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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : Dr. Ipsita Bhattacharya

PAPER : CC1

LECTURES ALLOTED: 12

ALLOTED SYLLABUS: Acid-Base

TOPIC/SUBTOPIC: **Acid-Base**	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
L-2	Acid-Base concept: Arrhenius concept, theory of solvent system (in H2O, NH3, SO2 and HF)
L-2	Bronsted-Lowry's concept, Solvent levelling and differentiating effects
L-2	Relative strength of acids
L-2	pH, buffer.Acid-base neutralisation curves; indicator, choice of indicators.
L-2	Acid-base equilibria in aqueous solution (Proton transfer equilibria in water)
L-2	LuxFlood concept, Lewis concept, group characteristics of Lewis acids, Thermodynamic acidity parameters,

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : Dr. Keya Ghosh

PAPER : ORGANIC CHEMISTRY-IB Theory

LECTURES ALLOTED: Stereochemistry I (17 Lectures) + General Treatment of Reaction Mechanism II (03 Lectures)

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
4L	Stereochemistry : Bonding geometries of carbon compounds and representation of molecules: tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying wedge and Newman projection formulae and their inter translations.
3L	Concept of chirality and symmetry: symmetry elements, molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of stereogenicity, chirotopicity and pseudoasymmetry;
3L	chiral centres and number of stereoisomerism: systems involving 1/2/3-chiral centre(s) (AA, AB, ABA and ABC types).
3L	Relative and absolute configuration: D/L and R/S descriptors; erythro/threo and meso nomenclature of compounds; syn/anti nomenclatures for aldols; E/Z descriptors for C=C, conjugated diene, triene, C=N and N=N systems; combination of R/S- and E/ Zisomerisms
4L	Optical activity of chiral compounds: optical rotation, specific rotation and molar rotation; racemic compounds, racemisation (through cationic, anionic, radical intermediates and through reversible formation of stable achiral intermediates); resolution of acids, bases and alcohols via diastereomeric salt formation; optical purity and enantiomeric excess; invertomerism of chiral trialkylamines.

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4L	General Treatment of Reaction Mechanism Reactive intermediates: carbocations (carbenium and carbonium ions), non-classical cabocations, carbanions, carbon radicals, carbenes: generation and stability, structure using orbital picture and electrophilic/nucleophilic behavior of reactive intermediates (elementary idea)

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : Dr. MONOJ KUMAR BARMAN

PAPER : CC1

LECTURES ALLOTED: 14

ALLOTED SYLLABUS: Redox Reactions

TOPIC/SUBTOPIC: **Redox Reactions**	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
L-4	Ion-electron method of balancing equation of redox reaction.Elementary idea on standard redox potentials with sign conventions, Nernst equation (without derivation). Influence of complex formation, precipitation and change of pH on redox potentials; formal potential.
L-4	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).
L-4	Solubility and solubility effect – common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulfides, phosphates, carbonates, sulfates and halides.
L-2	Electroanalytical methods: Basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : PARAMITA DAS

PAPER : CEMG-CC-1/GE 1

LECTURES ALLOTED: Theory: 20 Lectures

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
ORGANIC CHEMISTRY: O (1A) LAB (15 Lectures)	
6L	Fundamentalsof Organic Chemistry Electronic displacements: inductive effect, resonance and hyperconjugation; nucleophiles and electrophiles; reactive intermediates: carbocations, carbanions and free radicals.
4L	Stereochemistry Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (upto two carbon atoms); asymmetric carbon atom; interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, meso compounds; threo and erythro, D and L, cis and trans nomenclature; CIP Rules: R/S (only one chiral carbon atoms) and E/Z nomenclature.
6L	Nucleophilic Substitution and Elimination Reactions Nucleophilic substitutions: SN1 and SN2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : PARAMITA DAS

PAPER : CEMA-CC-1-2-P:

LECTURES ALLOTED: Practical: 15 Lectures

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC: Determination of boiling point of common organic liquid compounds	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
ORGANIC CHEMISTRY: O (1B) LAB (15 Lectures)	
	Determination of boiling point of common organic liquid compounds
1-4L	butyl alcohol, cyclohexanol, ethyl methyl ketone, cyclohexanone, benzaldehyde (Known sample)
5-8L	acetylacetone,isobutyl methyl ketone, isobutyl alcohol, acetonitrile, acetophenone (Known sample)
9-12L	Practice of unknown sample
13-15L	Practice of unknown sample

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : PARAMITA DAS

PAPER : CEMA-CC-1-1-P

LECTURES ALLOTED: Practical: 15 Lectures

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
ORGANIC CHEMISTRY: O (1A) LAB (15 Lectures)	
	Separation based upon solubility, by using common laboratory reagents like water (cold,hot), dil. HCl, dil. NaOH, dil. $NaHCO_3$, etc., of components of a binary solid mixture; purification of any one of the separated components by crystallization and determination of its melting point. The composition of the mixture should be of the following types [ANY THREE]:
1-4L	benzoic acid/naphthalene (Known sample); Benzoic acid/Benzophenone (Known sample)
5-8L	Benzoic acid/Anthracene (Known sample); Urea/Benzophenone (Known sample)
9-12L	p-chlorobenzoic acid/ benzophenone (Known sample); p-Nitrobenzoic acid/p-Aminobenzoic acid (Known sample);
13-15L	pNitrotolune/p-Anisidine (Known sample); p-toluidine/benzophenone (Known sample);

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : PARAMITA DAS

PAPER : CC1A

LECTURES ALLOTED: Theory: 20 Lectures

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
Basics of Organic Chemistry Bonding and Physical Properties (18 Lectures)	
4L	Valence Bond Theory: concept of hybridisation, shapes of molecules, resonance (including hyperconjugation); calculation of formal charges and double bond equivalent (DBE); orbital pictures of bonding (sp3 , sp2 , sp: C-C, C-N & C-O systems and s-cis and s-trans geometry for suitable cases).
6L	Electronic displacements: inductive effect, field effect, mesomeric effect, resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.
4L	MO theory: qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ*, π, π *, n – MOs; concept of HOMO, LUMO and SOMO; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6] annulenes; charged systems: 3-,4-,5-membered ring systems); Hückel's rules for aromaticity up to [8] annulene (including mononuclear heterocyclic compounds up to 6- membered ring); concept of antiaromaticity and homoaromaticity; non-aromatic molecules; Frost diagram (qualitative drawing).

