POST GRADUATE DEPARTMENT

UNIVERSITY OF MUMBAI, FORT CAMPUS

Time Table of Post-Graduate lectures for M.Sc. Part-II Semester-III: Inorganic Chemistry at Zone 1& 2 for the year 2019-2020

(Lectures will commence from 9th August 2019, at WILSON COLLEGE)

PAPER-1. Chemistry of Inorganic Solids			
Dr. Juleikha Shaikh Friday (2.00-4.00pm)	**Aug-9,16,23,30 Sept-13,20,27 Oct-4**	**Paper-I : Unit-I 15 Lectures**	**Descriptive Crystal Chemistry** **(a) Simple structures** Structures of **AB** type compounds (PbO and CuO), $\mathbf{AB_2}$ type (β cristobalite, CaC_2 and Cs_2O), $\mathbf{A_2B_3}$ type (Cr_2O_3 and Bi_2O_3), AB_3 (ReO_3, Li_3N), $\mathbf{ABO_3}$ type, relation between ReO_3 and perovskite $BaTiO_3$ and its polymorphmic forms, Oxide bronzes, ilmenite structure, $\mathbf{AB_2O_4}$ type, normal, inverse, and random spinel structures. **(b)Linked Polyhedra** (i) Corner sharing: tetrahedral structure (Silicates) and octahedral structure (ReO_3) and rotation of ReO_3 resulting in VF_3, RhF_3 and calcite type structures. (ii) Edge sharing: tetrahedral structures (SiS_2) and octahedral structures (BiI_3 and $AlCl_3$). pyrochlores, octahedral tunnel structures and lamellar structures
Dr.H.A.Parbat Wilson College Saturday (4.00-6.00pm)	**Aug-10,24,31 Sept-14,21,28 Oct-5,12**	**Paper-I : Unit-II 15 Lectures**	**Imperfection in crystals and Non- Stoichiometry** **(a) Point defects**: Point defects in metals and ionic Crystal – Frenkel defect and Schottky defect. Thermodynamics formation of these defects (mathematical derivation to find defect concentration and numerical problems expected); Defects in non-Stoiochiometric compounds, colour centres. **(b) Line defects**: Edge and Screw Dislocations. Mechanical Properties and Reactivity of Solids. (c) **Surface Defects:** Grain Boundary and Stacking Fault. Dislocation and Grain Boundaries, Vacancies and Interstitial Space in Non-Stoichiometric Crystals, Defect Clusters, Interchangeable Atoms and Extended Atom Defects
Dr.S.Z.Bootwala Wilson College Thursday (4.00-6.00pm)	**Aug-22,29 Sept-12,19,26, Oct-3,10**	**Paper I: Unit:III 15 Lectures**	**Inorganic Materials-I: Preparations** **(a) Methods of Synthesis**: Chemical Method, High Pressure Method, Arc Technique and Skull Method (with examples). **(b) Different methods for single crystal growth:**

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			(i) Crystal Growth from Melt–: Bridgman and Stockbargar, Czochralski and Vernuil methods. (ii) Crystal growth from liquid solution: Flux growth and temperature gradient methods (iii) Crystal growth from vapour phase: – Epitaxial growth methods. **(c) Thin film preparation**: Physical and Chemical methods. **(d) Solid Solutions:** Formation of Substitutional, Interstitial and Complex Solid Solutions; Mechanistic Approach; Study of Solid solutions by X-ray Powder Diffraction and Density Measurement.
Dr. Juleikha Shaikh Saturday (2.00-4.00pm)	**Aug-10,24,31 Sept-14,21,28 Oct-5,12**	**Paper-I : Unit-IV 15 Lectures**	**Behaviour of Inorganic Solids : Properties** **(a) Diffusion in Solids**: Fick's Laws of Diffusion (numerical problems expected); Kirkendal Effect; Wagner mechanism Diffusion and Ionic Conductivity; Applications of Diffusion in Carburizing and non-Carburizing Processes in Steel Making. **(b) Solid state reactions**: General principles and factors influencing reactions of solids, Reactivity of solids. **(c) Liquid Crystals**: Introduction and classification of thermotropic liquid crystals, Polymorphism in liquid crystal, Properties and applications of liquid crystals. **(d) Optical properties:** Colour Centres and Birefringence; Luminescent and Phosphor Materials; Coordinate Model; Phosphor Model; Anti Stokes Phosphor; Ruby Laser; Neodymium Laser.
PAPER- 2. Bioinorganic and Coordination Chemistry.			
Dr. S.Z. Bootwala Wilson College Monday (2.00-4.00pm)	**Aug-19,26, Sept-9.16,23,30 Oct-7,14**	**Paper-II: Unit-I 15 Lectures.**	(i) Coordination geometry of the metal ion and functions. (ii) Zn in biological systems: Carbonic anhydrase, protolytic enzymes, e.g. carboxy peptidase, Zinc finger. (iii) Role of metal ions in biological electron transfer processes ;iron sulphur protein (iv) Less common ions in biology e.g. . Mn (arginase; structure and reactivity), Ni (urease ; structure and reactivity) (v) Metallothionines Biomineralization.

