DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

SYLLABUS

B.Sc. (Chemistry)

SECOND YEAR

SEMESTER SYSTEM

THIRD / FOURTH SEMETER

[Effective from - June, 2010-2011onwards]

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGBAD

B.Sc. (Chemistry) IN SEMESTER PATTERN FOR THREE YEAR DEGREE

YEAR	SEMESTER	PAPER NUMBER	PAPER TITLE	CREDITS	MARKS
First	I	Paper - I	Inorganic Chemistry	3	50
		Paper - II	Organic Chemistry	3	50
		Paper - III	Lab Course I	1.5	50
		Paper - IV	Lab Course II	1.5	50
	II	Paper - V	Physical Chemistry	3	50
		Paper - VI	Inorganic Chemistry	3	50
		Paper - VII	Lab. Course - III	1.5	50
		Paper - VIII	Lab Course - IV	1.5	50
Second	III	Paper - IX	Organic Chemistry	3	50
		Paper - X	Physical Chemistry	3	50
		Paper - XI	Lab. Course V	1.5	50
		Paper - XII	Lab. Course VI	1.5	50
	IV	Paper - XIII	Inorganic Chemistry	3	50
		Paper - XIV	Physical Chemistry	3	50
		Paper - XV	Lab. Course VII	1.5	50
		Paper - XVI	Lab. Course VIII	1.5	50
Third	V	Paper - XVII	Physical Chemistry	3	50
		Paper - XVIII	Organic Chemistry	3	50
		Paper - XIX	Lab. Course IX	1.5	50
		Paper - XX	Lab. Course X	1.5	50
	VI	Paper - XXI	Inorganic Chemistry	3	50
		Paper - XXII	Organic Chemistry	3	50
		Paper - XXIII	Lab. Course XI	1.5	50
		Paper - XXIV	Lab. Course XII	1.5	50
	Note : For Theory Paper 1 Credit = 15 Periods and for practicals paper 1 Credit = 30 periods				

B.Sc. Chemistry
(Three year Degree Course)

First Year		**First Semester**
Paper I	**Inorganic Chemistry**	**3 Credits (45 Hrs)** **3 Hrs. / Week**
I	Atomic Structure	**15 Hrs.**
II	Periodic Properties	**10 Hrs.**
III	S - Block Elements	**10 Hrs.**
IV	P - block Elements	**10 Hrs.**
Paper II	**Organic Chemistry**	**3 Credits (45 Hrs)** **3 Hrs / Week**
I	Structure and Bonding	**6 Hrs.**
II	Mechanism of Organic reactions	**8 Hrs.**
III	Stereo - Chemistry	**8 Hrs.**
IV	Alkanes	**6 Hrs.**
V	Alkenes	**6 Hrs.**
VI	Arenes and Aromaticity	**6 Hrs.**
VII	Alkyl and Aryl Halides	**5 Hrs.**
Paper III	**Lab Course I**	**1.5 Credits (45 Hrs.)** **3 Hrs / Week**
Paper IV	**Lab Course II**	**1.5 Credits (45 Hrs.)** **3 Hrs / Week**

First Year		**Second Semester**
Paper V	**Physical Chemistry**	**3 Credits (45 Hrs)** **3 Hrs. / Week**
I	Mathematical Concepts	**10 Hrs.**
II	Gaseous State	**06 Hrs.**
III	Liquid State	**06 Hrs.**
IV	Solid State	**06 Hrs.**
V	Colloidal State	**06 Hrs.**
VI	Chemical Kinetics and Catalysis	**11 Hrs.**
Paper VI	**Inorganic Chemistry**	**3 Credits (45 Hrs)** **3 Hrs / Week**
I	Chemistry of Noble gases	**05 Hrs.**
II	Chemical Bonding	**20 Hrs.**
III	Nuclear Chemistry	**10 Hrs.**
IV	Theory of volumetric analysis.	**10 Hrs.**
Paper VII	**Lab Course III**	**1.5 Credits (45 Hrs.)** **3 Hrs / Week**
Paper VIII	**Lab Course IV**	**1.5 Credits (45 Hrs.)** **3 Hrs / Week**

B. Sc. Chemistry
(Three Year Degree Course)

Second Year

Paper IX	**Organic Chemistry**	**Third Semester** **3 Credits (45hrs)** 3 **Hrs/ Week**
1	Alcohols	06 Hrs
2	Phenols	06 Hrs
3	Aldehydes and Ketones	10 Hrs
4	Carboxylic Acids	09 Hrs
5	Organic Compounds of Nitrogen	14 Hrs

Paper- X	**Physical Chemistry**	**3 Credits (4 Hrs)** **3 Hrs (Week)**
1	Thermodynamics- I	15 Hrs
2	Thermodynamics -II	20 Hrs
3	Chemical Equilibrium	10 Hrs