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4L	Physical properties: influence of hybridization on bond properties: bond dissociation energy (BDE) and bond energy; bond distances, bond angles; concept of bond angle strain; melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments; relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation and heat of combustion data.
TOPIC/SUBTOPIC: General Treatment of Reaction Mechanism I (02 Lectures)	
2L	Mechanistic classification: ionic, radical and pericyclic (definition and example); reaction type: addition, elimination and substitution reactions (definition and example); nature of bond cleavage and bond formation: homolytic and heterolytic bond fission, homogenic and heterogenic bond formation; curly arrow rules in representation of mechanistic steps; reagent type: electrophiles and nucleophiles (elementary idea).

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Ipsita Bhattacharya

PAPER : CEMA-CC-3-6-TH

LECTURES ALLOTED: 19

ALLOTED SYLLABUS: Coordination Chemistry and Noble Gases

Subtopics division	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-2	Coordinate bonding: double and complex salts. Werner's theory of coordination complexes
3-6	Classification of ligands, Ambidentate ligands, chelates, Coordination numbers
7-8	IUPAC nomenclature of coordination complexes (up to two metal centers)
9-11	Isomerism in coordination compounds
12-13	constitutional and stereo isomerism
14-15	Geometrical and optical isomerism in square planar and octahedral complexes.
16	Occurrence and uses, rationalization of inertness of noble gases,
17	Clathrates; preparation and properties of XeF2, XeF4 and XeF6
18	Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF2 and XeF4). Xenon-oxygen compounds.
19	Molecular shapes of noble gas compounds (VSEPR theory)

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 5-GENERAL-DSE

NAME OF FACULTY : Dr. Ipsita Bhattacharya

PAPER : SEM5-CEMG-DSE-A2

LECTURES ALLOTED: 40

ALLOTED SYLLABUS: Inorganic material of industrial importance

TOPIC/SUBTOPIC: Inorganic material of industrial importance	
LEC. NO.	PROPOSED TOPICS TO BE TAUGHT
1-3	Glass: Glassy state and its properties, classification (silicate and non-silicate glasses).Manufacture and processing of glass.
4-5	Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.
6-8	Important clays and feldspar, ceramic, their types and manufacture.
9-11	Hightechnology ceramics and their applications, superconducting and semiconducting oxides
12-13	fullerenes carbon nanotubes and carbon fibre.
14-16	Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.
17-18	CLASS TEST
19-20	Different types of fertilizers. compound and mixed fertilizers
21-23	Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, potassium chloride, potassium sulphate. Surface Coatings
24-26	Surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings.Paints and pigments-formulation, composition and related properties.
27-29	Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents.

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30-31	Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives
32-33	Metallic coatings (electrolytic and electroless), metal spraying and anodizing.
34-35	Batteries: Primary and secondary batteries, battery components and their role, Characteristics of Battery.Working of following batteries:
35-36	Pb acid, Li-Battery, Solid state electrolyte battery
37-38	Fuel cells, Solar cell and polymer cell.
39-40	CLASS TEST

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 5-HONS.-DSE

NAME OF FACULTY : Dr. Ipsita Bhattacharya

PAPER : SEM5-CEMA-DSE-B1

LECTURES ALLOTED: 40

ALLOTED SYLLABUS: Inorganic material of industrial importance

TOPIC/SUBTOPIC: Inorganic material of industrial importance	
LEC. NO.	PROPOSED TOPICS TO BE TAUGHT
1-3	Glass: Glassy state and its properties, classification (silicate and non-silicate glasses).Manufacture and processing of glass.
4-5	Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.
6-8	Important clays and feldspar, ceramic, their types and manufacture.
9-11	Hightechnology ceramics and their applications, superconducting and semiconducting oxides
12-13	fullerenes carbon nanotubes and carbon fibre.
14-16	Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.
17-18	CLASS TEST
19-20	Different types of fertilizers. compound and mixed fertilizers
21-23	Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, potassium chloride, potassium sulphate. Surface Coatings
24-26	Surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings.Paints and pigments-formulation, composition and related properties.
27-29	Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents.

