UNIVERSITY OF MUMBAI
No. UG/166 of 2016-17

CIRCULAR:-

A reference is invited to the Syllabi relating to the B.Sc. degree course , **vide** this office Circular No. UG/128 of 2011, dated 13th June, 2011 and the Principals of affiliated Colleges in Science are hereby informed that the recommendation made by the Ad-hoc Board of Studies in Chemistry at its meeting held on 7th July, 2016 has been accepted by the Academic Council meeting held on 14th July, 2016 **vide** item No. 4.12 and that in accordance therewith, the revised syllabus as per the Choice Based Credit System for F.Y. B.Sc. programme in Chemistry (Sem. I & II), which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

(Dr.M.A.Khan)
REGISTRAR

MUMBAI – 400 032
19 November, 2016

To,

The Principals of the affiliated Colleges in Science.

A.C/4.12/14.07.2016

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No. UG/166 -A of 2016 MUMBAI-400 032 19 November, 2016

Copy forwarded with Compliments for information to:-

1) The Co-ordinator, Faculties of Science,
2) The Chairman, Board of Studies in Chemistry,
3) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
4) The Director, Board of College and University Development,
5) The Co-Ordinator, University Computerization Centre,
6) The Controller of Examinations.

(Dr.M.A.Khan)
REGISTRAR

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Choice Based Credit System F.Y.B.Sc. Chemistry Syllabus

To be implemented from the Academic year 2016-2017

SEMESTER I

Course Code	Unit	Topics	Credits	L / Week
USCH101	I	Chemical Thermodynamics Chemical calculations	2	1
	II	Atomic structure, Periodic Table and periodicity		1
	III	Basics of Organic Chemistry: Classification and Nomenclature of Organic Compounds Bonding and Structure of organic compounds Fundamentals of organic reaction mechanism		1
USCH102	I	Chemical Kinetics Liquid state	2	1
	II	Comparative chemistry of Main Group Elements		1
	III	Stereochemistry I		1
USCHP1		Chemistry Practicals	2	6

Semester I
Paper I
Unit-I

1.1 Chemical Thermodynamics: (10L)

Thermodynamic terms: System, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state functions and path functions, zeroth law of thermodynamics

First law of thermodynamics: concept of heat (q), work (w), internal energy (U), statement of first law, enthalpy, relation between heat capacities, sign conventions, calculations of heat (q), work (w), internal energy (U), and enthalpy (H) (Numericals expected)

Thermochemistry: Heats of reactions, standard states, enthalpy of formation of molecules, enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equation (Numericals expected)

1.2 Chemical Calculations: (5L)

Expressing concentration of solutions: Normality, molality, molarity, formality, mole fractions, weight ratio, volume ratio, weight to volume ratio, ppm, ppb, millimoles, milliequivalents (Numericals expected)

Unit II

2.1 Atomic structure: (10L)

(Qualitative treatment only; it is expected that the learner knows the mathematical statements and understands their physical significance after completing this topic. No derivations of the mathematical equations required)

a) Historical perspectives of the atomic structure; Rutherford's Atomic Model, Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Structure of hydrogen atom.
b) Hydrogenic atoms:
    1. Simple principles of quantum mechanics;
    2. Atomic orbitals
        i) Hydrogenic energy levels
        ii) Shells, subshells and orbitals
        iii) Electron spin
        iv) Radial shapes of orbitals
        v) Radial distribution function
        vi) Angular shapes of orbitals.

Introduction to types of organic reactions: Addition, Elimination and Substitution reaction. (With one example of each)

Semester II

Paper I

Unit-I

1.1 Gaseous State: (8L)

Ideal gas laws, kinetic theory of gases, Maxwell-Boltzmann's distribution of velocities (qualitative discussion), ideal gases, real gases, compressibility factor, Boyle's temperature (Numericals expected)

Deviation from ideal gas laws, reasons for deviation from ideal gas laws, Van der Waals equation of state, Joule-Thomson effect: qualitative discussion and experimentation, inversion temperature. (Numericals expected)

1.2 Chemical Equilibria and Thermodynamic Parameters: (7L)

Reversible and irreversible reactions, law of mass action, dynamic equilibria, equilibrium constant, (K_c and K_p), relationship between K_c and K_p, Le Chatelier's principle, factors affecting chemical equilibrium (Numericals expected)

Statement of second law of thermodynamics, concepts of entropy and free energy, spontaneity and physical significance of free energy, thermodynamic derivation of equilibrium constant (Numericals expected)

Unit II

2.1 Concept of Qualitative Analysis: (7L)

a) Testing of Gaseous Evolutes, Role of Papers impregnated with Reagents in qualitative analysis (with reference to papers impregnated with starch iodide, potassium dichromate, lead acetate, dimethylglyoxime and oxine reagents).

b) Precipitation equilibria, effect of common ions, uncommon ions, oxidation states, buffer action, complexing agents on precipitation of ionic compounds. (Balanced chemical equations and numerical problems expected.)

2.2 Acid Base Theories: (8L)

Arrhenius, Lowry- Bronsted, Lewis, Solvent – Solute concept of acids and bases, Hard and Soft acids and bases. Applications of HSAB
Applications of acid base chemistry in:

i) Understanding organic reactions like Friedel Craft's (acylation/alkylation) reaction
ii) Volumetric analysis with special reference to calculation of titration curve involving strong acid and strong base.

Unit III

3. Chemistry of Aliphatic Hydrocarbons

3.1 Carbon-Carbon sigma bonds: (3L)

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

3.2 Carbon-Carbon pi bonds: (12L)

Formation of alkenes and alkynes by elimination reactions: Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition),
Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction(catalytic and chemical), syn and anti-hydroxylation (oxidation). 1, 2-and 1, 4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination using N-bromosuccinimide and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.
Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Reference Books

Unit I: Physical Chemistry

1. Khosla B.D., Garg V.C. and Gulati A., Senior Practical Physical Chemistry, R. Chand and Co., New Delhi (2011).
2. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
3. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).
4. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Unit II: Inorganic Chemistry

Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.

Unit III: Organic Chemistry

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996

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