UNIVERSITY OF MUMBAI

TIME-TABLE OF POST- GRADUATE LECTURES FOR MSc-PART-I (SEMESTER-I) STUDENTS FOR THANEZONE

ACADEMIC YEAR 2018-2019

Co-Ordinator :Dr. V.B.Patil(8554954802)

Sr.No	Name	Day & Dates	Topic	30L
01	Prof. Ruby Kuriakose C.H.M.College 2.00p.m-4.00p.m 1.00p.m-5.00p.m 2.00p.m-6.00p.m	Mondays Aug: 20,27 Sep;10,24 Oct:1,8,15 Oct:,22 Oct:29 Nov: 26 Dec: 3	**PSCH 102 Paper-II: Unit – III** [15L] Material Chemistry and Nanomatrials **3.1** Solid State Chemistry **3.1.1** Electronic structure of solids and band theory,Fermi level, K space and Brillouin zones. **3.1.2** Structures of Compounds of the type: AB [Nickel arsenide(NiAs)],AB_2[Fluorite (CaF_2)] and antifluorite structures, rutile (TiO_2) structure and layered structure[Cadmium chloride and iodide($CdCl_2$, CdI_2)]. **3.1.3** Methods of preparation for inorganic solids: Cermic method, precursor method, sol-gel method(applications in Biosensors), microwave synthesis(discussion on principles, examples, merits and demerits are expected) **3.2** Nanomaterials **3.2.1** Preparative methods, solvothermal, combustion synthesis, microwave, co-precipitation, Langmuir Blodgett(L-B) method, biological methods: synthesis using microorganisms. **3.2.2** Applications in the field of semiconductors, solar cells. **UNIT IV** **Characterisation of Co-ordination compounds [15l]** 4.1 Formation , thermal studies, conductivity measurements, electronic, spectral and magnetic measurements, IR,NMR and ESR spectroscopic methods. 4.2 Spectral calculations using Orgel and Tanabe-Sugano diagram, calculation of electronic parameters such as Δ,B,C,Nephelauxetic ratio. 4.3 Determination of formation constants of metal complexes(Overall and stepwise): Comparative studies of potentiometric and spectral methods.	

02	Dr. Manisha Khemani C.H.M. College 4.00p.m-6.00p.m 5.00p.m-6.00p.m	Mondays Aug: 20,27 Sep;10,24 Oct:1,8,15 Oct:,22	**. PSCH103 Paper-III Unit -II** Nucleophilic substitution reactions and Aromaticity 2.1 Nucleophilic substitution reactions: (9L) 2.1.1 Aliphatic nucleophilic substitution: S_N^1, S_N^2, S_N^i reactions, mixed S_N^1& S_N^2 SET mechanisms S_N reactions involving NGP- participation by aryl rings, σand pi bonds. Factors affecting these reactions: substrate, nucleophilicity, solvent,steric effect, hard-soft interaction, leaving group. Ambident nucleophiles, S_N^cA,S_N^1 and S_N^2 reactions. S_N at sp^2(vinylic) carbon. 2.1.2.Aromatic nucleophilic substitution: S_NAr, S_N^1, benzyne mechanisms, Ipso, cine, tele and vicarious substitution. 2.1.3 Ester hydrolysis: Classification, nomenclature and study of all eight mechanisms of acid and base catalyzed hydrolysis with suitable examples. 2.2 **Aromaticity (6L)** 2.2.1 Structural, thermochemical, and magnetic criteria for aromaticity, including NMR characteristics of aromatic systems, Delocalization and aromaticity. 2.2.2 Application of HMO theory to monocyclic conjugated systems. Frost-Musulin diagrams. Huckel's (4n+ 2) and 4n rules. 2.2.3 Aromatic and antiaromatic compounds upto 18 carbon atoms. Homoaromatic compounds. Aromaticity of all benzenoid systems, heterocycles, metallocenes, azulenes, annulenes, aromatic ions and Fullerene (C_{60}). [Reference Books 4-15]	15L
03	Dr. Yogini B. C.H.M. College 2.00p.m-4.00p.m 2.00p.m-3.00p.m	Tuesdays Aug: 21,28 Sep:4,11,18,25 Oct:9 Oct:16	**PSCH102 Unit- I** **- Chemical Bonding (15L)** **1.1** Recapitulation of Hybridization: Derivation of wave functions for sp ,sp_2, sp_3 orbital hybridization types, considering only sigma bonding. **1.2** Discussion of involvement of d orbitals in various types of hybridizations. Concept of resonance, resonance energy derivation expected. Formal charge with examples. **1.3** Critical analysis of VBT. **1.4** Molecular Orbital Theory for diatomic species of First transition series.	15L