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30-31	Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives
32-33	Metallic coatings (electrolytic and electroless), metal spraying and anodizing.
34-35	Batteries: Primary and secondary batteries, battery components and their role, Characteristics of Battery.Working of following batteries:
35-36	Pb acid, Li-Battery, Solid state electrolyte battery
37-38	Fuel cells, Solar cell and polymer cell.
39-40	CLASS TEST

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DEPARTMENT OF

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : Dr. Keya Ghosh

PAPER : CC 8

LECTURES ALLOTED: 30

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
4L	Addition to C=O: structure, reactivity and preparation of carbonyl compounds; mechanism (with evidence), reactivity, equilibrium and kinetic control; formation of hydrates, cyanohydrins and bisulphite adduct; nucleophilic addition-elimination reactions with alcohols, thiolsand nitrogen-based nucleophiles;
4L	reactions: benzoin condensation, Cannizzaro and Tischenko reactions, reactions with ylides: Wittig and Corey-Chaykovsky reaction; Rupe rearrangement, Nucleophilic addition to α,β-unsaturated carbonyl system:general principle and mechanism (with evidence); direct and conjugate addition,
4L	specific enol equivalents (lithium enolates, enamines and silyl enol ethers) in connection with alkylation, acylation and aldol type reaction.
4L	condensations (mechanism with evidence): Aldol,Tollens', Knoevenagel, Claisen-Schmidt, Claisen ester including Dieckmann, Stobbe; Mannich reaction,Perkin reaction, Favorskii rearrangement; alkylation of active methylene compounds; preparation and synthetic applications of diethyl malonate and ethyl acetoacetate;
4 L	oxidations and reductions: Clemmensen, Wolff-Kishner, LiAlH4, NaBH4, MPV, Oppenauer, Bouveault-Blanc, acyloin condensation; oxidation of alcohols with PDC and PCC; periodic acid and lead tetraacetate oxidation of 1,2-diols. Exploitation of acidity of α-H of C=O: formation of enols and enolates; kinetic and thermodynamic enolates; reactions (mechanism with evidence):halogenation of carbonyl compounds under acidic and basic conditions, Hell-Volhard-Zelinsky (H. V. Z.) reaction, nitrosation, SeO2 (Riley) oxidation;

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10L	addition of enolates (Michael reaction), Stetter reaction, Robinson annulation. Substitution at sp2 carbon (C=O system): mechanism (with evidence): BAC2, AAC2, AAC1, AAL1 (inconnection to acid and ester); acid derivatives: amides, anhydrides & acyl halides (formation and hydrolysis including comparison). Organometallics(5 Lectures) Grignard reagent; Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behaviour of Grignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents; Reformatsky reaction; Blaise reaction; concept of umpolung.
TOPIC/SUBTOPIC:	
	CEMA-CC-3-7-P:(45 Lectures)
Aug 17th To end of Aug:	1. Estimation of glycine by Sörensen's formol method 2. Estimation of glucose by titration using Fehling's solution 3. Estimation of sucrose by titration using Fehling's solution 4. Estimation of aromatic amine (aniline) by bromination (Bromate-Bromide) method 5. Estimation of acetic acid in commercial vinegar 6. Estimation of urea (hypobromite method) 7. Estimation of saponification value of oil/fat/ester Reference Books 1. Bhattacharyya, R. C, A Manual of Practical Chemistr
September	A. Identification of a Pure Organic Compound Solid compounds: oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoic acid and salicylic acid
	Liquid Compounds: formic acid, acetic acid, methyl alcohol, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene B. Quantitative Estimations: Each student is required to perform all the experiments

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DEPARTMENT OF

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : Dr. Keya Ghosh.
PAPER : CC 12 [Sem 5]
LECTURES ALLOTED: 30 L
ALLOTED SYLLABUS: 30.

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
3L	Pericyclic reactions (08 Lectures) **Electrocyclic reactions: FMO approach involving 4π- and 6π-electrons (thermal and photochemical) and corresponding cycloreversion reactions.**
3L	Sigmatropic reactions:FMO approach,sigmatropic shifts and their order; [1,3] and [1,5] H shifts and [3,3] shifts with reference to Claisen and Cope rearrangements
2L	**Cycloaddition reactions: FMOapp**roach, Diels-Alder reaction, photochemical [2+2] cycloadditions.
3L	Carbohydrates Monosaccharides: Aldoses up to 6 carbons; structure of D-glucose & D-fructose (configuration & conformation); ring structure of monosaccharides (furanose and pyranose forms): Haworth representations and non-planar conformations; anomeric effect (including stereoelectronic explanation)
3L	mutarotation; epimerization; reactions (mechanisms in relevant cases): Fischer glycosidation, osazone formation, bromine water oxidation, HNO3 oxidation, selective oxidation of terminal –CH2OH of aldoses, reduction to alditols, Lobry de Bruyn-van Ekenstein rearrangement;.
4L	stepping–up (Kiliani-Fischer method) and stepping–down (Ruff's &Wohl's methods) of aldoses; end-group-interchange of aldoses; acetonide (isopropylidene and benzylidene protections; ring size determination
4L	; Fischer's proof of configuration of (+)-glucose. Disaccharides: Glycosidic linkages, concept of glycosidic bond formation by glycosyl donor-acceptor, structure of sucrose, inversion of cane sugar

