

DEPARTMENT OF CHEMISTRY

Course Structure & Syllabi for MINOR Programme in Chemical Science & Technology (To be applicable from BTech 2010-batch onwards).

Semester	Course Code	Course Title	L-T-P-C
3 rd	CH 211M	Inorganic Chemistry	3 - 0 - 0 - 6
4 th	CH 222M	Applied Organic Chemistry	3 - 0 - 0 - 6
5 th	CH 331M	Spectroscopic techniques in Chemistry	3 - 0 - 0 - 6
6 th	CH 332M	Physical Chemistry	3 - 0 - 0 - 6
7 th	CH 421M	Chemical Technology	3 - 0 - 0 - 6
Total credits			15 - 0 - 0 - 30

CH 211M Inorganic Chemistry (3-0-0-6)

Acids and bases: classification, Lewis acid and base concept, hard acid, hard base classification, Pearson's HSAB concept and application; Oxidation and reduction: redox reactions, redox potential, electrochemical series, use of electrochemical series; Metallic chains, sheets and clusters; Metal silicates, zeolites and polyoxo-metallates; Metals and alloys, ceramic materials, inter-metallic compounds and intermetallic phases; Chemistry of phosphorus, phosphorus oxides and phosphorus hydrides; Chemistry of oxyacids and oxyanion of nitrogen and phosphorus; Differences between the chemistry of nitrogen and phosphorus; Chemistry of the halogens: pseudo-halogen, inter-halogen; Oxides and oxyacids; Polyhalides; Chemistry of the rare gases: Chemistry of xenon, structure and bonding of xenon compounds; Non-aqueous solvents: types of solvents, general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2 .

Texts:

1. N. N. Greenwood, and A. Earnshaw, *Chemistry of the Elements*, 2nd Ed, Butterworth Heinmann, London, 1997.
2. D. J. Shriver, P. W. Atkins, and C. H. Langford, *Inorganic Chemistry*, 2nd Ed, Oxford University Press, 1994.

References:

1. F. A. Cotton, and G. W. Wilkinson, *Advanced Inorganic Chemistry*, 5th Ed, John-Wiley & Sons, 1988.
2. J. E. Huheey, E. A. Keiter, and R. L. Keiter, *Inorganic Chemistry: Principles of Structure and Reactivity*, Dorling Kindersley, 2006.
3. P. K. Dutt, *Concepts of Chemistry*, Levant Book, 2004.

CH 222M**Applied Organic Chemistry****(3-0-0-6)**

Fats, oils and detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, soaps, synthetic detergents; Synthetic dyes: Classification of dyes, synthesis of some dyes; Liquid Crystals: Liquid crystal phase, classification, synthesis and application; Principles and Concepts of Green Chemistry: Atom economy, reducing toxicity; waste-production, problems and prevention, water as solvents, solvent free conditions, ionic liquids, super critical solvents; Introduction to medicinal and pharmaceutical chemistry: Methods of classification of drugs based on structure and biological activity.

Texts:

1. R. T. Morrison, and R. N. Boyd, *Organic Chemistry*, 6th Ed, Prentice-Hall, 2004.
2. M. Lancaster, *Green Chemistry: An Introductory Text*, Royal Society of Chemistry, 2002.

Reference:

1. I. L. Finar, *Organic Chemistry*, Vol. 1 & 2, 5th Ed, Pearson education, 2005.
2. D. Singh, B. Deshwal, and S. K. Vats, *Comprehensive Engineering Chemistry*, I. K. International, Mumbai, 2007.
3. D. A. Williams, and T. L. Lemke, *Foye's Principles of Medicinal Chemistry*, Lippincott Williams & Wilkins, Philadelphia, 2002.

CH 331M**Spectroscopic Techniques in Chemistry****(3-0-0-6)**

Characterization of electromagnetic radiation, width and intensity of the transitions, stimulated emission, rotational spectra of diatomic and polyatomic molecules, chemical analysis, infra-red spectra of diatomic and polyatomic molecules, analysis of infra-red techniques, pure rotational and vibrational Raman spectra, electronic spectra of diatomic and poly atomic molecules, radiative and nonradiative decay, nuclear magnetic resonance spectroscopy of hydrogen and other nuclei, electron spin resonance spectroscopy.

Texts:

1. C. N. Banwell, and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, Tata McGraw Hill, 1994.
2. P. Atkins, and J. de Paula, *Atkins' Physical Chemistry*, 7th Ed. (Third impression), Oxford University Press, 2005.

