| Semester | Course | Course Title | Marks | | | Credit |
|---|---|---|---|---|---|---|
| | | | IA | EA | Total | |
| I | Core I | Research Methodology | 40 | 60 | 100 | 4 |

**Unit I Survey of Literature**

1.1 Need for literature survey-Primary, Secondary and Tertiary Sources. Journals, Chemical Abstracts - Subject index, Substance index, Author Index, Formula index and other indices. Other similar abstracts for special topics. Current Titles-Reviews – Monographs - Selection of Research topic-Selection of Research Facility – Location of Journals and Articles.

1.2 Use of computers in the Literature Survey – Websites – Search Engines, Internet, E-mail. Scientific Information and Documentation centers - INSDOC, BANSDOC, NCSI, British Library – Digital Library - e-Journals - e-Content.

**Unit II Presentation of Research Output**

2.1 Research Paper - Preparation of Manuscript for Publication in National and International Journals like Indian Journal of Chemistry (Section A and Section B), Journal of Indian Chemical Society, Current Science, Journal of American Chemical Society and Tetrahedron.

2.2 Thesis - Rough drafting-Title, Abstract, Introduction, Scope of the Work, Literature Review, Problem and Time Limitation, Experimental Methods, Results and Discussion, Foot Notes. Data Presentation - Figures and Tables. Sign Conventions followed. Bibliography - Conclusion and Recommendations. Abbreviations used. Storing and Retrieval of Information using Computer-CD, Pen Drive and DVD.

**Unit III Data Analysis**

3.1 Error Analysis - Errors – Types – Precision and accuracy – Significant figures – Tests for accuracy of results – Positive and negative deviation from accuracy – Distributions: Normal, Binomial and Gaussian-The normal distribution of random errors – Mean value - Variance – Standard deviation – Correlation coefficient-Curve fitting-Method of Least Squares- Reliability interval – t-test, F-test, Q-test and Chi-Square test – Regression analysis –Multiple linear Regression – Observation and Inference.

**Unit IV Separation and Purification Techniques**

4.1 Extraction – Solvent extraction Principle – Theory – Different methods of extraction.

4.2 Separation techniques – Chromatography – Paper, Thin layer, Column, Ion-Exchange, Gas, HPLC and GC-MS. Principles and uses of other separation techniques: Filtration and Crystallization.

**Unit V Computers in Chemistry**

5.1 Introduction to computers–history of computers -Main frame, mini, micro and super computer systems–Computer hardware -CPU, input, output devices, auxillary storage devices, interpreter, compiler–Languages–C Language & Programming–Constants, variables, function –Logical & Arithmetic statements–Transfer & control structure–arrays- pointers–File handling procedures.

5.2 Simple programming examples from chemistry like Temperature conversion, Calculation of frequency of electromagnetic Radiation, Cv of solid (Cv at T<30 K and at T>30 K), Activity coefficient of Electrolytes, Rate constants of I & II order reactions, $t_{1/2}$ of I, II & III order reactions, Calculation of Arrhenius Parameters, Calculation of Modes of Vibration.

**References**


1. J.Anderson, B.H.Durston and M.Poole, *Thesis and Assignment writing*, John Wiley Publications, Sydney, 1970.
2. C.R.Kothari, *Research Methodology (Methods & Techniques),* 2nd Edition, WishwaPrakasam, 2002.
3. P.Ramadass and A.WilsonAruni, Research and Writing Across the Disciplines, MJP Publishers, Chennai, 2009.
4. J.March, *Advanced Organic Chemistry: Reactions, Mechanisms and Structure*, 5thEdition, Wiley, New York, 1996.
5. G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denney, *Vogel's Text book of Quantitative chemical analysis*, 5th Edition, Longman Group UK Ltd., England, 1989.
6. R.A.Day, Jr., and A.L.Underwood, *Quantitative analysis*, 6th Edition Prentice-Hall of India Private Ltd., New Delhi, 1993.
7. Hobart A.Willard, Lynne L.Merritt, Jr., John A.Dean and Frank A.Settle, Jr., *Instrumental methods of Analysis,* 6th Edition, CBS Publishers & Distributors, Delhi, 1986.
8. K.V.Raman, *Computers in Chemistry*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
9. E. Balagurusamy, "*Programming in ANCI C"* – Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
10. E. Balagurusamy,"*Object Oriented Programming with C++"*– Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2003.
11. D. Ravichandran, "*Programming with C++*", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.


