M. PHIL/PH.D Inorganic Chemistry

CHM-701 Solid State Chemistry 3(3-0)

Classification of bonds and crystals, The effect of radius ratio and charge on crystals, Application of the isoceletronic principle, Ordered solids including interstitial compounds, Alloys, Superclustures and Storage batteries, Amorphous solids (Glass and Polymers)

Recommended Books:

1. S. Prakash, G.D. Tuli, S.K. Basu, R. D. Madan, "Advanced Inorganic Chemistry" Volume I, New Dehli (1997).
2. B. D. Cullity "Elements of X-ray diffraction" 2nd edition Addison-wasley publishing company, California (1977).
3. E. P. Bertin, "Principles and Practice of X-ray Spectrometric Analysis", Plenum Press, New York, USA (1975).

CHM-702 Photochemical Reactions of Transition Metals 3(3-0)

Introduction, Basic Photochemical processes, Photosubstitution reactions, Photoredox reactions, Reactivity of CTTM and CTTL excited states, Ligand photoreactions, Scavenging of reaction intermediates, Photoreaction and solar energy conversion, Photochemistry techniques.

Recommended Books:

1. J. G. Calvert, J. N. Pitts, "Photochemistry" John Wiley, New York, USA (1966).
2. P. Suppan, "Principles of Photochemistry", The Chemical Soc., UK (1973).
3. J. G. Calvert, J. N. Pitts, "Photochemistry" John Wiley, New York, USA (1966).
4. Wayne, P. Richard, "Photochemistry" 2nd Ed., Macmillan, UK (1988).

CHM-703 Applied Transition Metal Catalytic Chemistry 3(3-0)

Ziegler-Natta and Wacker catalyst, polymerization and Oligomerization of ethylene, propylene, olefins, cyclic olefins and alkynes, Fischer-Tropsch process, Oxidation reaction, synthesis of acrylates and related derivative.

Recommended Books:

1. N. C. Norman, "Periodicity and the S &P block elements" 2nd Revised Ed., Oxford University press, UK (1997).
2. A. Yamamoto, "Organotransition metal chemistry" John Wiley and Sons: New York, USA (1986).
3. M. Bochmann, "Orgaometallics 2, complexes with transition metal carbon π-bonds" Oxford Chemistry Primers, UK (1993).
4. G. L. Miessler, D. A. Tarr, "Inorganic chemistry" 2nd edition, Prentice Hall International, USA (1998).
5. F. A Cary, "Organic Chemistry" 7th edition, The McGraw-Hill Company, USA (2008).

CHM-704 Chemistry of Organometallic Compounds 3(3-0)

Nature of metal-carbon bond in organometallic compounds , transition metal organometallic complexes, naturally occurring organometallic compound, Fundamental process in reactions of organotransition metal complexes like insertion and extrusion of CO, SO_2, NO, olefins and diffraction, Experimental techniques in organometallics (techniques using Schlenk glass ware, chemical analysis, IR Raman, photoelectronic, Mossbauer and NMR spectroscopy, X-ray and neutron diffraction)

Recommended Books:

1. P. Powell, "Principles of Organometallics Chemistry", 2nd Ed, London, Chapman and Hall, New York, USA (1988).
2. A. Yamamoto "Organotransition metal chemistry" John Wiley and Sons: New York, USA (1986).
3. M. Bochmann "Orgaometallics 2, complexes with transition metal carbon π-bonds" Oxford University Press, UK (1993).
4. G. L. Miessler, D. A. Tarr, "Inorganic chemistry" 2nd Ed., Prentice Hall International, USA (1998).
5. F. A. Cary, "Organic Chemistry" 7th Ed, The McGraw-Hill Company, USA (2008).

CHM-705 Inorganic Electronic Spectroscopy 3(3-0)

Introduction, Term symbols, Russel Sanders coupling scheme, Development of correlation and Tanabe-sugano diagram, Ligand field spectra of octahedral complexes, Absorption spectra of coordination compounds, Band assignments and interpretation of absorption spectra of complexes, Charge transfer spectra, Spectra of low symmetry complexes, Magneto chemistry.