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3L	Biomolecules Aminoacids:synthesis with mechanistic details: Strecker, Gabriel; acetamido malonic ester, azlactone, Bücherer hydantoin synthesis, synthesis involving diketopiperizine, isoelectric point, zwitterions; electrophoresis,
3L	reaction (with mechanism): ninhydrin reaction, Dakin-West reaction; resolution of racemic amino acids. Peptides:peptide linkage and its geometry;
4L	syntheses (with mechanistic details) of peptides using N-protection & C-protection, solid-phase (Merrifield) synthesis; peptide sequence: C-terminal and N-terminal unit determination (Edman, Sanger and 'dansyl'methods);
4L	partial hydrolysis; specific cleavage of peptides; use of CNBr. Nucleic acids:pyrimidine and purine bases (only structure & nomenclature); nucleosides and nucleotides corresponding to DNA and RNA;mechanism for acid catalysed hydrolysis of nucleosides (both pyrimidine and purine types); comparison of alkaline hydrolysis of DNA and RNA; elementary idea of double helical structure of DNA (Watson-Crick model); complimentary base–pairing in DNA.
TOPIC/SUBTOPIC: CEMA-CC-5-12-P:(45 Lectures)	
32L	A. Chromatographic Separations 1. TLC separation of a mixture containing 2/3 amino acids 2. TLC separation of a mixture of dyes (fluorescein and methylene blue) 3.Column chromatographic separation of mixture of dyes 4.Paper chromatographic separation of a mixture containing 2/3 amino acids 5. Paper chromatographic separation of a mixture containing 2/3 sugars B. Spectroscopic Analysis of Organic Compounds 1. Assignment of labelled peaks in the 1 H NMR spectra of the known organic compounds explaining the relative δ-values and splitting pattern.
18L	2. Assignment of labelled peaks in the IR spectrum of the same compound explaining the relative frequencies of the absorptions (C-H, O-H, N-H, C-O, C-N, C-X, C=C, C=O, N=O, C≡C, C≡N stretching frequencies; characteristic bending vibrations are included). 3. The students must record full spectral analysis of at least 15 (fifteen) compounds from the following list: (i) 4'-Bromoacetanilide (ii) 2-Bromo-4'-methylacetophenone (iii) Vanillin (iv) 2'-Methoxyacetophenone (v) 4-Aminobenzoic acid (vi) Salicylamide (vii) 2'- Hydroxyacetophenone (viii) 1,3-Dinitrobenzene (ix) trans-Cinnamic acid (x) Diethyl fumarate (xi) 4-Nitrobenzaldehyde (xii) 4'-Methylacetanilide (xiii) Mesityl oxide (xiv) 2-Hydroxybenzaldehyde (xv) 4-Nitroaniline (xvi) 2,3-Dimethylbenzonitrile (xvii) Pent- 41 1-yn-3-ol (xviii) 3-Nitrobenzaldehyde (xix) 3-Aminobenzoic acid (xx) Ethyl 3- aminobenzoate (xxi) Ethyl 4-aminobenzoate (xxii) 3-nitroanisole

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Manas Kumar Biswas

PAPER : CEMG-CC3/GE3-TH

LECTURES ALLOTED: 20

ALLOTED SYLLABUS: Chemical Bonding and Molecular Structure

TOPIC/SUBTOPIC: Covalent bonding	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	VB Approach
2	Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples.
3	Examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.
4	Concept of resonance and resonating structures in various inorganic and organic compounds.
5	MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals.
6	MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including idea of s- p mixing)
7	MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including idea of s- p mixing)
8	MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including idea of s- p mixing)
9	MO treatment of heteronuclear diatomic molecules such as CO, NO and NO^+.
10	MO treatment of heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches

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TOPIC/SUBTOPIC: Comparative study of p-block elements Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements:	
11	i) B-Al-Ga-In-Tl ii) C-Si-Ge-Sn-Pb iii) N-P-As-Sb-Bi
12	iv) O-S-Se-Te v) F-Cl-Br-I
TOPIC/SUBTOPIC: Transition Elements (3d series)	
13	General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.
14	Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only)
TOPIC/SUBTOPIC: Coordination Chemistry	
15	Werner's coordination theory, Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6).
16	Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.
TOPIC/SUBTOPIC: Ionic Bonding	
17	General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.
18	Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications.
19	Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment.
20	Dipole moment and percentage ionic character.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Manas Kumar Biswas

PAPER : CEMA-CC-3-6-P

LECTURES ALLOTED: 45

ALLOTED SYLLABUS: Practical (Inorganic)

TOPIC/SUBTOPIC: Complexometric titration	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-4	Zn(II)
5-8	Zn(II) in a Zn(II) and Cu(II) mixture.
9-12	Hardness of water.
13-16	Ca(II) and Mg(II) in a mixture.
17-20	Al(III) in Fe(III) and Al(III) in a mixture.
TOPIC/SUBTOPIC: Gravimetry	
21-24	Estimation of Ni(II) using Dimethylglyoxime (DMG).
25-28	Estimation of copper as CuSCN.
29-32	Estimation of Al(III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminiumoxinate).
33-36	Estimation of chloride.
TOPIC/SUBTOPIC: Chromatography of metal ions Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:	
37-40	Ni (II) and Co (II)
41-44	Fe (III) and Al (III)

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45	Discussion on student's queries.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Manas Kumar Biswas

PAPER : CEMA-CC-3-6-TH

LECTURES ALLOTED: 26

ALLOTED SYLLABUS: Chemistry of s and p Block Elements (Excluding Noble Gases)

TOPIC/SUBTOPIC: Chemistry of s and p Block Elements	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-2	Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation.
3-4	Hydrides and their classification ionic, covalent and interstitial.
5-6	Basic beryllium acetate and nitrate.
7-8	[Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.] Beryllium hydrides and halides.
9-10	Boric acid and borates, boron nitrides, borohydrides (diborane) and graphitic compounds.
11-12	Silanes, Oxides and oxoacids of nitrogen, phosphorus, sulphur and chlorine.
13-14	Peroxo acids of sulphur, sulphur-nitrogen compounds,
15-16	Interhalogen compounds, polyhalide ions, pseudohalogens, fluorocarbons and basic properties of halogens.
17-18	Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes.
19-20	Borazines, silicates
21-22	Silicates (rest) and phosphazenes.