**WEBSITES**

http://indianchemsoc.org/jourindx.htm
http://www.ias.ac.in/currsci/
http://pubs.acs.org/journal/jacsat
http://ees.elsevier.com/tet/

| Semester | Course | Course Title | Marks | | | Credit |
|---|---|---|---|---|---|---|
| | | | IA | EA | Total | |
| I | Core II | Recent Trends in Chemistry | 40 | 60 | 100 | 4 |

**Unit I Retrosynthesis and Functional Group Interconversions**

1.1 Synthons and Synthetic equivalents – donors and acceptors – Regioselective and Stereo selective alkylation of cyclic ketones & cyclic enones. Retro synthetic Analysis of acyclic and cyclic compounds - one and two group disconnections.

1.2 Interconversions of functional groups like C = O, -CHO, -OH, -SH, -COOH, -$NH_2$, -COOR, -CONHR, C = C. Reversible protection of reactive sites.

**Unit II Green Chemistry**

2.1 Green Chemistry- Need, Goals, Limitations and Progress. Heterogeneous reaction of green chemistry. Alternative solvents: ionic liquids, super critical fluid extraction and organic synthesis using water resistant Lewis acids.

2.2 Microwave assisted organic synthesis – the reaction vessel, medium, advantages, limitations and applications. Microwave assisted reactions in water: Hoffmann elimination, hydrolysis, oxidation of alcohols and saponification – Microwave assisted reactions in organic solvents: Esterification, Diels-Alder reaction, decarboxylation – Solvent free microwave reactions: deprotanation, saponification of esters, and synthesis of anhydrides from dicarboxylic acids.

2.3 The use of Ultrasound in organic synthesis: Introduction and Instrumentation. Types of Sonochemical reactions: Esterification, substitution, oxidation and reduction.

**Unit III Nanochemistry**

3.1 Introduction – types of nanotechnology and nanomachines – molecular nanotechnology – Scanning Electron Microscope (SEM) – modern Transmission Electron Microscope (TEM) – Scanning Probe Microscope (SPM) – Atomic Force Microscope (AFM) – nano dots – nano materials – preparation – plasma arching – sol gels – electro deposition – ball milling.

3.2 **Applications of nanomaterials**: carbon nano tubes – molecular switches – rotaxanes and catenanes – lithography – nano biometrics –future applications.

**Unit IV Cheminformatics**

4.1 **Basics of Cheminformatics**: Introduction – evolution – history of chemical information science – uses of Cheminformatics.

4.2 **Drug design and discovery**: Development of drug – pharmacodynamics – biological testing and bioassays – chemical parameters in drug design – physicochemical parameters in drug design – structure based drug design – drug discovery.

**Unit V Advanced Instrumental Techniques**

5.1 Principles and applications of 2D NMR (COSY, HMBC, HSQC and NOESY), XPS and ENDOR spectroscopy (Instrumentation is not needed).