Recommended Books

1. G. D. Christian, J. E. O'Reilley, "Instrumental Analysis," 2nd Ed, Boston, USA (1986).
2. E. S. Gilreath "Fundamental concepts of inorganic chemistry" McGraw- Hill, New York, USA (1958).
3. H. H. Jaffe, M. Orchin, "Theory and Applications of Ultraviolet Spectroscopy," 1st Ed, John Wiley & Sons, New York, USA (1962).

CHM-706 Kinetics and Mechanisms of Inorganic Reactions 3(3-0)

Principles of kinetics. Steady state approximation. Determination of rate law. Inert and labile complexes. Substitution reactions of octahedral, square planer and tetrahedral complexes. Oxidation-reduction reactions of metal ions. Organotransition metal compounds. Free radical reactions.

Recommended Books:

1. J. E. Huheey, E. A. Keiter, R. L. Keiter, "Inorganic Chemistry: Principles of Structure and Reactivity", 4th Ed., Harper & Row, New York, USA (2001).
2. K. M. Mackay, R. A. Mackay, W. Henderson, "Introduction to Modern Inorganic Chemistry", 5th Ed, Stanley Thomas Publisher Ltd. USA (1996).

3. G. L. Miessler, A. T. Donald, "Inorganic Chemistry", 2nd Ed., Prentice Hall International, USA (1991).

CHM-707 Bio-Inorganic Chemistry 3(3-0)

Development and importance of bio-inorganic chemistry. Introduction to metals of biological importance. Function of metals in enzyme catalysis. Oxygen carriers; nitrogen fixation; vitamin B6 and B12. Importance of metals and nonmetals in biological systems. Metal ions and chelating agents for medicinal purposes.

Recommended Books:

1. D. F. Shriver, P. W. Atkins, C. H. Langford, "Inorganic Chemistry" 2nd Ed, Oxford University Press, UK (1994).
2. A. K. Das, "A Text Book on Medicinal Aspects of Bio-Inorganic Chemistry" CBS Publishers and Distributors. New Dehli, India (1990).
3. G. L. Miessler, A. T. Donald, "Inorganic Chemistry", 2nd Ed., Prentice Hall International, USA (1991).
4. R. W. Hay, "Bio-inorganic Chemistry" Ellis Horwood Limited, UK (1987).

CHM-708 Nano Chemistry 3(3-0)

Nanotechnology, nanomaterials, mesoporous, microporous and macroporous materials. Nanoscale, Nanometer, Nanoparticles, Nanotubes, Thin films, Nanocomposites, Nanostructured bulk materials. Synthesis of nanoparticles and composites (Bottom Up and Top Down Production). Synthesis by anodization, hydrothermal and deposition-precipiation methods. Characterization of nanomaterials by X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Fourier Transform Infrared (FTIR) spectroscopy and applications.

Recommended Books:

1. G. B. Sergeev, "Nanochemistry" 1st Ed., Elsevier, The Netherlands (2006).
2. A. I. Kirkland, J. L. Hutchison "Nanocharacterisation" The Royal Society of Chemistry, UK (2007).
3. R. E. Hester, R.M. Harrison,"Nanotechnology: Consequences for Human Health and the Environment" The Royal Society of Chemistry, UK (2007).
4. H. Hosono, K. MacKenzie, Y. Mishima, H. Takezoe, "Nanomaterials" Elsevier Science Ltd, Netherland (2006).

CHM-709 Applied Spectroscopy 3(3-0)

UV/Visible Spectroscopy, Beer-Lamberts law, Instrumentation and application, Working of single and double beam spectrophotometer, Application of UV/Visible Spectroscopy, Infrared Spectroscopy, modes and absorption frequencies, Hooks Law, Instrumentation and sample handling, Interpretation of Infrared spectra, Applications of Infrared spectroscopy, Nuclear

Magnetic Resonance**,** Spin flipping Nuclear Precession and absorption of electromagnetic radiation, Chemical shift, Sample handling and Instrumentation, Mass spectroscopy**,** Principle, Instrumentation, The mass spectrum, Modes of Fragmentation, Applications of mass spectroscopy.