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23-24	Review of whole topic. Discussion on student's queries.
25-26	Class test & Discussion.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : Dr. Manas Kumar Biswas

PAPER : CC 1

LECTURES ALLOTED: 14

ALLOTED SYLLABUS: Extra nuclear Structure of atom

TOPIC/SUBTOPIC: Extra nuclear Structure of atom	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-2	Quantum numbers and their significance
3-4	Schrödinger's wave equation, significance of ψ and ψ2.
5-6	Radial and angular wave functions for hydrogen atom.
7-8	Radial and angular distribution curves. Shapes of s, p, d and f orbitals.
9-10	Pauli's Exclusion Principle, Hund's rules and multiplicity
11-12	Exchange energy, Aufbau principle and its limitations
13-14	Ground state Term symbols of atoms and ions for atomic number up to 30.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY: Dr. Monoj Kumar Barman

PAPER: CC 6

LECTURES ALLOTED: 15 (Th) + 45 (Prac.)

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC: **Chemical periodicity**	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
L-5	Modern IUPAC Periodic table, Effective nuclear charge, screening effects and penetration, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii, lanthanide contraction.
L-5	Ionization potential, electron affinity and electronegativity (Pauling's, Mulliken's and Allred-Rochow's scales) and factors influencing these properties, group electronegativities.
L-5	Group trends and periodic trends in these properties in respect of s-, p- and d-block elements. Secondary periodicity, Relativistic Effect, Inert pair effect.
L-5	Question answers discussion, tutorial classes
TOPIC/SUBTOPIC: **CEMA-CC-3-6-P**	
L-20	Complexometric titration
L-16	Gravimetry
L-8	Chromatography of metal ions
L-12	Practice of practical as required

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY: Dr. Monoj Kumar Barman

PAPER: DSE-A2 (CEMG)

LECTURES ALLOTED: 20 (Th) + 45 (Prac.)

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
L-5	General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.
L-5	Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.
L-5	Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Composition and properties of different types of steels.
L-5	Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (Arand heat treatment, nitriding, carburizing).
TOPIC/SUBTOPIC: PRACTICALS-DSE A-2	
L-4	Determination of composition of dolomite (by complexometric titration)
L-4	Analysis of (Cu, Zn) in alloy
L-4	Determination of free acidity in ammonium sulphate fertilizer.
L-4	Estimation of phosphoric acid in superphosphate fertilizer.
L-4	Estimation of Calcium in Calcium ammonium nitrate fertilizer.
L-4	Analysis of (Cu, Ni) in alloy

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L-4	Analysis of Cement
L-4	Preparation of pigment (zinc oxide)
L-4	Electroless metallic coatings on ceramic and plastic material
L-10	Practice of practical as required

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DEPARTMENT OF

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY: Dr. Monoj Kumar Barman

PAPER: DSE-B1 (CEMA)

LECTURES ALLOTED: 20 (Th) + 45 (Prac.)

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
L-5	General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.
L-5	Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.
L-5	Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Composition and properties of different types of steels.
L-5	Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (Arand heat treatment, nitriding, carburizing).
TOPIC/SUBTOPIC: PRACTICALS-DSE B-1	
L-4	Determination of composition of dolomite (by complexometric titration)
L-4	Analysis of (Cu, Zn) in alloy
L-4	Determination of free acidity in ammonium sulphate fertilizer.
L-4	Estimation of phosphoric acid in superphosphate fertilizer.
L-4	Estimation of Calcium in Calcium ammonium nitrate fertilizer.
L-4	Analysis of (Cu, Ni) in alloy

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L-4	Analysis of Cement
L-4	Preparation of pigment (zinc oxide)
L-4	Electroless metallic coatings on ceramic and plastic material
L-10	Practice of practical as required

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Niladri Sekhar Karan

PAPER : CC 5

LECTURES ALLOTED: 20

ALLOTED SYLLABUS: Conductance and Transport Number, Chemical Equilibrium, Systems with Variable Composition

TOPIC/SUBTOPIC:	Conductance and Transport Number
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	Introduction about electrolytes, electricity due to ions in electrolytic solutions, ion-solvent interactions, factors for speed of ions, conductance, specific conductance and equivalent conductance
2	Change of conductance with dilution for strong and weak electrolytes with explanation, Equivalent conductance at infinite dilution.
3	Ionic conductances, Kohlrausch law of independent migration of ions, Ostwald dilution law
4	Debye- Huckel-Onsager theory
5	Application of conductometric measurements
6-7	Problems and solutions related to conductance
TOPIC/SUBTOPIC: Chemical Equilibrium	
8	Introduction, condition for equilibrium state, extent of reactions, advancement of reaction

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9	Concept of equilibrium constant from free energy, derivation of the relation between free energy and equilibrium constant
10	Definition of Kp, Kc and Kx. Derivation of their relations. Equilibrium constants for some typical gaseous, liquid phase and heterogenous reactions
11-14	Equilibrium constant and free energy change (The reaction isotherm, van't Hoff equation, Le-Chatelier's principle and its derivation, Nernst distribution law, solvent extractions
15	Problems related to chemical equilibrium
16-18	Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures
19-20	Change in thermodynamic functions in mixing of ideal gases, Activities and activity coefficients, Fugacity and fugacity coefficient.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 5

NAME OF FACULTY : Dr. Niladri Sekhar Karan

PAPER : DSE A2

LECTURES ALLOTED: 40

ALLOTED SYLLABUS: Introduction to Spreadsheet Software (MS Excel); Statistical Analysis

TOPIC/SUBTOPIC:	Introduction to Spreadsheet Software (MS Excel)
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-3	Creating a Spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents, simple calculations.
4-10	Solution of simultaneous equations (for eg: in chemical Equilibrium problems) using Excel **SOLVER** Functions. Use of Excel **Goal Seek** function. Examples of use of Goal Seek functions.
11-18	Numerical Modelling: Simulation of pH metric titration curves for strong acid vs strong base; weak acid vs strong base. Plot of first and second derivative for pH and potentiometric titrations.
19-25	Excel functions **LINEST** and Least Squares. Numerical Curve Fitting. Regression
25-30	Numerical Differentiation and Integration
TOPIC/SUBTOPIC: Statistical Analysis	
1-3	Gaussian Distribution and Errors in Measurement and their effect on data sets.
4-6	Descriptive Statistics using Excel
7-10	Statistical Significance Testing, the T test and the F test.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : Dr. Niladri Sekhar Karan