**References**


1. S.Warren, *Organic Synthesis: The Disconnection Approach,* John Wiley & Sons, 1984.
2. V.K.Ahluvalia, R.Agarwal, Narosa Publishing House, *Organic Synthesis-Special Techniques,* Chennai, 2001.
3. Jonathan Clayden, Nick Greeves, Stuart Warren, and Peter Wothers, *Organic Chemistry*, Oxford University Press, 2001.
4. V.Kumar, *An Introduction to Green Chemistry*, Vishal Publishing Co., Jalandhar.
5. P.T.Ananstas, J.C.Warner, *Green Chemistry-Theory and Practice*, Oxford University Press, New York, 2000.
6. R.Sanghi, M.M.Srivastava, *Green Chemistry-Environment friendly Alternatives*, Narosa Publishing House, Chennai, 2003.
7. V.K.Ahluwalia, *Green Chemistry-Environmentally Benign Reaction*, Ane Books India, New Delhi, 2008.
8. V.S.Muralidharan and A.Subramania, *Nano Science and Technology*, CRC Press, 2008.
9. Andrew R.Leach, Vallerie J. Gillet and A.R.Leach, *An Introduction to Cheminformatics*, Springer, 2003.
10. Johann Gasteiger, *Handbook of Cheminformatics: From Data to Knowledge*, Volumes 1- 4, Wiley-VCH Verlag GmbH & Co, Weinheim, 2003.
11. GurdeepChatwal and Sham Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, 1993.
12. J.M.Hollas, *Modern Spectroscopy*, 3rd Edition, John Wiley, New York, 1996.
13. R.L.Pecsok, L.D.Shields, T.Cairns and L.C. Mc William, *Modern Methods of Chemical Analysis*, 2nd Edition, John Wiley, New York, 1976.


**WEBSITES**

http://en.wikipedia.org/wiki/Nanochemistry
http://en.wikipedia.org/wiki/Nanotechnology
http://en.wikipedia.org/wiki/Cheminformatics

| Semester | Course | Course Title | Marks | | | Credit |
|---|---|---|---|---|---|---|
| | | | IA | EA | Total | |
| I | Core III | Selected Topics in Chemical Research | 40 | 60 | 100 | 4 |

**Unit I Coordination Chemistry**

1.1 Methods of preparation of coordination compounds – Analysis and determination of molecular formula – Volumetric, gravimetric and colorimetric methods – Conductance and magnetic measurements and complexes.

1.2 Characterization of metal complexes by UV, IR, NMR and ESR studies.

**Unit II Bioorganic Chemistry**

2.1 Biosynthesis of proteins - role of DNA and RNA.

2.2 Determination of base sequence of DNA-polymerase chain reaction (PCR)-antisense technology in chemotherapy and other nucleic acid-targeted drugs-DNA binding-fundamental interactions with nucleic acids-Binding of tris (phenanthroline) metal complexes with DNA - Techniques to monitor binding-Applications of different metal complexes that bind nucleic acids.

**Unit III Water analysis**

3.1 Methods and procedure for the estimation of Dissolved Oxygen (DO), Biological Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Temporary and Total hardness, Acidity, Alkalinity, Heavy metals and Fluoride.

3.2 Water Quality parameters for domestic, industrial and agricultural usage (Indian and WHO standards).

**Unit IV Reagents in Organic Synthesis**

4.1 **The survey of reactions and reagents**: NaH, $LiAlH_4$, Tri-tertiary butoxy Aluminium hydride, $NaCNBH_3$, $SiMe_3H$, Alkali metal in acidic, basic, neutral solvents, hydrazines, Osmium tetroxide, Chromyl chloride, Ozone, LTA, Selenium diazide, dioxane, Gilman's reagent, LDA-DCC, Wilkinson's catalyst, DDQ, Evans' catalyst, zeolites.

**Unit V Corrosion & Adsorption**

5.1 **Corrosion** – Types - dry, wet, galvanic, concentration cell, pittig, stress and microbial.

5.2 **Corrosion monitoring techniques**: Electrochemical and Non-Electrochemical methods.

5.3 **Adsorption**-Choice of adsorbents for the removal of heavy metals- Natural and Synthetic adsorbents – Effect of Variable parameters (Dosage of adsorbents, Initial Concentration, Contact Time, Initial pH and Temperature)- Adsorption Isotherms-Freundlich and Langmuir.

**References**

1. J.D.Lee, *Concise Inorganic Chemistry*, 6th Edition, ELBS, London, 1988.
2. J.E.Huheey, *Inorganic Chemistry Principle, Structure and Reactivity*, 2nd Edition, Harper &Row Publishers, New York, 1972.