Paper XI	**Lab Course V**	**1.5 credits (45 Hrs) 3Hrs/ week**
Paper XII	**Lab Course VI**	**1.5 credits (45 Hrs) 3Hrs/week**

Second Year

Paper XIII	**Inorganic Chemistry**	**Fourth Semester**
		3 Credits (45Hrs) 3Hrs/Week
1	Chemistry of Elements of first Transition series	10 Hrs
2	Coordination compounds	10 Hrs
3	Chemistry of Lanthanides	06 Hrs
4	Chemistry of Actinides	05 Hrs
5	Acids and Bases	06 Hrs
6	Non Aqueous solutions	08 Hrs

Paper XIV	**Physical Chemistry II**	**3 Credits (45Hrs) 3Hrs/week**
1	Phase Equilibrium	15 Hrs
2	Electro-chemistry I	15 Hrs
3	Electro-Chemistry II	15 Hrs

Paper XV	**Lab Course VII**	**1.5 Credits (45 Hrs) 3Hrs /week**
Paper XVI	**Lab Course VIII**	**1.5 Credits (45 Hrs) 3Hrs/week**

B.Sc. (Second Year)
Third Semester

(Organic Chemistry) Paper IX 45 Hrs (3 Hrs/week)

1) Alcohols: 6 Hrs.

Defination: *Monohydric Alcohols***:** Methods of Formation by reduction of Aldehydes, Ketones, Carboxylic Acids and Esters (One eg.each) Acidic Nature, Reactions of Alcohols.

Dihydric Alcohols: Method of Formation of Ethylene Glycol-industrial method and From Alkene using OsO_4, Chemical Reactions of Ethylene Glycol-nitration, Acylation, Oxidation (Using $Pb(OAc)_4$ without Mechanism Pinacol-Pinacolone rearrangement,

Trihydric Alcohols: Preparation of Glycerol from propane, Reactions of Glycerol.

2) Phenols: 6 Hrs.

Preparation of Phenol from Chlorobenzene, Cumene and Benzene Sulphonic Acid, Physical properties, Acidic Nature of Phenol, Resonance stabilization of Phenoxide Ion. Reactions of Phenols- Electrophilic Aromatic Substitution, Acylation, Carboxylation (Without Mechanism) Reactions with Mechanism- intramolecular Fries Rearrangement, Claisen Rearrangement, Gatterman Synthesis and Reimer Tiemann Reaction.

3) Aldehydes and Ketones: 10Hrs.

Aldehydes: Preparation of Aldehydes from Acid Chloride, Gattermann-Koch synthesis *Ketones*- Preparation from nitriles and from Carboxylic Acid, Physical Properties of Aldehydes and Ketones. Mechanism of Nucleophilic Additions to Carbonyl Group with particular emphasis on Benzoin, Aldol Knoenenagel condensations, Mannich Reactions. Use of Acetals as Protecting Group. Oxidation of Aldehydes using Chromium Trioxide, Baeyer-Villeger Oxidation of Ketones.

4) Carboxylic Acids: 9 Hrs.

Acidity of Carboxylic Acids, Effects of substituents on Acid strength, preparation of Acetic Acid from CO_2 from Nitriles, from Acid Chloride, Anhydride, Ester and Amide. Physical Properties and reactions of Carboxylic Acids-Synthesis of Acid Chloride, Ester and Amide, Hell-Volhard-Zelinsky Reaction. Reduction using $LiAlH_4$, Mechanism of Decarboxylation, Hydroxyl Acids- Malic, Tartaric and Citric Acid. Methods of Formation and Chemical reactions of Acrylic Acid.

5) Organic Compounds of Nitrogen: 14 Hrs.

Preparation of *Nitroalkanes* and *Nitroarenes*.

Chemical reactions of Nitroalkanes. Nitration of Benzene and Their Reduction in Acidic, Neutral and Basic media.

Amines- Basicity of Amines, Amine Salt as PTC. Preparation of Alkyl and Aryl Amines (Reduction of Nitro Compounds, Nitriles) Reductive Amination, Hoffmann Bromamide Reactions. Reactions of Amines- Electrophilic Aromatic Substitution in *Aryl amines*, Reactions of Amines with Nitrous Acid.

B.Sc. (Second Year)
Third Semester

(Physical Chemistry-I) Paper X 45 Hrs (3 Hrs/week)

1) Thermodynamics: I 15Hrs

Defination of *Thermodynamic Terms*: System, Surrounding types of system, intensive and extensive properties. Thermodynamic Process, Concept of heat and work. Work done in reversible and irreversible process, concept of maximum work (Wmax), Numerical problems.

First law of Thermodynamics: Statement, Defination of Internal energy and Enthalpy.

Heat capacity, heat capacities at constant volume pressure and their relationship. Calculation of W, q, du and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Numerical problems, Hess's law of heat Summation and its application.