			1.5 Molecular Orbital Theory for Polyatomic species considering σ bonding for SF_6, CO_2,B_2H_6,I_3^- **1.6** Weak forces of attraction: Hydrogen bonding – concept, types, properties, methods of detection and importance. Van der Waal's forces, ion-dipole, dipole-dipole, London forces.	
04	Prof Mrs. Ruby K. C.H.M. College 4.00p.m-6.00pm 2.00p.m-6.00pm 2.00p.m-5.00pm	Tuesdays Sep:25 Oct:9 Oct:16,23 Oct:30	**PSCH104 Paper-IV Unit-II** **Calculations based on Chemical Principles [15L]** The following topics are to be covered in the form of numerical problems only. a. Concentration of a solution based on volume and mass units. b. Calculations of ppm, ppb and dilution of the solutions, concept of mmol. c. Stoichiometry of chemical reactions, concept of kg mol, limiting reactant, theoretical and practical yield. d. Solubility and solubility equilibria, effect of presence of common ion. e. Calculations of pH of acids, bases, acidic and basic buffers. f. Concept of formation constants, stability and instability constants, stepwise formation constants. g. Oxidation number, rules for assigning oxidation number, redox reaction in term of oxidation number, oxidizing and reducing agents, equivalent weight of oxidizing and reducing agents, stoichiometry of redox titration(Normality of a solution of a oxidizing/ reducing agent and it's relationship with molarity).	15L
05	Dr. V.B. Patil C.H.M. College 2.00p.m-4.00pm 1.00p.m-5.00p.m 2.00p.m-6.00p.m	Wednesdays Aug:29 Sep:5,12,19 Oct:3,10,17 Oct:24 Oct:31 Nov:28 Dec:4	**PSCH 101 Paper-I Unit – I** Thermodynamics-I [15] **1.1** State Function and exact differentials. Maxwell equations, Maxwell thermodynamic Topic - Chemical K Relations; it's significance and applications to ideal gases, Joule Thomson experiment, Joule Thomson coefficient, inversion temperature, Joule Thomson coefficient in terms of van der Waals constants.[8L] **1.2** Third law of Thermodynamics, Entropy change for a phase transition, absolute entropies, determination of absolute entropies in terms of heat capacity, standard molar entropies and their dependence om molecular mass and molecular structure, residual entropy [7L] [Reference 2& 1,10,11,12,17] **PSCH 101 Paper-I-Unit-III** Chemical Dynamics-I [15 L]	30L