Recommended Books:

1. Ault, G. Dudek, "An Introduction to Proton NMR Spectroscopy," 1st Ed., Holden Day, San Francisco, USA (1976).
2. D. L. Pavia, G. M. Lampman, G. S. Kriz, Jr., "Introduction to Spectroscopy," 2nd Ed, W. B. Saunders, USA (1979).
3. D. W. Mathieson, "Nuclear Magnetic Resonance for Organic Chemistry," Academic Press, London, UK (1967).
4. A. Douglas, F. Skoog, J. Holler, T. A. Nieman "Principles of Instrumental Analysis", 5th Ed, Saunders College Publishing, New York, USA (1997).
5. E. D. Hoffmann, V. Stroobant (Editors) "Mass Spectrometry: Principles and Applications" 2nd Ed, John Wiley & Sons; USA (2001).
6. G. D. Christian, J.E. O'Reilley, "Instrumental Analysis," 2nd Ed, Boston, USA (1986).
7. G.W. Ewing "Instrumental Methods of Chemical Analysis, 5th Ed, McGraw-Hill, New York, USA (1985).
8. H. Budzikiewitz, C. Djerassi, and D. H. Williams, "Mass Spectrometry," Holden-Day. San Francisco, USA (1967).
9. J. R. Chapman, "Practical Organic Mass Spectrometry," John Wiley and Sons, USA (1985).

CHM- 710 Extractive Metallurgy 3(3-0)

Introduction; Pyrometallurgy, Hydrometallurgy, Biohydrometallurgy, Leaching of Au, Ag, Pt, Pd, Rh, Ce, In, Cu, Zn, Fe from minerals; General Principle, Leaching from oxides, leaching of sulfides, leaching of phosphate, leaching of silicates, Leaching of Secondary resources; slags, smelter dusts, Ashes, electronic wastes, Treatment of leach liquor; Crystallization, Adsorption, ionic precipitation, ionic flotation and precipitate flotation, solvent extraction

Recommended Books:

- F. Habashi, Principles of Extractive Metallurgy (1998), Volume 4. Amalgam & Electrometallurgy, Métallurgie Extractive Québec, Sainte-Foy, Québec City.
- Greenwood, N. N.; & Earnshaw, A. (1997). Chemistry of the Elements (2nd Edn.), Oxford:Butterworth-Heinemann. ISBN 0-7506-3365-4.
- F. Habashi, Chalcopyrite; Its Chemistry and Metallurgy (1978), McGraw-Hill, ISBN 0-07-025-83-8.
- F. Habashi, Principles of Extractive Metallurgy, Volume 1, Gordon & Breach Science Publishers, ISBN 0-677-01-7707.

- Biohydrometallurgical processes: a practical approach (2010), Luis, Gonzaga Santos Sobral, Débora Monteiro de Oliveira e Carlos, Eduardo Gomes de Souza - Rio de Janeiro: CETEM/MCT, ISBN 978-85-61121-85-3

CHM-711 Metal Based Drugs 3(3-0)

Introduction, Strategic considerations, Radiodiagnostic, Biopharmaceutical properties of drugs substances, Pharmacologic Activity, Drug Design, DRUG/Receptor Interactions, Drugs Resistance and Metabolism, Lithium and Mental Health, Gold and Rheumatoid Arthritis, Platinum ammine halides, Metallocenes and their halides: Ti, V, Fe, Gold and other metal phosphines, other main group and transition-metal compounds, cis-platin, carboplatin, platinum anti cancer drugs, technetium radiopharmaceuticals, gadolinium MRI contrast agents, auranofin, Mechanism of action studies, Dose-Limiting problems: toxicology,

Recommended Books:

1. W. I. Sundquist and S. J. Lippard, Coord. Chem. Rev. 100 (1990), 293
2. H. Sigel, ed. Metal Ions in Biological Systems, Dekker, Vol. 14, 1982.
3. D. A. Brown, Metal Ions Bioi. Syst. 14 (1982), 125.
4. A. D. Young and R. W. Nobel, Methods Enzymol. 76 (1981).792.
5. J. G. Wright et al., Prog. Inorg. Chem. 38 (1990), 323.
6. J. D. Helmann, L. M. Shewshuck, and C. T. Walsh, Adv. Inorg. Biochem. 8 (1990), 331.

