

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY,

MURTHAL (SONEPAT)

DEPARTMENT OF CHEMISTRY

Scheme of Studies & Examinations of course work for Ph.D.

Odd/Even Semester

(Effective from 2009-10)

Paper No	Paper Title	Teaching Scheme			Examination Scheme			Duration of Exam	Credit
		L	T	P	Internal Marks	External Marks	Total		
RM-900	Research Methodology	4	0	0	50	100	150	3 hrs	4
CH-902	Inorganic Chemistry	4	0	0	50	100	150	3 hrs	4
CH-903	Organic Chemistry	4	0	0	50	100	150	3 hrs	4
CH-904	Physical Chemistry	4	0	0	50	100	150	3 hrs	4
CH-905	Analytical Chemistry	4	0	0	50	100	150	3 hrs	4

Note:

1. Paper RM-900 is compulsory and candidates will have to opt two of the other four Papers (CH-902, CH-903, CH-904 and CH - 905) as second & third Paper. Total pass credit = 12
2. Credit based system being followed in PG (M. Sc.) programme will be applicable.
3. Schedule for External Examination shall be notified by the Examination Branch.

Member

Member

**Chairman
DRC.**

**DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY,
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DEPARTMENT OF CHEMISTRY

**Course Work for Ph.D.
Inorganic Chemistry**

Paper No. CH-902

04 Hrs /week

Total: 60 Hrs.

Credits: 04

Max. Marks: 100+50

Duration of Exam: 03 Hrs.

Note: The question paper will comprise of eight questions. The candidates will be required to attempt any five questions. All questions will carry equal marks.

Medicinal Bioinorganic Chemistry

Bioinorganic Chemistry of Toxic Metals- Detoxification by Metal Chelation- Drugs which add by binding at the metals site of the Metalloenzymes- Radiation risks and medical benefits- Natural and Man made Radio isotopes- Bio inorganic chemistry of Radio Pharmaceuticals- Platinum complexes in Cancer Therapy- Cis-Platin and its mode of action- Gold containing Drugs as Antirheumatic Agents.

Metal –Complexes

Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

Supra molecular Chemistry

Basic concept and language, Supramolecular reactivity and catalysis. Transport process and carrier design, Supramolecular photochemistry, Supramolecular devices, Supramolecular electronic ionic and switching devices. Some examples of self assembly in Supramolecular chemistry.

Metal Clusters

Higher boranes, carboranes, metalloboranes and metallocarboranes. Metal carbonyl and halide clusters, compounds with metal-metal multiple bonds. Bonding and skeletal structure in boranes, carboranes and carbonyl clusters, Wade's rule, 18-electron rule and isolobal analogy.

Books Recommended:

1. S.J.Lippard and J.M.Berg, Principles of Bioinorganic chemistry, Panima Publishing Company, New Delhi, 1997.
2. Bioinorganic Chemistry: State of Art., J.Chem., Education, 62, 11, 1985.
3. Herman Dugas and C.Penny, Bio-organic chemistry: A chemical approach to enzyme action, Sprigerverlag, 1995.
4. Supramolecular chemistry Jonathan W.Steed, Jerry L.Atwood, John Wiley & sons 2000.
5. H.L.Schmeiider and A YatsimineskyöPrinciples and methods in Supramolecular chemistry (chapters A&B) John Wiley & Sons Ltd, Newyork, 2000.
6. The organometallic Chemistry of the transition Metals, R.H.Crabtree, John Wiely.
7. Organomettalis, A. Salzer, Ch.Elschenbrioch. VCH Publications.

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**Course Work for Ph.D.
Organic Chemistry**

Paper No. CH-903

04 Hrs /week

Total: 60 Hrs.

Credits: 04

Max. Marks: 100+50

Duration of Exam: 03 Hrs.

Note: The question paper will comprise of eight questions. The candidates will be required to attempt any five questions. All questions will carry equal marks.

