COURSE WORK SYLLABUS FOR CHEMISTRY

Subject code: 18SPHDCH01

ORGANIC CHEMISTRY
ORGANIC REACTIONS AND MECHANISM

Module-1

Substitution reactions – Kinetics, mechanism and stereo chemical factor affecting the rate ofSN1, SN2, SRNi, SNi , SN1, SN2, SN1i, reactions, neighbouring group participation. Electrophilic substitution reactions – Kinetics, mechanism and stereo chemical factor affecting the rate of SE1& SE2.

Module -2

Aromatic electrophilic substitution reactions: Mechanism of nitration, halogenation, sulphonation, Friedel-Crafts alkylation and acylation, Mannich reaction, chloromethylation, Vilsmeier Haack reaction, Diazonium coupling, Gattermann–Koch reaction, Mercuration reaction.

Module-3

Addition reactions: Addition to C-C multiple bonds involving electrophiles, nucleophiles and free radicals. Markownikoff's rule and anti Markownikoff's rule, Hydroboration. Typical additions to carbonyl compounds: Addition of hydride, water, alcohol, HCN, Grignard reagents and amino compounds to carbonyl compounds.

Module -4

Mechanism of ester formation and their hydrolysis, formation and hydrolysis of amides, decarboxylation mechanisms. Elimination reactions: Mechanism and stereochemistry of eliminations– E1, E2, cis-elimination, Hofmann and Saytzeff eliminations, competition between Elimination and substitution, Chugaev reaction. Rearrangement reactions: Inter and Intra molecular.

Module-5

Aromatic nucleophilic substitution reactions: SN1, SN2 and benzyne mechanism, Bucherer reaction, von Richter reaction. **Aldol and related reactions:** Keto-enoltautomerism, mechanism and synthetic applications of aldol condensations, Claisen reaction, Schmidt reaction, Perkin reaction, Knoevenogel, benzoin, Stobbe and Darzen's glysidic ester condensation, Cannizaro reaction, Michael addition, Robinson's annulation reactions.

REFERENCES:

1) I. L. Finar, Organic Chemistry, ELBS Longmann, Vol. I & II, 1984
2) J. March Advanced Organic Chemistry, Wiley Interscience, 1994.
3) E. S. Gould, Mechanism and Structure in Organic Chemistry, Halt, Rinhart& Winston, New York, 1964.
4) F. A. Carey and Sundberg, Advanced Organic Chemistry – Part A & B, 3rd edition, Plenum Press, New York, 1990.
5) Comprehensive Organic Synthesis – B. M. Trost and I. Fleming series, Pergamon Press, New York, 1991.
6) A Guide book to mechanism in organic chemistry – Petersykes.
7) S. K. Ghosh, Advanced General Organic Chemistry, Book and Alleied (P) Ltd, 1998

8) R. K. Bansal, Organic Reaction Mechanism, Wiley Eastern Limited, New Delhi, 1993.
9) K.S. Tewari et al, Vikas publishing house private limited 2005.

Subject code : 18SPHDCH02

PHYSICAL CHEMISTRY
ELECTROCHEMISTRY AND TECHNIQUES

Module -1:

Electrochemistry: Introduction, Derivation of Nernst equation for electrode potential. Reference electrodes: Introduction, construction, working and applications of calomel and Ag / AgCl electrodes. Measurement of electrode potential using calomel electrode. Ion selective electrode: Introduction; Construction and working of glass electrode, determination of pH using glass electrode. Concentration cells: Electrolyte concentration cells, numerical problems.

Module -2:

Electronic Properties and Band Theory: Metals, insulators and semiconductors, electronic structure of solids-band theory, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties- Optical reflectance, photoconduction. Magnetic Properties- Classification of materials: quantum theory of paramagnetic cooperative phenomena-magnetic domains, hysteresis.

Module -3:

Electrode Kinetics: Metal/solution interface- Dependence of electrochemical reaction rate on over potential-current density for single step and multi-step processes-Influence of electrical double layer on rate constants. Activation and diffusion controlled processes- Marcus kinetics and quadratic dependence of Gibbs free energies-electron transfer processes involving organic and inorganic compounds. Different types of over potentials- polarization behaviour. Mechanism of hydrogen evolution and oxygen reduction in acid and alkaline media. Experimental methods for elucidation of reaction mechanism.

Module -4:

Metal Finishing: Introduction, Technological importance. Electroplating: Introduction, principles governing-Polarization, decomposition potential and overvoltage. Factors influencing the nature of electro deposit-current density, concentration of metal ion & electrolyte; pH, temperature & throwing power of plating bath; additives- brighteners, levellers, structure modifiers & wetting agents. Electroplating of Nickel (Watt's Bath) and Chromium (decorative and hard).