CHM-712 Medicinal Inorganic Chemistry 3(3-0)

Role of Micro-nutrient elements in human body; metal bearing enzymes and their functions; adverse effects of access / deficiency of essential Micro-nutrients. Sulphur phosphorus and Nitrogen containing compounds in biological systems; Use of transition metals and other inorganic compounds in diagnosis and treatment of various diseases.

Recommended Books:

1. D. F. Shriver, P. W. Atkins, C. H. Langford, "Inorganic Chemistry" 2nd Edition Oxford University Press, UK (1994).
2. A. K. Das, "A Text Book on Medicinal Aspects of Bio-Inorganic Chemistry" CBS Publishers and Distributors, New Dehli, India (1990).

CHM-713 Advanced Thermal Analysis 3(3-0)

Introduction, Types of thermal methods, TGA, Instrumentation, Performing measurements, influence of different factors, Temperature measurement and calibration, Buoyancy correction, Interpreting TG curves, gravimetric effects on melting, identifying artefacts, Final comments on

the interpretation of TG curves, Quantitative evaluation of TGA data, , Typical applications, High resolution TGA and modulated TGA, DTA, classical DTA, calorimetric DTA, Interpretation of DTA curves, Instrumentation, DSC, Modulated temperature DSC, Quantitative aspects of DTA curves, Quantitative aspects of DSC curves, Interpretation of DSC curves, Determination of phase diagram, determination of heat capacity, Determination of thermal conductivities, General applications of DTA and DSC

Recommended Books:

1. M. E. Brown, "Introduction to Thermal analysis, Techniques and Applications, Chapman and Hall, New York, USA (1988).
2. P. Gabbot, "Principles and Applications of Thermal Analysis, Blackwell publishing Ltd. USA (2008).
3. W. Hemminger, S. M. Sarge, "Hand Book of Thermal Analysis and Calorinery, Vol. 1, (Ed. M. E. Brown), Elsevier, Amsterdam, Netherland (1998).
4. J. O. Hill (Ed.) For "Better Thermal Analysis and Calorimetry, 3rd Ed, CPC Reprographics, Portsmouth, UK (1991).
5. B. Wunderlich, "Thermal Analysis" Academic Press, Boston, USA (1990).

CHM-714 Metal Complexes in Cancer Chemotherapy 3(3-0)

Platinum and non-platinum complexes in clinical trials and current status and new development. Platinum complexes with specific activity with hormone development tumor. Ruthemium complexes, potential role in anti cancer pharmaceuticals. Gold complexes in cancer chemotherapy. Clinical experience with tumor inhibiting Gallium complexes. Tin analogues of Cis-platin.

Recommended Books:

1. B. K. Keppler, "Metal Complexes in Cancer Chemotherapy" VCH, D-6940 Weinhein, Germany (1993).
2. C. A. Lepre, S. J. Lippard, "Nucleic Acids and Molecular Biology" F. Eckstein, D. M. J. Lilley, (eds) Vol. 4, Springer-Va-erlag Berlin Heidelberg, Germany (1990).
3. M. V. Fiorentino, C. Ghitto, "Platinum and other Metal Coordination Compounds in Cancer Chemotherapy" M. Nicolini (ed), Boston, Martinus Nijhoff Publ., USA (1988).
4. M. J. Cleare, P. C. Hydes, "Metal Ions in Biological Systems" Vol. 11, H. Sigel, (ed). Marcel Dekker, New York, USA (1980).
5. E. Von Angerer, E. Holler, H. Schonenberger, R. Schonenberger, " Hand book of Stereoisomers" Therapeutic Drugs, D. F. Smith (ed). Boca Raton, CRC-Press, New York, USA (1989).