Organic Synthesis: The Disconnection approach.

Disconnection approach: An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X disconnections, reversal of polarity. General strategy in designing /synthesis of aromatic heterocycles.

Heterocyclic compounds

Methods of synthesis and reactions including mechanism of following:

Three membered heterocycles: Aziridines, Oxiranes, Thiranes

Four membered heterocycles: Azetidines, Oxetanes, Thietanes

Seven membered heterocycles: Azepines, Oxipines, Thiepinines

Medicinal Chemistry

General introduction, Structure-activity relationship (SAR): Qualitative and quantitative, Synthesis and mechanism of action of representative examples of Antineoplastic agents, Antibiotics, Antiinfective and Anti-inflammatory agents.

Nuclear Magnetic Resonance Spectroscopy

General introduction to NMR, Karplus curve-variation of coupling constant with dihedral angle, simplification of complex spectra, nuclear magnetic double resonance, contact shifts reagents, Fourier transform technique, nuclear Overhauser effect(NOE), resonance of other nuclei-F,P, Two dimensional NMR spectroscopy-COSY, HETCOR,INADEQUATE,NOESY etc.

Mass Spectroscopy

Introduction to Mass Spectroscopy, Mass spectral fragmentation of organic compounds, High resolution mass spectrometry (HRMS).

Books suggested:

1. Modern Synthetic Reactions, H.O. House, W.A. Benjamin.
2. Advance Organic Chemistry, Reactions Mechanisms and Structure, J. March, John Wiley.

3. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
4. Advance Organic Chemistry Part B, F.A. Carey and R.J. Sandburg, Plenum Press.
5. Designing Organic Synthesis, S. Warren, Wiley.
6. New Horizons in Organic Synthesis, Nair V, New Age International.
7. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V. Gupta, Springer Verlag.
8. Heterocyclic Chemistry, J.A. Joule, ELBS.
9. Heterocyclic Chemistry, T.L. Gilchirst, Longman Scientific Technical.
10. Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, eds. Pergamon Press.
11. An Introduction to Medicinal Chemistry, G.L. Patrick, Oxford University Press.
12. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
13. Burger's Medicinal Chemistry and Drug Discovery, Vol. 1, Ed. M. e. Wolff, John Wiley.
14. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Horwood.
15. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpuch and G.J. Martin, Heyden.
16. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler and T.C. Morrill, John Wiley.

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DEPARTMENT OF CHEMISTRY

**Course Work for Ph.D.
Physical Chemistry**

Paper No. CH-904

04 Hrs /week

Total: 60 Hrs.

Credits: 04

Max. Marks: 100+50

Duration of Exam: 03 Hrs.

Note: The question paper will comprise of eight questions. The candidates will be required to attempt any five questions. All questions will carry equal marks.

Reaction on surfaces: Introduction, Competitive adsorption, Adsorption isotherm, Non ideal adsorption, Thermodynamics of adsorption, Mechanism of surface reactions, Kinetic effects of surface heterogeneity, Unimolecular surface reaction, Bimolecular surface reaction between adsorbed molecules, a gas molecules and an adsorbed molecule, atoms at surface, transition state theory of surface reactions.

Thermodynamic Properties of Fluids: Fundamental property relations, Maxwell's equations, Residual properties, Clapeyron's Equation, Generalized correlations for thermodynamic properties of gases.

Multi-component Systems: Chemical potential, ideal-gas mixture, ideal solution, Raoult's Law. Partial properties, fugacity and fugacity coefficient, generalized correlations for the fugacity coefficient, excess Gibbs' energy, activity coefficient.

Phase Equilibria at Low to Moderate Pressures: Phase rule, phase behavior for vapor liquid system, Margules equation, Van Laar equation, Wilson equation, NRTL equation. Dew point, bubble point and flash calculations.

Solution Thermodynamics: Ideal solution, fundamental residual-property relation, fundamental excess-property relation. Evaluation of partial properties. Heat effects of mixing processes. Partially miscible systems.

