**Ph.D Syllabus**

**Inorganic Material Chemistry**

*(Optional Subject: Inorganic Chemistry C.H 04)*

**Topics:**

Transition metal oxides, non-stoichiometry, zeolites, layer compounds chemistry, high temperature superconductors and fullerides. The synthesis of these compounds.

**Crystallographic and Microstructural Considerations**: important solid state materials, the primer addresses the major experimental technique used to study and characterise the powder x-ray diffraction. The basis of this method and associated relevant crystallography is discussed; experimental data from this technique is used to illustrate topics throughout the primer. This is concerned with the synthesis, characterisation and functional properties of inorganic complexes and materials. It has a particular emphasis on solid state-chemistry, synchrotron studies and understanding material properties through computational work. It is very skilled in high pressure and thin film work. It also has interests in crystallography (powders and single crystals), polymorphism, preparation of catalysts, hydrogen storage medium, combinatorial materials science, metal enzyme mimics, bone structure, supercritical fluids, molecular precursors and chemical vapour deposition.

**Nanomaterials Synthesis:** Design of nanoporous framework materials for a variety of applications, including catalysis and gas separation. Using computational methods, we can compute the structures and properties of numerous hypothetical materials with desirable properties, and estimate how feasible they would be to synthesize. Explore fundamental links between chemistry and topology. A number of our predicted structures have subsequently been made. The materials include both zeolite types and metal-organic frameworks which are of interest for carbon dioxide and hydrogen storage. Organometallic Chemistry and Catalysis - the synthesis, spectroscopy, structure, reactivity, redox chemistry, and dynamics of organometallic complexes; their application to the catalysis of organic reactions.

 **Materials Chemistry**: synthesis, characterisation and evaluation of new materials; solid state bioinorganic chemistry, biomimetic materials chemistry; biomineralization; nanoscale and composite materials; electron microscopy; crystal engineering. Main Group Chemistry - new techniques in the synthesis of main group compounds; applications of these to the chemistry of materials, catalysis and destruction of pollutants.

Books: Inorganic Materials Synthesis and Fabrication: JOHN WILEY & SONS, INC., PUBLICATION. Nanochemistry: G.B. Sergeev.

Prof. Dr. Ahmed-u-ddin Rajpar (In-organic Chem) Prof. Dr. Ghulam Abbas Shar (In-organic Chem)