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Dr. S.Z. Bootwala Wilson College Wednesday (2.00-4.00pm)	**Aug-14,21,28 Sept-11,18,25 Oct-9,16.**	**Paper-II: Unit-II 15 Lectures**	Reactivity of Chemical Species –I (15Lectures) (i) Recapitulation of the definition of Lewis acids and bases, Classification of Lewis acids and bases based on frontier Molecular orbital topology, Reactivity matrix of Lewis acids and bases (ii) Group Characteristic of Lewis acids (Gp-1,13-17) (iii) Pauling rules to determine the strength of oxoacids; classification and Structural anomalies.
Dr.S.Z.Bootwala Friday (4.00-6.00pm)	**Aug-9,16,23,30 Sept-13,20,27 Oct-4**	**Paper-II: Unit-III 15 Lectures**	**Reactivity of Chemical Species-II** (i) Pourbaix Diagrams. (ii) Amphoteric behavior, Periodic trends in amphoteric properties of p-block and d-block elements (iii) Oxoanions and Oxocations. (iv) Measures of hardness and Softness of Acids and Bases, Drago-wayland equations **(v)** Applications of acid-base Chemistry: Super acids and Super bases, heterogeneous acid-base reactions
Dr. S.Z. Bootwala Wilson College Tuesday (4.00-6.00pm)	**Aug-13,20,27 Sept-3,17,24 Oct-1,15,22**	**Paper-II: Unit-IV 15 Lectures**	**Synthesis, Structure and Bonding, and Stereochemistry** **(a) Structure and Bonding** (i) Molecular Orbital Theory for Complexes with Coordination Number 4 and 5 for the central ion (sigma as well as Pi bonding) (ii) Angular Overlap Model **(b) Stereochemistry of Coordination Compounds** (i) Chirality and Fluxionality of Coordination Compounds with Higher Coordination Numbers. (ii) Geometries of Coordination Compounds from coordination number 6 to 9.
PAPER- 3. Spectral Methods in Inorganic Chemistry			

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Dr.H.A.Parbat Wilson College Thursday (2.00-4.00pm)	**Aug-22,29 Sept-12,19,26, Oct-3,10**	**Paper-III: Unit-I 15 Lectures**	**Diffraction Methods-I** X-Ray Diffraction: Bragg Condition; Miller Indices; Laue Method; Bragg Method; Debye Scherrer Method of X-Ray Structural Analysis of Crystals
Dr. H.A.Parbat Wilson College Wednesday (4.00-6.00pm)	**Aug-14,21,28 Sept-11,18,25 Oct-9,16.**	**Paper-III : Unit-II 15 Lectures**	**Diffraction Methods-II** (a) Electron Diffraction: Scattering of electrons, Scattering Intensity versus Scattering Angle, Weirl Measurement Technique, Elucidation of Structures of Simple gas Phase Molecules (b) Neutron Diffraction: Scattering of Neutrons: Scattering of neutrons by Solids and Liquids, Magnetic Scattering, Measurement Technique.
Dr. H.A.Parbat Wilson College Monday (4.00-6.00pm)	**Aug-22,29 Sept-12,19,26, Oct-3,10**	**Paper-III: Unit-III 15 Lectures**	**Electron Spin Resonance Spectroscopy** (a) Electron behaviour, interaction between electron spin and magnetic field. (b) Instrumentation: Source, Sample cavity. Magnet and Modulation coils, Microwave Bridge, Sensitivity. (c) Relaxation processes and Line width in ESR transitions: (i) ESR relaxation and chemical bonding. (ii) Interaction between nuclear spin and electron spin (hyperfine coupling) (iii) Spin polarization for atoms and transition metal ions, (iv) Spin-orbit coupling and significance of g-tensors, (v) Application to transition metal complexes (having one unpaired electron)