PAPER : CC 2

LECTURES ALLOTED: 12

ALLOTED SYLLABUS: Chemical Kinetics

TOPIC/SUBTOPIC:	Chemical Kinetics
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	Introduction about rate laws, Extent of reaction, order and molecularity, rate constants
2	Rate law for zeroth order reaction
3	Rate law for first order reaction
4	Rate law for second order reaction, nth order reaction.
5	Pseudo first order reaction.
6-7	Determination of order of the reaction by half life method, Differential Method, Rate determining step, steady state approximation
8-9	Opposing Reaction, Consecutive Reaction and Parallel Reaction
10-11	Temperature dependence of rate constant, Arrhenius Equation, Activation energy
12	Homogeneous Catalysis, Enzyme catalysis

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DEPARTMENT OF CHEMSITRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : PARAMITA DAS

PAPER : GE 3

LECTURES ALLOTED: 20

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
4L	Aromatic Hydrocarbons Benzene: Preparation: from phenol, by decarboxylation, from acetylene.
4L	Reactions: electrophilic substitution reaction (general mechanism); nitration (with mechanism), halogenations (chlorination and bromination), and
4L	Friedel-Crafts reaction (alkylation and acylation) (up to 4 carbons on benzene).
4L	Organometallic Compounds Introduction; Grignard reagents: Preparations (from alkyl and aryl halide); Reformatsky reaction.
4L	Aryl Halides Preparation: (chloro- and bromobenzene): from phenol, Sandmeyer reactionand effect of nitro substituent (activated nucleophilic substitution
TOPIC/SUBTOPIC:	

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : PARAMITA DAS

PAPER : SEC 2 (SEM 3 HONS)

LECTURES ALLOTED: 30L

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
ANALYTICAL CLINICAL BIOCHEMISTRY (30 Lectures)	
4L	Carbohydrates: Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations, Krebs cycle.
4L	Proteins: Classification, biological importance; Primary and secondary and tertiary structures of proteins: α-helix and β- pleated sheets, Isolation, characterization, denaturation of proteins.
4L	Enzymes: Nomenclature, Characteristics (mention of Ribozymes), and Classification; Active site, Mechanism of enzyme action, Stereospecificity of enzymes, Coenzymes and cofactors, Enzyme inhibitors, Introduction to Biocatalysis: Importance in "Green Chemistry" and Chemical Industry.
4L	Lipids: Classification. Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions and underlying applications.
2L	Lipoproteins: Properties, functions and biochemical functions of steroid hormones. Biochemistry of peptide hormones.
4L	Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation, Introduction to Gene therapy.
4L	Biochemistry of disease: A diagnostic approach by blood/ urine analysis. Blood: Composition and functions of blood, blood coagulation. Blood collection and preservation of samples.Anaemia, Regulation, estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubi

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4L	Urine: Collection and preservation of samples. Formation of urine.Composition and estimation of constituents of normal and pathological urine

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : PARAMITA DAS

PAPER : CC 3 (Sem 3 Hons)

LECTURES ALLOTED: 30L

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
Aromatic Substitution (10 Lectures)	
2L	Electrophilic aromatic substitution:mechanisms and evidences in favour of it; orientation and reactivity;
2L	reactions: nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction;
2L	one-carbonelectrophiles (reactions: chloromethylation, Gatterman-Koch, Gatterman, Houben-Hoesch,Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmitt); Ipso substitituion.
2L	Nucleophilic aromatic substitution:addition-elimination mechanism and evidences in favour of it
2L	SN1 mechanism; cine substitution (benzyne mechanism), structure of benzyne
Organometallics(5 Lectures)	
2L	Grignard reagent; Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates;
3L	Corey-House synthesis; abnormal behaviour of Grignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents; Reformatsky reaction; Blaise reaction; concept of umpolung.

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Chemistry of alkenes and alkynes (15 Lectures)	
2L	Addition to C=C:mechanism (with evidence wherever applicable), reactivity, regioselectivity (Markownikoff and anti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenation,
2L	hydrohalogenation, hydration, oxymercuration demercuration, hydroboration-oxidation, epoxidation, syn and anti-hydroxylation, ozonolysis, addition of singlet and triplet carbenes;
2L	Simmons-Smith cyclopropanation reaction; electrophilic addition to diene (conjugated dienes and allene);
2L	radical addition: HBr addition; mechanism of allylic and benzylic bromination in competition with brominations across C=C; use of NBS;
2L	Birch reduction of benzenoid aromatics; interconversion of E- and Z- alkenes; contra-thermodynamic isomerization of internal alkenes.
2L	Addition to C≡C (in comparison to C=C):mechanism, reactivity, regioselectivity(Markownikoff and anti-Markownikoff addition) and stereoselectivity;
2L	reactions:hydrogenation, halogenations, hydrohalogenation, hydration, oxymercuration demercuration, hydroboration-oxidation,
2L	dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity; interconversion of terminal and non-terminal alkynes.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : PARAMITA DAS

PAPER : CC 12 (SEM 5 HONS)

LECTURES ALLOTED: 26

ALLOTED SYLLABUS:

TOPIC/SUBTOPIC:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
Carbocyles and Heterocycles (16 lectures)	
2L	Polynuclear hydrocarbonsand their derivatives:synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook and other useful syntheses (with mechanistic details);
3L	fixation of double bonds and Fries rule;reactions (with mechanism) of naphthalene, anthraceneand phenanthrene and their derivatives.
2L	Heterocyclic compounds:Biological importance of heterocycles referred in the syllabus; 5- and 6-membered rings with one heteroatom; reactivity, orientation and important reactions (with mechanism) of furan, pyrrole,thiophene and pyridine;
2L	synthesis (including retrosynthetic approach and mechanistic details): pyrrole: Knorr synthesis, Paal-Knorr synthesis, Hantzsch; furan: Paal-Knorr synthesis,
2L	Feist-Benary synthesis and its variation; thiophenes: Paal-Knorr synthesis, Hinsberg synthesis;
4L	pyridine: Hantzsch synthesis;benzo-fused 5-and 6-membered rings with one heteroatom: reactivity, orientation and important reactions (with mechanistic details) of indole, quinoline and isoquinoline;
2L	synthesis (including retrosynthetic approachand mechanistic details): indole: Fischer,quinoline: Skraup, isoquinoline: Bischler Napieralski synthesis.
Cyclic Stereochemistry (10 Lectures)	

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4L	Alicyclic compounds:concept of I-strain (Baeyer's strain theory); conformational analysis: cyclohexane, mono and disubstituted cyclohexane; symmetry properties and optical activity; topomerisation; ring size and ease of cyclisation;
2L	conformation & reactivity in cyclohexane system: consideration of steric and stereoelectronic requirements; elimination (E2, E1), nucleophilic substitution (SN1, SN2, SNi, NGP),
2L	merged substitution-elimination; rearrangements; oxidation of cyclohexanol, esterification, saponification,
2L	lactonisation, epoxidation, pyrolytic syn elimination and fragmentation reactions.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : DR. PRASENJIT PANDEY

PAPER : CC5

LECTURES ALLOTTED: 25 (Theory)

ALLOTTED SYLLABUS:

TOPIC/SUBTOPIC: Chemical Thermodynamics	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
5L	1st law of Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics;Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities, calculations of q, w, ΔU and ΔH for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions; Joule's experiment and its consequence
5L	Thermochemistry: Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equations ; Adiabatic flame temperature.
10L	Second Law of Thermodynamics: Need for a Second law; statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Carnot engine and refrigerator; Kelvin – Planck and Clausius statements and equivalence of the two statements with entropic formulation; Carnot's theorem; Values of §dQ/T and Clausius inequality;Physical concept of Entropy; Entropy is a measure of the microscopic disorder of the system.

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	Entropy change of systems and surroundings for various processes and transformations; Entropy and unavailable work; Auxiliary state functions (G and A) and their variation with T, P and V. Criteria for spontaneity and equilibrium.
5L	Thermodynamic relations: Maxwell's relations; Gibbs- Helmholtz equation, Joule-Thomson experiment and its consequences; inversion temperature; Joule-Thomson coefficient for a van der Waals gas; General heat capacity relations

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : DR. PRASENJIT PANDEY

PAPER : CC11

LECTURES ALLOTTED: 10 (Theory) + 45 (Practical)

ALLOTTED SYLLABUS:

TOPIC/SUBTOPIC: Quantum Chemistry	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
5L	Simple Harmonic Oscillator: Setting up of One dimensional Schrödinger equation and discussion of solution and wave functions. Classical turning points, Expectation values of x, x^2, p_x and p_x^2 .
5L	Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component; Rigid rotator model of rotation of diatomic molecule; Schrödinger equation, transformation to spherical polar coordinates; Separation of variables. Spherical harmonics; Discussion of solution
TOPIC/SUBTOPIC: Computer programs (using FORTRAN) on numerical methods (Practical)	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
15L	Roots of equations (e.g. volume of van der Waals gas and comparison with ideal gas, pH of a weak acid)
15L	Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, Potentiometric titrations)

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15L	Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : DR. PRASENJIT PANDEY

PAPER : DSE-A2

LECTURES ALLOTTED: 20 (Theory)

ALLOTTED SYLLABUS:

TOPIC/SUBTOPIC: Computer Programming Basics (FORTRAN)	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
10L	Elements of FORTRAN Language. FORTRAN Keywords and commands, Logical and Relational Operators, iteration.
10L	Array variables, Matrix addition and multiplication. Function and Subroutine.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER

NAME OF FACULTY : DR. PRASENJIT PANDEY

PAPER : CC2

LECTURES ALLOTTED: 15 (Theory)

ALLOTTED SYLLABUS:

TOPIC/SUBTOPIC: Chemical Thermodynamics	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1L	Kinetic Theory of gases: Concept of pressure and temperature
2L	Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules)
2L	Wall collision and rate of effusion
7L	Maxwell's distribution of speed and energy: Nature of distribution of velocities, Maxwell's distribution of speeds in one, two and three dimensions; Kinetic energy distribution in one, two and three dimensions
1L	calculations of average, root mean square and most probable values in each case
1L	Calculation of number of molecules having energy $\geq \varepsilon$
1L	Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CEMG-CC-1/GE-1

LECTURES ALLOTED: 06

ALLOTED SYLLABUS: Inorganic:

TOPIC/SUBTOPIC: Atomic structure:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-2	Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model, Sommerfeld's model.
3-4	Quantum numbers and their significance, Pauli's exclusion principle, Hund's rule.
5-6	Electronic configuration of many-electron atoms, Aufbau principle and its limitations.
TOPIC/SUBTOPIC: Chemical Periodicity:	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-2	Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements.
3-4	Positions of hydrogen and noble gases. Atomic and ionic radii, ionization potential, electron affinity, and electronegativity.
5-7	Periodic and group-wise variation of above properties in respect of s- and p- block elements.
TOPIC/SUBTOPIC: Acids and Bases:	