			3.1 Composite Reactions: Recapitulation of rate laws, Differential rate equations, Consecutive reactions, Steady state Approximation, rate determining steps, Microscopic Reversibility and Detailed Balance Chain reactions-chain initiation processes. Some inorganic mechanisms: formation and decomposition of phosgene decomposition of ozone, Reaction between Hydrogen and Bromine and some general examples. **Organic Decompositions**: Decomposition of ethane, decomposition of acetaldehyde Gas phase combustion: Reaction between hydrogen and oxygen, Semenov – Hinshelwood and Thompson mechanism, Explosion limits and factors affecting explosion limits. **3.2Polymerization reactions:** Kinetics of stepwise polymerization, Calculation of degree of polymerization for stepwise reaction. Kinetics of free radical chain polymerization, Kinetic chain length and estimation of average no .of monomer units in the polymer produced by chain polymerization. **3.3 Reaction in Gas Phase** Unimolecular Reactions: Lindeman-Hinshelwood theory, Rice-Ramsperger-Kasssel (RRK) theory, Rice-Ramsperger-Kassel-Marcus(RRKM) theory [Reference 2 and 15,17,18]	
06	Dr.C.L.Patil C.H.M.College 4.00pm-6.00pm 5.00pm-6.00pm	Wednesdays Aug:29 Sep:5,12,19 Oct:3,10,17, Oct:24	***PSCH 102 Paper-II Unit – II*** **- Molecular Symmetry and Group theory** ***2.1*** Symmetry criterion of optical activity, symmetry restrictions on dipole moment. A systematic procedure for symmetry classification of molecules. **2.2** Concepts of Groups, Sub-groups, Classes of Symmetry operations, Group Multiplication Tables. Abelian and non -Abelian point groups. **2.3** Representation of Groups: Matrix representation of symmetry operations, reducible and irreducible representations. The Great Orthogonality Theorem and it's application in construction of character tables for point groups C_{2v} . C_{3v} and D_{2h} structure of character tables. **2.4** Applications of Group Theory (a) Symmetry adapted linear combinations(SALC), symmetry aspects of MO theory, sigma-bonding in AB_n (NH_3. CH_4) molecule. (b) Determination of symmetry species for translations and rotations.	15L

			(c)Mulliken's notations for irreducible representations. (d) Reduction of reducible representations using reduction formula. (e) Group- subgroup relationships. (f) Descent and ascent in symmetry correlation diagrams showing relationship between different groups.	
07	Dr.Sandeep Kotwal C.H.M.College 2.00p.m-4.00p.m 2.00p.m-3.00p.m	Thursdays Aug:23,30 Sep:6,20,27 Oct:4,11 Oct:18	**PSCH 103- Unit-IV** **Oxidation and Reduction: (15L)** **4.1 Oxidation: General mechanism, selectivity and important applications of the following** **4.1.1 Dehydrogenation :** Dehydrogenation of C-C bonds including aromatization of six membered rings using metal (Pt, Pd, Ni) and organic reagents (chloranil, DDQ). **4.1.2 Oxidation of alcohols to aldehydes and ketones:**Chromium reagents such as $K_2Cr_2O_7/H_2SO_4$ (Jones reagent), CrO_3-pyridine(Collin's reagent), PCC (Corey's reagent) and PDC (Cornforth reagent), hypervalent iodine reagents (IBX, Dess-Martin periodinane). DMSO based reagents (Swern oxidation), Corey-Kim oxidation-advantages over Swern and limitations; and Pfitzner-M0ffatt oxidation-DCC and DMSO and Oppenauer oxidation. **4.1.3 Oxidation involving C-C bonds cleavage:** Glycols using HIO_4; cycloalkanones using CrO_3 ; carbon-carbon double bond using ozone, $KMnO_4$, CrO_3, $NaIO_4$ and OsO_4 ; aromatic rings using RuO_4 and $NaIO_4$. **4.1.4 Oxidation involving rplacement of Hydrogen by oxygen:** Oxidation of CH_2 to Co by SeO_2, oxidation of arylamethanes by CrO_2Cl_2 (Etard oxidation) **4.1.5: Oxidation of aldehydes and ketones:**with H_2O_2 (Dakin reaction), with peroxy acid (Baeyer-Villager oxidation. **4.2 Reduction :** General mechanism, selectivity, and important applications of the following reducing reagents: **4.2.1:Reduction of CO to CH_2 in aldehydes and Ketones-**Clemmensen reduction, Wolff-Kishner reduction and Huang- Minlon modification. **4.2.2: Metal hydride reduction:** Boron reagents ($NaAlH_4$, $NaCNBH_3$, diborane, 9-BBN, $Na(OAc)_3BH$, aluminium reagents ($LiAlH_4$, DIBAL-H, Red Al, L and K- selectrides). **4.2.3: NH_2NH_2(diimide reduction) and other non-metal based agents including organic reducing agents (Hantzsch dihydropyridine).** **4.2.4: Dissolving metal reductions:** using Zn, Li, Na and Mg under neutral and acidic conditions, Li/Na-liquid Nh_3 mediated reduction (Birch reduction) of aromatic compounds and acetylenes. [Reference Books: 17,18,14]	15L