Electro less plating: Introduction, distinction between electroplating and electro less plating, electro less plating of copper & manufacture of double sided Printed Circuit Board with copper.

Module-5

Electrochemical Techniques: Polarography; Chronopotentiometry; Chronoamperometry, Chronocoulometry, Linear Potential Sweep Voltammetry; Cyclic Voltammetry, Impedance measurements; AC Voltammetry.

REFERENCES:

1. B.S.Jai Prakash, R.Venugopal, Sivakumaraiah&PushpaIyengar., “Chemistry for Engineering Students”, Subhash Publications, Bangalore.

2. R.V.Gadag&A.Nityananda Shetty., “Engineering Chemistry”, I K International Publishing House Private Ltd. New Delhi.

3. P.C.Jain& Monica Jain., “Engineering Chemistry”, DhanpatRai Publications, New Delhi.

4. A. J. Bard and L. R. Faulkner, Electrochemical Methods: Fundamentals and Applications, 2nd Ed., John Wiley & Sons, New York, 2001. ISBN: 0-471-04372-9.

5. Gurdeep and Rajesh : Thermodynamics, Goel Publishing House, Meerut.

6. Barrow G M : Physical Chemistry, 5th Ed, Mcgraw Hill Co. (1968).

7. Chemical Kinetics and Dynamics; Jeffrey I Steinfeld, Joseph S. Francisco and William L. Hase. Prentice Hall, 2nd edition, 1998.

8. Laidler, K. J.; “Chemical Kinetics", 3rd Edition 1997 , Benjamin-Cummings. Indian reprint - Pearson 2009.

9. W.J.Albery; Electrode kinetics Clarendon Press, Oxford 1975.

Subject code:18SPHDCH03

ANALYTICAL CHEMISTRY & ALLIED SUBJECT

NANO TECHNOLOGY

Module -1

Introduction to Nano science:

Introduction to Nano science; History and Scope, Interdisciplinary nature, Structure of nanomaterials, Quantum wells, quantum wires, quantum dots, fullerenes, graphite, carbon nanotubes, inorganic nanowires, nanoparticles. Nano-optoelectronic materials and devices, medicine and pharmacology applications, thin-films, One Dimensional Nanostructures, Nano wires and nano rods, Spontaneous growth: Evaporation and condensation growth, vapor-liquid-solid growth.

Module-2

Template based synthesis: Electrochemical deposition, Electro-phoretic deposition. Two dimensional nano-structures, Fundamentals of film growth. Physical vapour Deposition (PVD): Evaporation molecular beam epitaxy (MBE), Sputtering, Comparison of Evaporation and sputtering. Chemical Vapour Deposition (CVD). Wet chemical synthesis methods: sol-gel, hydrothermal, co-precipitation and solution combustion methods.

Module -3

Nanomaterials and composites:

Introduction, Nylon 6-clay hybrid (NCH) - Synthesis, Characterization; Epoxy nanocomposites, Epoxy layered silicate nanocomposites, Epoxy-nanocomposites based on other Nano fillers, Biodegradable polymer/layered silicate nanocomposites, Polymer/layered silicate nanocomposites technology, structure-property relationships, polypropylene layered silicate nanocomposites, Nanotubes, nanoparticles and inorganic organic hybrid systems, Single-walled carbon nanotubes in epoxy, Fullerene/carbon nanotube (CNT) composites, Filled polymer nanocomposites containing functionalized nanoparticles, Magnetic polymer nanocomposites, Polymer/graphite nanocomposites.

Module -4

Nano magnetic Materials:

Basics of ferromagnetism, Effect of bulk structuring of Magnetic properties, Dynamics of Nano magnets, Nano pore containment of magnetic properties, Nano carbon Ferro magnets, Giant Magneto resistance, Applications in data storage, Ferro fluids, Band structure in magnetic fields, Parallel and perpendicular field. Thin films, Atomic layer deposition (ALD), electrochemical deposition (ECD), Sol-Gel films.

Module -5

Characterization of Nano-structured materials:

Principle, instrumentation and applications of Powder X-ray diffraction, Fourier transform infrared spectroscopy, Scanning electron microscopy(SEM), tunneling electron microscopy(TEM), atomic force microscopy(AFM), magnetic-force microscopy (MFM), scanning near-field optical microscopy (SNOM).

REFERENCES:

1) Nanomaterials – AK Bandyopadhyay, Newage International (p) limited publishers.
2) Nanomaterials- J Dutta and H Hofmann
3) Nanostructured materials processing, properties and applications- Carl C Koch, Jaicopublishing house.
4) Nanotechnology- William Illsey Atkinson, Jaico publishing house.