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Dr.H.A.Parbat **Wilson College** **Tuesday** **(2.00-4.00pm)**	**Aug-13,20,27** **Sept-3,17,24** **Oct-1,15,22**	**Paper-III:** **Unit-IV.** **15 Lectures**	**Mossbauer Spectroscopy** : 3.4.1 Basic principle, recoil energy and Doppler shift 3.4.2 Instrumentation: sources and absorber; motion devices, detection, reference substances and calibration 3.4.3 Isomer shift, quadrupole interaction, magnetic interaction electronegativity and chemical shift 3.4.4 Applications: *Iron compounds*- low spin and high spin Fe(II) and Fe(III) compounds and complexes, effect of pi-bonding, mono and polynuclear Iron complexes, spinel oxides and iron-sulphur proteins; *Tin compounds*- tin halides and tin oxides, organotin compounds; *Iodine compounds*- I_2 and alkali metal iodide compounds
Paper4. Applied Chemistry(Elective)			
Dr.H.A.Parbat **Wilson College** **(2.00-4.00pm)**	**Oct- 5,11,12** **18,19,16,17**	**Paper-IV:** **Unit-I** **15 Lectures**	**4.1 Inorganic Materials (15 Lectures)** **(a) Classification, manufacture and applications of (i) Inorganic fibers, and (ii) Inorganic fillers.** **Study of (i) Condensed phosphates, and (ii) Coordination polymers.** **(b) Preparation, properties and uses of industrially important chemicals – potassium permanganate, sodium thiosulphate, bleaching powder, hydrogen peroxide, potassium dichromate**
Dr.S.Z.Bootwala **Wilson College** **(4.00-6.00pm**	**Oct-5,11,12,** **18,19,16,17**	**Paper-IV:** **Unit-II** **15 Lectures**	**4.2 Nuclear Chemistry and Inorganic Pharmaceuticals (15 Lectures)** **(a) Nuclear Chemistry : Introduction to of nuclear fuels and separation of fission products from spent fuel rods by PUREX process. Super heavy element, discovery,preparation, position in the periodic table.** **(b) Inorganic Pharmaceuticals : Radiopharmaceuticals containing Tc and Bi, contrast agents for X-ray and NMR imaging. Gasrtrointestinal agents viz. (i) antacids(aluminium hydroxide, milk of magnesia, sodium bicarbonate and (ii) Cathartics(magnesium sulphate and sodium phosphate). Topical agents viz.(i) protectives and adsorbents(talc, calamine), (ii) antimicrobial agents(potassium permanganate, tincture iodine, boric acid) and astringents(potash alum) .**

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Dr.H.A.Parbat Wilson College (2.00-4.00pm)	Nov- 15,16,2122, 23,28 , 29,30	Paper-IV: Unit-III 15 Lectures	4.3 Advances in Nanomaterials: (15 Lectures) (a) Types of nanomaterials, e.g. nanotubes, nanorods, solid spheres, core-shell nanoparticles, mesoporous materials; isolation of nano materials (b) Some important properties of nanomaterials: optical properties of metal and semiconductor nanoparticles, magnetic properties. (c) Some special nanomaterials: Carbon nanotubes: Types, synthesis using various methods, growth mechanism, electronic structure; Porous silicon: Preparation and mechanism of porous silicon formation, Factors affecting porous structure, properties of porous silicon; Aerogels: Types of aerogels, Properties and applications of aerogels. (d) Applications of nanomaterials in electronics, energy, automobiles, sports and toys, textile, cosmetics, medicine, space and defense. Environmental effects of nanotechnology
Dr. Juleikha Shaikh Maharashtra College (4.00-6.00)	Nov- 15,16,2122, 23,28 29,30	Paper-IV: Unit-IV 15 Lectures	4.4 Some Selected Topics (15 Lectures) i) Isopoly and Hetropoly acids, ii) Supramolecular chemistry iii) Inorganic pesticides, and iv) Intercalation compounds

M. Sc. (Part – II) (Semester – III) Inorganic Chemistry **2019-20**

NOTE: - Attention of the post-graduate students M. Sc. (Part - II) (Semester – III) 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 **Inorganic 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.
13th August, 2019.

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P.S. Teachers participating in the scheme of post-graduate teaching and Instructions in the subject of **Inorganic Chemistry** are requested to submit the attendance rolls in respect of the lectures delivered by them during the academic year **2019-2020** 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/ 1042 /of 2019. 13th August, 2019.

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 **Inorganic Chemistry** and the Principals of the respective colleges for information and necessary action.

P.S. Dhumal 13/8/19
Assistant Registrar,
Post Graduate Studies Section

Mumbai – 400 032.
13th August, 2019.

13/8/19 13/8/19