References:

1. G. M. Barrow, *Introduction to Molecular Spectroscopy*, McGraw Hill, 1962.
2. H. E. White, *Introduction to Atomic Spectra*, McGraw Hill, 1934.
3. N. J. Turro, *Modern Molecular Photochemistry*, University Science Books, 1991.
4. B. Valeur, *Molecular Fluorescence Principles and Applications*, Wiley-VCH, 5th reprint, 2009.

Rates of Chemical reactions, simple reactions, transition state theory, Opposing reactions, consecutive reactions, parallel reactions, reversible reactions, relaxation method, reaction mechanisms, Arrhenius equation Complex reactions- chain reactions, polymerization reactions; Catalysis, enzyme catalysis; surface catalysis; Laws of thermodynamics, Zeroth Law, First Law, Second Law, Thermochemistry, Hess Law, Entropy. Gibbs free energy, chemical equilibrium, Electrochemical cells - cell representation, types of electrodes, half reactions, standard potentials, cell reactions, cell EMF, applications of standard potentials - electrochemical series, determination of pH, pKa, solubility product.

Texts:

1. G. W. Castellan, *Physical Chemistry*, 3rd Ed., Narosa Publishing House, 1985.
2. P. Atkins, J. de Paula, *Atkin's Physical Chemistry*, 7th Ed., Oxford University Press, 2002.

References:

1. K. Laidler, *Chemical Kinetics*, 3rd Ed., Pearson Education, 2004.
2. G. M. Barrow, *Physical Chemistry*, 5th Ed., Tata Mcgraw-Hill, 1992.

Fine chemicals and their synthesis: Homogeneous and heterogeneous catalysis, biocatalysis, phase transfer catalysis; Energy and its biological resources; BioFuels, Market and product process of low cost bio-fuels; Synthetic polymers: polymerization, methods of polymerization, step growth polymerization, structure and physical properties, natural and synthetic rubbers, recent development in the field of biodegradable polymers.

Texts:

1. A. Cybulski, J. A. Moulijn, and M. M. Sharma, and R. A. Sheldon, *Fine Chemicals Manufacturing and Engineering*, Elsevier Science, 2001.
2. C. M. Drapcho, N. P. Nhuan, and T. H. Walker, *Biofuels Engineering and Process Technology*, McGraw Hill, 2008.

References:

1. P. Pollak, *Fine Chemicals: The industry and the Business*, John Wiley and Sons, 2007.
2. A. Nag, *Biofuels refining and performance*, McGraw Hill, 2008.
3. D. M. Mousdale. *Biofuels: Biotechnology, Chemistry and Sustainable Development*, CRC Press, 2008
4. R. N. Shreve, and J. A. Brink, *Chemical Process Industries*, 4th Ed., International students Ed., 1977.
5. G. F. Austin, *Shreve's Chemical Process Industries*, 5th Ed., McGraw Hill Pub., 1984.
6. J. R. Fried, *Polymer Science and Technology*, Prentice Hall, Englewood Cliffs, 1995.

CH 401M**Modern Chemical Technology****(3 0 0 6)**

Fine chemicals and their synthesis- biocatalysis, enantioselective catalysis; Catalysis in fine chemicals- Mechanism of catalysis, homogeneous and heterogeneous catalysis; Catalyst performance, phase transfer catalysis; Selectivity engineering, process development, energy and its biological resources; BioFuels, Biofuel feedstocks- sugar, starch, lignocellulosic, plant and animal fats feedstock; Market and product process of bioethanol, raw materials to produce low cost bio-diesel, harvesting energy from biochemical resources.

Text Books:

1. A. Cybulski, J. A. Moulijn, M. M. Sharma, and R. A. Sheldon, *Fine Chemicals Manufacturing and Engineering*, Elsevier Science, 2001.
2. C. M. Drapcho, N. P. Nhuan, T. H. Walker, *Biofuels Engineering and Process Technology*, McGraw Hill, 2008.

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1. P. Pollak, *Fine Chemicals: The industry and the Business*, John Wiley and Sons, 2007.
2. A. Nag, *Biofuels refining and performance*, McGraw Hill, 2008.
3. D. M. Mousdale. *Biofuels: Biotechnology, Chemistry and Sustainable Development* CRC Press ,2008
4. R. N. Shreve, J. A. Brink, *Chemical Process Industries*, 4th Ed., International students Ed., 1977.
5. G. F. Austin, *Shreve's Chemical Process Industries*, 5th Ed., McGraw Hill Pub., 1984.