08	Dr.T.N.Bansode C.H.M. College 4.00p.m-6.00p.m 4.00p.m-5.00p.m	Thursdays Aug:23,30 Sep:6,20,27 Oct:4,11 Oct:18	**PSCH 103 Paper-III Unit - I** **Physical Organic Chemistry (15L)** **1.1 Thermodynamic and kinetic requirements of a reaction:** Rate and equilibrium constants, reaction coordinate diagram,transition state(activated complex), nature of activated complex, Hammond postulate, Reactivity vs selectivity. Curtin- Hammet Principle, Microscopic reversibility, Kinetic vs thermodynamic control of organic reactions. **1.2 Determining mechanism of a reaction:**Product analysis, kinetic studies, use of isotopes(Kinetic isotope effect- primary and secondary kinetic isotope effect). Detection and trapping of intermediates, crossover experiments and stereochemical evidence. **1.3 Acids and Bases:** Factors affecting acidity and basicity: Electronegativity and Inductive effect, resonance, bond strength, electrostatic effects, hybridization, aromaticity and solvation, Comparative study of acidity and basicity of organic compounds on the basis of pK_a values. Leveling effect and non-aqueous solvents. Acid and base catalysis- general and specific catalysis with examples. **[Reference Books:** 1,2,3, 16]	15L
09	Dr. Nagesh Sutar C.H.M College 2.00p.m-4.00p.m 2.00p.m-3.00p.m	Fridays Aug:24,31 Sep:7,28 Oct:5,12,26 Nov:2	**PSCH 103 Paper-III Unit- III** **Stereochemistry: (15L)** **3.1 Concept of Chirality:** Recognition of symmetry elements. **3.2 Molecules with tri- and tetra- coordinate centres:** Compounds with carbon, silicon,nitrogen, phosphorus and Sulphur chiral centres, relative configurational stabilities. **3.3 Molecules with two or more chiral centres:** Constitutionally unsymmetrical molecules: erythro-threo and syn-anti systems of nomenclature. Interconversion of Fischer, Sawhorse, Newman and Flying wedge projections, Constitutionally symmetrical molecules with odd and even number of chiral centres: enantiomeric and meso forms, concept of stereogenic, chirotopic and pseudoasymmetric centres. R-S nomenclature for chiral centres in acyclic and cyclic compounds. **3.4. Axial and planar chirality:** Principles of axial and planar chirality.Stereochemical features and configurational descriptors (R,S) for the following classes of compounds: allenes, alkylidene cycloalkanes, spirans,	15L

			biaryls(buttressing effect) (including BINOLS and BINAPS),ansa compounds, cyclophanes, trans-cyclooctenes. **3.5 Prochirality:** Chiral and prochiral centres, prochiral axis and prochiral plane. Homotopic,heterotopic (enantiotopic and diastereotopic) ligands and faces. Identification using substitution and symmetry criteria. Nomenclature of stereoheterotopic ligands and faces, Symbols for stereoheterotopic ligands in molecules with (i) one or more prochiral centres (ii) a chiral as well as a prochiral centre, (iii) a prochiral axis (iv) prochiral plane (v) pro-pseudoasymmetric centre. Symbols for enantiotopic and diastereotopic faces. [Reference Books: 6-8]	
10	Dr. Neena Anand C.H.M College 4.00p.m-6.00p.m 4.00p.m-6.00p.m 2.00p.m-4.00p.m 2.00pm-6.00pm	Fridays Aug:24,31 Sep:7,28 Oct:5,12,26 Nov:2 Nov:30 Thursdays Oct:25 Nov:1,29	**PSCH 104 Unit-I** **1.1 Language of Analytical Chemistry[8L]** 1.1.1 Analytical perspective, Common analytical problems, terms involved in analytical chemistry (analysis, determination, measurement, techniques, methods, procedures and protocol) **1.1.2** An overview of analytical methods, types of instrumental methods, instruments for analysis, data domains, electrical and non-electrical domains, detectors, transducers and sensors, selection of an analytical method, accuracy,precision, selectivity, sensitivity, detection limit and dynamic range. **1.1.3** Errors, determinate and indeterminate errors, Types of determinate errors, tackling of errors. **1.1.4** Quantitative methods of analysis: calibration curve, addition and internal standard method. **1.2 Quality in Analytical Chemistry: [7L]** **1.2.1Quality Management System (QMS):** Evolution and significance of Quality Management, types of quality standards for laboratories,total quality management (TQM), philosophy implementation of TQM (reference of Kaizen, Six Sigma approach & 5S), quality audits and quality reviews, responsibility of laboratory staff for quality and problems. **1.2.2** Safety in Laboratories:Basic concepts of Safety in Laboratories,personal protection Equipment(PPE), OSHA, Toxic Hazard (TH) classifications, Hazardous Chemical Processes(including process calorimetry/thermal build up concepts). **1.2.3 Accreditations:** Accreditation of Laboratories, Introduction to ISO series,	30L

