>Physical Chemistry</b> 1. Distribution Law  2. Conductance 3. Potentiometry	Prof. R. Mondal	2	
		<b>Analytical and Environmental Chemistry</b> 1. To find the total hardness of water by EDTA titration. 2. 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. 3. To determine the rate constant for the acid catalysed hydrolysis of an ester. 4. Determination of the strength of the H <sub>2</sub> O <sub>2</sub> sample. 5. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)	Prof. P. Halder	2	

<b>Pharmaceuticals Chemistry</b>	<b>SEC-2</b>	<b>Pharmaceuticals Chemistry</b> Drugs & Pharmaceuticals	<b>Dr. N. Saha</b>	<b>1</b>	
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Course Title (Prac./Theo.)	Course Code	Subject Topics	Teacher's Name	Classes/Week	Curriculum Delivery
Inorganic Chemistry-V (Theo)	CC-13	<ol style="list-style-type: none"> <li>Bioinorganic Chemistry</li> <li>Organometallic Chemistry</li> <li>Catalysis by Organometallic Compounds Study of the following industrial processes               <ol style="list-style-type: none"> <li>Alkene hydrogenation (Wilkinson's Catalyst)</li> <li>Hydroformylation</li> <li>Wacker Process</li> <li>Synthetic gasoline (Fischer Tropsch reaction)</li> <li>Ziegler-Natta catalysis for olefin polymerization.</li> </ol> </li> <li>Reaction Kinetics and Mechanism</li> </ol>	Dr. N. Saha	1	<ol style="list-style-type: none"> <li>Theory classes</li> <li>Practical classes</li> <li>Internal Assessments were arranged for every course code.</li> </ol>
Inorganic Chemistry-V (Prac)	CC-13	<b>Qualitative semimicro analysis</b> Qualitative semimicro analysis of mixtures containing four radicals. Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition. Cation Radicals: Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup> , Al <sup>3+</sup> , Cr <sup>2+</sup> , Mn <sup>2+</sup> /Mn <sup>4+</sup> , Fe <sup>3+</sup> , Co <sup>2+</sup> /Co <sup>3+</sup> , Ni <sup>2+</sup> , Cu <sup>2+</sup> , Zn <sup>2+</sup> , Pb <sup>2+</sup> , Cd <sup>2+</sup> , Bi <sup>3+</sup> , Sn <sup>2+</sup> /Sn <sup>4+</sup> , As <sup>3+</sup> /As <sup>5+</sup> , Sb <sup>3+</sup> /Sb <sup>5+</sup> , NH <sub>4</sub> <sup>+</sup> , Mg <sup>2+</sup> . Anion Radicals: F <sup>-</sup> , Cl <sup>-</sup> , Br <sup>-</sup> , BrO <sub>3</sub> <sup>-</sup> , I <sup>-</sup> , IO <sub>3</sub> <sup>-</sup> , SCN <sup>-</sup> , S <sub>2</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , AsO <sub>4</sub> <sup>3-</sup> , BO <sub>3</sub> <sup>3-</sup> , CrO <sub>4</sub> <sup>2-</sup> /Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup> , Fe(CN) <sub>6</sub> <sup>4-</sup> , Fe(CN) <sub>6</sub> <sup>3-</sup> . Insoluble Materials: Al <sub>2</sub> O <sub>3</sub> (ig), Fe <sub>2</sub> O <sub>3</sub> (ig), Cr <sub>2</sub> O <sub>3</sub> (ig), SnO <sub>2</sub> , SrSO <sub>4</sub> , BaSO <sub>4</sub> , CaF <sub>2</sub> , PbSO <sub>4</sub> .	Dr. N. Saha	2	4. ICT class on biogas
			Prof. P. Halder	2	
Physical Chemistry-IV (Theo)	CC-14	<ol style="list-style-type: none"> <li>Molecular Spectroscopy</li> <li>Photochemistry</li> <li>Surface phenomenon</li> </ol>	Prof. R. Mondal	1	
			Prof. A.K.De	1	
Physical Chemistry-IV (Prac)	CC-14	<ol style="list-style-type: none"> <li>Determination of surface tension of a liquid using Stalagmometer.</li> <li>Determination of CMC from surface tension measurements.</li> <li>Verification of Beer and Lambert's Law for KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.</li> <li>Determination of pH of unknown buffer, spectrophotometrically</li> </ol>	Prof. R. Mondal	2	
			Prof. A.K.De	2	
Green Chemistry (Theo)	DSE-3	<ol style="list-style-type: none"> <li>Principles and applications</li> <li>Examples of Green Synthesis/ Reactions and some real world cases</li> <li>Future scope</li> </ol>	Dr. N. Saha	1	
			Prof. S. Marick	1	
Green Chemistry (Prac)	DSE-3	<ol style="list-style-type: none"> <li>Preparation of propene by two methods can be studied</li> <li>Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.</li> <li>Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.</li> <li>Photoreduction of benzophenone to</li> </ol>	Dr. N. Saha	2	
			Prof. S. Marick	2	

		benzopinacol in the presence of sunlight.			
Dissertation followed by power point presentation	<b>DSE-4</b>	Dissertation followed by power point presentation	<b>Prof. P. Halder</b>		1
Dissertation followed by power point presentation	<b>DSE-4</b>	Dissertation followed by power point presentation	<b>Prof. P. Halder</b>		2

**Coordinator, Chemistry Dept.**

**BBKM, Hooghly**

**(Principal)**

**BBKM, Hooghly**