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LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-2	Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and leveling solvents.
3-4	Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept.
5-7	Hard and soft acids and bases (HSAB concept), applications of HSAB process.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CC1/GE 1 Practical

LECTURES ALLOTED: 45

ALLOTED SYLLABUS: PHYSICAL CHEMISTRY: P (1) LAB

TOPIC/SUBTOPIC: Practical	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-8	Estimation of oxalic acid by titrating it with KMnO4.
9-16	Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.
17-24	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
25-31	Estimation of Cu (II) ions iodometrically using Na2S2O3.
32-38	Estimation of Fe (II) ions by titrating it with K2Cr2O7 using internal indicator.
39-45	Estimation of Fe(II) and Fe(III) in a given mixture using K2Cr2O7 solution.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CEMA-CC-1-2-TH

LECTURES ALLOTED: 08

ALLOTED SYLLABUS: Transport processes

TOPIC/SUBTOPIC: Covalent bonding	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	General features of fluid flow (streamline flow and turbulent flow); Newton's equation, viscosity coefficient.
2	Poiseuille's equation (with derivation).
3	Principle of determination of viscosity coefficient of liquids by falling sphere method and using Ostwald's viscometer
4	Temperature variation of viscosity of liquids and comparison with that of gases.
5	Relation between viscosity coefficient of a gas and mean free path.
6	Fick's law, Flux, force.
7	Phenomenological coefficients & their interrelationship (general form)
8	Different examples of transport properties

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TEACHING PLAN FOR SEMESTER 1

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CEMA-CC-1-2-P

LECTURES ALLOTED: 30

ALLOTED SYLLABUS: PHYSICAL CHEMISTRY: P (1) LAB

TOPIC/SUBTOPIC: LAB	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-6	Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator).
7-12	Study of viscosity of unknown liquid (glycerol, sugar) with respect to water.
13-18	Study of the variation of viscosity with the concentration of the solution.
19-24	Study of kinetics of decomposition of H2O2.
25-30	Study of kinetics of acid-catalyzed hydrolysis of methyl acetate.

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CC3/GE 3 Practical

LECTURES ALLOTED: 08

ALLOTED SYLLABUS: Qualitative semimicro analysis of mixtures containing two radicals. Emphasis should be given to the understanding of the chemistry of different reactions.

TOPIC/SUBTOPIC: Covalent bonding	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1-6	Dry T.T heating
7-12	Flame test
13-18	Borax bead test.
19-24	Dry test for acid radical
25-31	Interfering acid radical.
32-38	Wet test for basic radical.
39-45	Wet test for acid radical.

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TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CEMA-CC-3-5-TH

LECTURES ALLOTED: 08

ALLOTED SYLLABUS: Ionic equilibrium:

TOPIC/SUBTOPIC: Covalent bonding	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	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.
2	Dissociation constants of mono-, di-and triprotic acids (exact treatment).
3	Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH.
4	Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH for different salts (exact Treatment).
5	Relation between viscosity coefficient of a gas and mean free path.
6	Determination of hydrolysis constant conductometrically. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action.
7	Qualitative treatment of acid– base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.
8	Multistage equilibrium in polyelectrolyte systems; hydrolysis and hydrolysis constants.

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TEACHING PLAN FOR SEMESTER 3

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CEMA-CC-3-5-TH

LECTURES ALLOTED: 08

ALLOTED SYLLABUS: Electromotive Force:

TOPIC/SUBTOPIC: Covalent bonding	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	Rules of oxidation/reduction of ions based on half-cell potentials,; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement
2	Thermodynamic derivation of Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells.
3	Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants.
4	pH values,using hydrogen, quinone-hydroquinone and glass electrodes.
5	Relation between viscosity coefficient of a gas and mean free path.
6	Concentration cells with and without transference.
7	Liquid junction potential; determination of activity coefficients and transference numbers.
8	Potentiometric titrations (acid-base, redox, precipitation)

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DEPARTMENT OF CHEMISTRY

TEACHING PLAN FOR SEMESTER 5

NAME OF FACULTY : Dr. Srijita Basumallick

PAPER : CEMA-CC-5-11-TH

LECTURES ALLOTED: 20

ALLOTED SYLLABUS: Hydrogen atom and hydrogen like atom:

TOPIC/SUBTOPIC: Hydrogen atom and hydrogen-like ions	
LEC. NO.	PROPOSED TOPIC(S) TO BE TAUGHT
1	Setting up of Schrödinger equation in spherical polar coordinates, Separation of variables.
2	Separation of variables, Solution of angular Part (φ part only)
3	Application and problem related to wave function for H like atom.
4	Quantization of energy (only final energy expression).
5	Real wave functions.
6	Average and most probable distances of electron from nucleus.
7	Problems associated with average and most probable distance.
8	Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods.
9	Statement of variation theorem. Variation theorem.
10	Variation theorem and application to simple systems (particle-ina-box)
11	Variation theorem and application to simple systems (harmonic oscillator, hydrogen atom).
12	Born-Oppenheimer approximation.
13	Covalent bonding.

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14	Valence bond approach.
15	Molecular orbital approaches.
16	LCAO-MO treatment of H2+.
17	Bonding and anti-bonding orbitals.
18	Qualitative extension to H2.
19	Comparison of LCAO-MO and VB treatments of H2 and their limitations (only wave functions, detailed solution not required) and their limitations.
20	Problem