Indian government Standards (ISI, Hallmark, Agmark)
1.2.4 Good laboratory Practices (GLP): Principle, Objective, OECD guidelines, The US FDA 21 CFR58, Klimisch score.

PSCH104 Paper-IV Unit-III
Optical Methods [15L]
3.1 Recapitulation and FT Technique
3.1.1 Recapitulation of basic concepts, Electromagnetic spectrum, Sources Detectors, sample containers.
3.1.2 Laser as a source of radiation, Fibre optics
3.1.3 Introduction of Fourier Transform
3.2 Molecular Ultraviolet and Visible Spectroscopy (Numericals are expected)
3.2.1 Derivation of Beer-Lambert's Law and it's limitations, factors affecting molecular absorption, types of transitions [emphasis on charge transfer absorption], pH, temperature, solvent and effect of substituents.
Applications of ultraviolet and visible spectroscopy:

1) On charge transfer absorption
2) Simultaneous spectroscopy
3) Derivative Spectroscopy

3.2.2 Dual spectrometry- Introduction, Principle, Instrumentation and Applications.
3.3 Infrared Absorption Spectroscopy
3.3.1 Instrumentation: Sources, Sample handling, Transducers, Dispersive, non-dispersive instrument
3.3.2 FTIR and it's advantages.
3.3.3 Applications of IR [Mid IR, Near IR, Far IR]: Qualitative with emphasis on "Finger print" region, Quantitative analysis, Advantages and Limitations of IR'
3.3.4 Introduction and basic principles of diffuse reflectance spectroscopy

11	Dr.V.B.Patil C.H.M College 2.00p.m-4.00p.m 2.00p.m-3.00p.m	Saturdays Aug:25,31 Sep:1,8,22,29 Oct:6, Oct:13	**PSCH 104 Unit IV** **4.1 Thermal Methods** **44.1.1 Introduction, Recapitulation of types of thermal methods, comparison between TGA and DTA.** **4.1.2 Differential Scanning Calometry- Principle, comparison of DTA and DSC, Instrumentation, Block diagram, Nature of DSC Curve, Factors affecting curves (sample size, sample shape, pressure).** **4.1.3 Applications- Heat of reaction,Specific heat, Safety screening, Polymers, liquid crystals, Percentage crystallinity, oxidative stability, Drug analysis, Magnetic transition e.g. Analysis of polyethylene for its crystallinity.** **4.2 Automation in chemical analysis** **Need for automation, Objectives of automation, an overview of automated instruments and instrumentation, process control analysis, flow injection analysis, discrete automated systems, automatic analysis based on multilayered films, gas monitoring equipments, Automatic titrators.**	15L
12	Prof. Sheela Vasu C.H.M. College 4.00p.m-6.00p.m 3.00p.m-5.00p.m 3.00p.m-5.00p.m 3.00p.m-5.00p.m	Saturdays Aug:25,31 Sep:1,8,22,29 Oct:6, Oct:13 Oct:20,27 Nov:2,30 Dec:1	**PSCH 101: Unit-I** **Quantum Chemistry :** [15] **2.1** ,Classical Mechanics, failure of classical mechanics: Need for Quantum Mechanics. **2.2** Particle waves and Shrodinger wave equation, wave functions, properties of wave functions, Normalization of wave functions, orthogonality of wave functions.**12.3** Operators and their algebra, linear and Hermitian operators, operators for the dynamic variables of a system such as position, linear momentum, angular momentum, total energy, eigen functions, eigen values and eigen value equation, Schrodinger wave equation as the eigen value equation of the Hamiltonian operator, average value and the expectation value of a dynamic variable of the system, Postulates of Quantum Mechanics, Schrodinger;s Time independent wave equation from Schrodinger's time dependent wave equation. **2.4**. Application of quantum mechanics to the following systems: a) Free particle, wave function and energy of a free particle b) Particle in a one,two and three dimensional box, separation of variables,Expression for the wave function of the system,expression for the energy of the system, concept of quantization,introduction of quantum number, degeneracy of the energy levels. C Harmonic oscillator, approximate solution of the equation, Hermite polynomials,expression	30L