CHM- 715 Inorganic Cage Compounds 3(3-0)

Introduction, Periodicity, Control of Dimensionality, Control of Connectivity, Thermodynamic and Kinetic control, Chemistry of Borazanes and Borazines, Cyclophosphazanes and Cyclophosphazenes, Other Phosphorous containing rings systems, A case study in the bonding nature of Cyclothiazenes,

Recommended Books:

1. F. A. Cotton, G. Wilkinson, "Advance Inorganic Chemistry", 5th Edition, John Wiley & Sons, New York, USA (1988).
2. G. Wood, Earnshaw, "Chemistry of elements, 2nd Ed., Pergamon press UK (1984).
3. J. E. Huheey, "Inorganic Chemistry" 3rd Ed., Harper& Row, New York, USA (1983).
4. N. C. Norman, "Periodicity and the S &P block elements" 2nd Revised Ed., Oxford University press, UK (1997).
5. F. A. Cotton, G. Wilkinson, C. A. Murillo, M. Bockhmann, "Basic Inorganic Chemistry" John Wiley & Sons, New York, USA (1987).

CHM-716 Inorganic Polymers 3(3-0)

Introduction to homoatomic and heteroatomic inorganic polymers, the polymerization process and techniques, molecular weight and its determination, polymer additives(plastizers, stabilizers and fillers), GPC and other chromatographic methods of analysis and X-ray diffraction analyses, chains of boron, silicon, synthesis and applications, Polyionic species, Isopoly and heteropoly anions of transition metals, silicates, borates, condensed phosphates, zeolites and composites

Recommended Books:

1. Brady, J. E., and Sense, F., *Chemistry-The Study of Matter and Its Changes,* 5th ed., Wiley Plus, (2009).
2. Miessler, G. L.,Tarr, D. A., *Inorganic Chemistry*, 4th ed., Prentice-Hall International, New Jersey, USA, (2010).
3. Douglas, B., McDanial, D., Alexander, J., *Concepts and Models of Inorganic Chemistry*, 3rd ed., John-Wiley & Sons, New York, (1994).
4. Huheey, J. E., Keiter, E. A., Keiter, R. L., *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th ed., Prentice Hall, (1997).
5. Shriver, D. F., Atkins, P. W., Langford, C. H., *Inorganic Chemistry*, 2nd ed., Oxford University Press, (1994).
6. Cotton, F. A., Wilkinson, G., Murillo, C. A. and Bochmann, M., *Advanced Inorganic Chemistry*, 6th ed., Wiley-Interscience, (1999).
7. Atkins, P. and Jones, L., *Chemicals Principles: The Quest for Insight,* 5th ed., W. H. Freeman, (2010).

CHM- 717 Radiochemistry 3(3-0)

Introduction, radioactive isotope production, Mass-energy equivalence, nuclear isomerism and binding energy, radio-diagnostics, radiotherapy, emitter therapy and radiopharmaceuticals: radio-labeled compounds for diagnostics and therapy, techniques, positron emission tomography and SPET, radiation

safety, radiobiology, effects of radioactive emissions, excitation, ionization, activation analysis, detection and measurement, control of radioactive pollution.

Books Recommended:

1. Gregory Choppin, Jan-Olov Liljenzin, "Jan Rydberg, Radiochemistry and Nuclear Chemistry" 3rd edition oxford ; Boston , Butterworth-Heinemann (2002).
2. Gordon, Breach, "Textbook of radiopharmacy, Theory and Practice" 3rd Ed, Science Publishers, Netherland (1999).
3. Prekeges, Jennifer, "nuclear medicine instrumentation" Society of Nuclear Medicine, 1st Ed, New York, USA (2004).
4. Gunderson, L. L. Tepper, "Clinical radiation oncology" 2nd Ed. Elsevier, Netherland (2007).
5. Dr. Tilk Ram "Radiation Chemistry"random publications New Delhi (2013).
6. A. stanly Thompson, Oliver E. Rodges, Thermal power from Nuclear reactors" john wiley &Sons London (1956).