3. F.A.Cotton and G.Wilkinson, *Advanced Inorganic Chemistry*, 3rd Edition, John Wiley & Sons, London, 1988.
4. S.F.A.Kettle, *Physical Inorganic Chemistry: A Coordination Chemistry Approach*, Specktrum, Oxford, 1996.
5. K.R.Markham, *Techniques of flavonoid identification*, Academic Press, London, 1982.
6. J.B.Harborne, *Phytochemical methods*, Chapman and Hall, London, 1982.
7. T.W.Goodwin, *Chemistry and Biochemistry of plant pigments*, Academic Press, London. Vol. I & II.
8. S.M.Khopkar, *Environmental Pollution Analysis*, 1st Edition, Wiley Easter Ltd., New Delhi, 1993.
9. A.K.De, *Environmental Chemistry*, 4th Edition, New Age International Private Ltd., New Delhi, 2000.
10. J.March, *Advanced Organic Chemistry: Reactions, Mechanisms and Structure*, 5th Edition, Wiley, New York, 1996.
11. Jonathan Clayden, Nick Greeves, Stuart Warren, and Peter Wothers, *Organic Chemistry*, Oxford University Press, 2001.
12. Mary Fieser, *Reagents for Organic Synthesis*, Volume 9, Wiley-Interscience, 1981.
13. L.Antropov, *Theoretical Electro Chemistry*, Mir Publishers, Moscow, 1972.
14. J.O.M. Bockris and A.K.N. Reddy, *Modern Electro Chemistry*, Volume I and II, Plenum Press, New York, 1970.

| Semester | Course | Course Title | Marks | | | Credit |
|---|---|---|---|---|---|---|
| | | | IA | EA | Total | |
| I | Core IV | Teaching and Learning Skills | 40 | 60 | 100 | 4 |

**Objectives:**

After completing the course, scholars will be able to:

- acquaint different parts of computer system and their functions.
- understand the operations and use of computers and common accessories.
- develop skills of ICT and apply them in teaching learning context and Research.
- appreciate the role of ICT in teaching, learning and Research.
- acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- understand the terms communication Technology and Computer mediated teaching and develop multimedia/E-content in their respective subject.
- understand the communication process through the web.
- acquire the knowledge of instructional.

**Unit I Computer Applications Skills**

Computer System: Characteristics, Parts and their functions - Different generations of computer – Operation of Computer: switching on/off/restart. Mouse control, Use of key board and some functions of key – Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, Spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations.

**Unit II Communication Skills**

Communication Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and Written: Non-verbal Communication – Intrapersonal, Interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of Communication: Listening, Speaking, Reading and writing – Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

**Unit III Communication Technology**

Communication Technology: Bases, Trends and Developments – Skills of using Communication Technology – Computer Mediated Teaching Multimedia, E – content – Satellite – based communication: EDUSAT and ETV Channels. Communication through web: Audio and Video applications on the internet, interpersonal communication through the web.

**Unit IV: Pedagogy**

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation – Versatility of Lecture technique – Demonstration: Characteristics, Principles, Planning Implementation and Evaluation – Teaching – learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion – Modes of teaching: CAI, CMI and WBI

**Unit V Teaching Skills**

Teaching Skill: Definition, Meaning and Nature: Types of Teaching skills: Skill of Set induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills.

**References**

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2. Don Skinner (2005), Teaching Training, Edinburgh University Press Ltd, Edinburgh Information and Communication Technology in Education: A Curriculum for schools and programme of Teacher development, Jonathan Anderson and Tom Van Weart, UNESCO, 2002.
3. Kumar, KL (2008) Educational Technology, New Age International Publishers, New Delhi.
4. Mangal, S.K. (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana.
5. Michael, D and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York.
6. Pandey, S.K (2005) Teaching Communication, Commonwealth Publishers, New Delhi.
7. Ram Babu, A and Dandapani, S (2006), Microteaching (vol. 1 &2), Neelkammal Publications, Hyderabad.
8. Singh V.K. and Sudarshan, K.N. (1996) Computer Education, Discovery Publishing Company, New York
9. Sharma, R.A. (2006) Fundamentals of Educational Technology, Surya Publications, Meerut.
10. Vanaja, M. and Rajasekar, S (2006), Computer Education, Neelkamal Publications, Hyderabad.