BAC-C102/BAC-C202
ENGINEERING CHEMISTRY

MM: 100 **Sessional: 30**
Time: 3 hrs **ESE: 70**
L T P **Credits 4**
3 1 0

NOTE: The question paper shall consist of three sections (Sec.-A, Sec.-B and Sec.-C). Sec.-A shall contain 10 objective type questions of one mark each and student shall be required to attempt all questions. Sec.-B shall contain 10 short answer type questions of four marks each and student shall be required to attempt any five questions. Sec.-C shall contain 8 descriptive type questions of ten marks each and student shall be required to attempt any four questions. Questions shall be uniformly distributed from the entire syllabus. The previous year paper/model paper can be used as a guideline and the following syllabus should be strictly followed while setting the question paper.

UNIT –I

Periodic properties (8 hours)

Effective nuclear charge, Penetration of orbitals, Variations of s, p, d and f orbital energies of atoms in the periodic table, Atomic and Ionic sizes, Ionization energies, Electron affinity and Electronegativity, Polarizability, Oxidation states, Coordination numbers and Geometries, Hydrogen bonding, Concept of hybridization.

UNIT -II

Chemical kinetics & Use of free energy in chemical equilibria (8 hours)

Introduction, Rate of reaction, Factors influencing rate of reaction, Order and Molecularity of reaction, Arrhenius equation, Concept of activation energy and its determination, Collision theory of reaction rates.

Thermodynamic functions: Energy, Entropy and Free energy, Estimations of entropy and Free energies, Free energy and emf. Cell potentials, the Nernst equation and applications (without derivation) Acid-base equilibria.

UNIT -III

Polymers (8 hours)

Polymers, Nomenclature of polymers, Types of polymerization, Classification of polymerization, Industrial application of polymers, Conducting polymers.

(i) Plastics: Structure, Properties and uses of thermoplastic (Polyvinyl chloride, Teflon, Nylons and Polymethyl methacrylate) & Thermosetting (Bakelite) materials, Uses of plastics.

(ii) Rubber: Natural rubber & Synthetic rubber, Vulcanization of rubber, Advantages of vulcanization of rubber.

UNIT -IV

Nano chemistry (8 hours)

Introduction, Nanotechnology applications, Role of bottom-up & Top-down approaches in Nanotechnology, Material self-assembly, Self-assembling materials, Nanomaterials, Nanocrystals/Nanoparticles, Properties and applications of Nanoparticles, Carbon Nano tube (Basic concept Only).

UNIT -V

Organic reactions and synthesis of a drug molecule (8 hours)

Introduction to reactions involving Substitution, Addition, Elimination, Oxidation, Reduction, Basic concept of stereoisomerism (Geometrical & Optical isomerism).

Synthesis of a commonly used drug molecule (Definitions of different classes of drugs, Synthesis of Aspirin, Phenacetin & Paracetamol Only, Excluding mechanism).



Suggested Text Books

- **(i)** University chemistry, by B. H. Mahan
- **(ii)** Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
- **(iii)** Fundamentals of Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- **(iv)** Physical Chemistry, by P. W. Atkins
- **(v)** Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp
- **(vi)** Principles of Physical Chemistry, by B.R. Puri, L.R. Sharma, M. Pathania
- **(vii)** A text book of Organic Chemistry, by S. K. Jain
- **(viii)** A text book of Engineering Chemistry, by S. S. Dara
- **(ix)** A text book of Engineering Chemistry, by Jain & Jain

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

The course will enable the student to:

- Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- Rationalize bulk properties and processes using thermodynamic considerations and learn about chemical kinetics.
- Know about the polymers, polymerization, synthesis and uses of different polymers, plastics and rubbers.
- Know about the Nano chemistry, nanoparticles, Nano materials, and their properties and applications.
- List major chemical reactions that are used in the synthesis of molecules.