			for wave function, expression for energy, use of the recursion formula. [Reference 7,8,&9] **PSCH 101- Unit IV** **Electrochemistry** [15L] **Recapitulation- basics of electrochemistry.** **4.1** Debye- Huckel theory of activity coefficient, Debye- Huckel limiting law and its extension to higher concentration(derivations are expected) **4.2** Electrolytic conductance and ionic interaction,relaxation effect. Debye- Huckel- Onsager equation(derivation expected). Validity of this equation for aqueous and non- aqueous solution, deviations from Onsager equation, Debye-Falkenhagen effect(dispersion of conductance at high frequencies), Wien effect. **4.3**Batteries: Alkaline fuel cells, Phosphoric acid fuel cells, High temperature fuel cells[Solid-Oxide Fuel cells (SOFC) and Molten Carbonate Fuel cells] **4.4**bio- electricity: Introduction, cells and membranes, membrane potentials,theory of membrane potentials, interfacial electron transfer in biological systems, adsorption of proteins onto metals from solution, electron transfer from modified metals t dissolved protein in solution, enzymes as electrodes, electrochemical enzyme- catalyzed oxidation of styrene. Goldmann equation. (derivations are expected). [Ref: 14 and 6,17,18]. **[Note: Numerical and theoretical problems from each unit are expected]**	

M.Sc. – I (Semester – I) Chemistry **2018-19**

NOTE: - Attention of the post-graduate students M.Sc. –I (Semester–I) is invited to the following:

1. That they will be required to attend in each of the term not less than 75% of the total number of lectures delivered and also not less than 75% of the lectures delivered in each paper.

2. That in addition to attendance at lectures, they will be required to carry out regularly the practical work assigned to them in the laboratory and shall be required to maintain a record there of in a properly bound journal. The work carried out by the students shall be reviewed by the respective teachers at the end of two terms. In case in the opinion of the Principal of the affiliated colleges or the Head of department of the recognized post-graduate Institution concerned, students has not done satisfactorily the work assigned to him by the respective teachers it shall be open to the Principals of the colleges or Head of the department of the recognized post-graduate institution concerned not to grant the terms to the student even though he might have kept the minimum attendance at the lectures.

N.B. Teachers participating in the scheme of post-graduate teaching and Instruction at the **M.Sc.** degree course in **Chemistry** are hereby informed that no change will be permitted in the venue and timings of the lectures.

Sd/-
Assistant Registrar,
Post Graduate Studies Section

Mumbai – 400 032.
31st January, 2020.

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P.S. Teachers participating in the scheme of post-graduate teaching and Instructions in the subject of **Chemistry** are requested to submit the attendance rolls in respect of the lectures delivered by them during the academic year **2018-2019** within 15 days after completion of their lectures in the respective terms are over, to the Coordinator at the respective centre.

No. PG/ICD/2019-20/ 2118 31st January 2020

Copy forwarded with compliments to the teachers of the University included in the scheme of post-graduate teaching and instructions at the **M.Sc.** degree in **Chemistry** and the Principals of the respective colleges for information and necessary action.

P.S. Khumale
Assistant Registrar,
Post Graduate Studies Section

Mumbai – 400 032.
31st January, 2020.