BOOKS SUGGESTED:

1. Chakrabarty, D.K., Adsorption and Catalysis by Solids, Wiley Eastern Limited, New Delhi.
2. Adamson, Physical Chemistry of Surfaces, John Wiley & Sons
3. Smith, J.M., Van, Ness, H.C. and Abbott, M.M. "Introduction to Chemical Engineering Thermodynamics", 6th Ed., McGraw-Hill, 2001.
4. Rao, Y.V.C., "Chemical Engineering, Thermodynamics," University Press, 1997.
5. Rao, Y.V.C., "An Introduction to Thermodynamics," John Wiley, 1993.
6. Glasstone, S. Thermodynamics, Wiley Eastern

7. Kyle, B.G., "Chemical and Process Thermodynamics," 3rd ed., PHI New Delhi
8. R.T. Yang, Adsorbent: Fundamentals and Applications, Wiley Inter-science

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DEPARTMENT OF CHEMISTRY

**Course Work for Ph.D.
Analytical Chemistry**

Paper No. CH-905
04 Hrs /week
Total: 60 Hrs.

Credits: 04
Max. Marks: 100+50
Duration of Exam: 03 Hrs.

Note: The question paper will comprise of eight questions. The candidates will be required to attempt any five questions. All questions will carry equal marks.

Separation techniques

Ion Exchange Chromatography: Ion exchangers (Synthetic and Natural), Ion-exchange equilibria, Experimental technique, applications.

Gel Chromatography: Introduction, types, mechanism of gel permeation chromatography, Resolution, Advantages of gel permeation chromatography, Applications of ion exclusion techniques.

Gas Chromatography: Principle, Theory of gas chromatography, GSC, GLC, HPCL, Instrumentation, detectors used in gas chromatography, Evaluation of gas chromatogram, Identification of gas chromatogram, Application of gas chromatography.

Thermal methods of analysis

Differential Thermal Analysis (DTA): Theories of DTA, factors affecting DTA curves, Instrumentation and applications of DTA, Thermogravimetry (TG): Instrumentation and balances X-Y recorder, thermogram, Factors effecting thermogram. Correlation of DTA and TGA data. Differential Scanning Calorimetry (DSC): Introduction and instrumentation, DSC Curve, factors effecting DSC curve.

Electroanalytical methods

Voltametry and Polarography: General introduction, theoretical consideration of classical polarography, polarographic currents, effect of capillary characteristic on diffusion current, residual current, halfwave potential, Effect of complex formation on polarographic waves and mixed anodic cathodic waves, oxygen waves, instrumentation, cell electrodes and their odification, application of polarography. Modified voltametric methods viz. current sampled polarography, Amperometric titration and their applications.

Miscellaneous methods

Calorimetry, pH metry /Potentiometry, Conductometry, Flame Photometry, Dilatometry

References:

- 1 A Text book of Quantitative Inorganic Analysis, A.I. Vogel, ELBS, London.
- 2 Dynamics of Chromatography-Part I; J.C. Gidding; Dekker, New York.
- 3 Instrumental Methods of Analysis, L.L. Merrit, R.H. Willard and J. Dean: Van Nostrand ó Reinhold.
- 4 Instrumental Methods of Chemical Analysis, H.Kaur; Pragati Prakashan.
- 5 Vogels Text book of Practical Organic Chemistry, B.S. Furniss et al, Longman group.

- 6 Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler and T.C. Morrill.
- 7 Spectroscopic Methods in Organic Chemistry, D.H. Williams and I. Fleming, Tata McGraw-Hill.
- 8 Organic Spectroscopy, William Kemp, John Wiley,
- 9 Designed Organic Synthesis, S. Warren, Wiley.
- 10 Advanced Practical Organic Chemistry, J. Leonard, B. Lygo and G. Proctor, Stanley Thornes.