2) Thermodynamic-II : 20 Hrs

Second Law of Thermodynamics: Need for the law, different statement of the law.

Carnot Cycle and its efficiency, Numerical Problems. Carnot Theorem.

Concept of *Entropy* : Definition, Physical significance, Entropy as a State Function, Entropy change in Physical change, Entropy as a criteria of Spontaneity & Equilibrium Entropy Change in Ideal Gases. Gibbs and Helmholtz Functions: Gibbs Function (G) and Helmoltz Function (A) as Thermodynamic Quantities. A and G as criteria for Thermodynamic Equilibrium and Spontaneity, their Advantage over Entropy change. Variation A with P, V and T.

3) Chemical Equilibrium: 10 Hrs

Equilibrium Constant and Free Energy. Thermodynamic Derivation of Law of Mass Action. Le Chatelier's Principle. Reaction Isotherm and Reaction Isochore. Clapeyron Equation, Clausius-Clapeyron Equation and its Application.

B.Sc. (Second Year)

Third Semester

Lab Course V — Paper XI

(Physical Chemistry) — 45 Hrs (3 Hrs/week)

Non Instrumental

i) To determine critical solution temperature of Phenol- water system.

ii) To determine solubility of benzoic acid at different temperature and determine Δ H of dissolution process.

iii) To determine heat of neutralization (ΔH_n) of NaOH and HCl

iv) To determine heat of neutralization (ΔH_n) of NaOH and Acetic acid.

v) Partition coefficient of Benzene – water system using benzoic acid.

vi) To determine the equilibrium constant for the reaction: $KI + I_2 \text{ ----- } KI_3$

vii) Determine the molecular mass of polymer from viscometry measurements.

viii) To investigate the Kinetics of Iodination of acetone.

B.Sc. (Second Year)

Third Semester

Lab Course VI — Paper XII

(Inorganic Chemistry) — 45 Hrs (3 Hrs/week)

Gravimetric Estimation:

i) Estimation of Zinc gravimetrically as Zinc ammonium phosphate ($ZnNH_4\ PO_4$)

ii) Estimation of Mn gravimetrically as manganese ammonium phosphate ($MnNH_4PO_4$)

iii) Estimation of Nickel gravimetrically as Ni-DMG

iv) Estimation of Barium gravimetrically as Ba-Chromate ($BaCrO_4$)

v) Estimation of Aluminium as Aluminium Oxinate.

Complex metric Titration:

i) Estimation of Zinc by EDTA solution using EBT indicator.

ii) Estimation of Nickel by EDTA using Murexide indicator

iii) Estimation of copper by EDTA using fast sulphon black F indication

iv) Estimation of Lead By EDTA using Xylenol Orange indicator.

B.Sc. (Second Year)

Fourth Semester

(Inorganic Chemistry) Paper XIII 45 Hrs (3 Hrs/week)

1) Chemistry of Elements of First Transition Series: 10 Hrs.

General characteristic features of d-block elements. Properties of the elements of the first transition series: Ionic Size, Atomic Size, Metallic properties, Ionization potential, magnetic properties, Oxidation State.

2) Co-ordination Compounds: 10 Hrs

Werner's Co-ordination Theory and its experimental verification, effective atomic Number concept, chelates, nomenclature of co-ordination compounds, isomerism in Co-ordination compounds, valence bond theory of transition metal complexes.

3) Chemistry of Lanthanide Elements: 06 Hrs

Occurrence and Isolation of Lanthanides, Electronic Configuration, Oxidation States, Ionic Radii, Lanthanide Contraction and its Consequences.

4) Chemistry of Actinides: 05 Hrs

Occurrence, Position in the periodic table, Electronic configuration. Oxidation State, chemistry of separation of Np, Pu and Am from U

5) Acids and Bases: 06 Hrs

Arrhenius, Bronsted-Lawry, The Lux-Flood, Solvent System and Lewis Concept of Acids and Bases

6) Non-Aqueous Solvents: 08 Hrs

Physical Properties of a Solvent, Types of Solvents and their general Characteristics, Reaction in Non-Aqueous Solvents with reference to liquid NH_3 and liquid SO_2

B.Sc. (Second Year)

Fourth Semester

(Physical Chemistry-II) Paper XIV 45 Hrs (3 Hrs/week)

1) Phase Equilibrium: 15 Hrs

Statement and Meaning of the Terms: Phase, Component, Degree of Freedom, Derivation of Phase Rule Equation.

Phase Equilibria of the One Component System: Water System.

Phase Equilibria of Two Components System: Solid-Liquid Equilibria, Simple Eutectic Pb-Ag. System Desilverisation of Lead.

Solid Solutions : Compound formation with congruent Melting Point (Mg-Zn) and Incongruent Melting Point ($FeCl_3 – H_2O$) System. Freezing Mixture, Acetone-Dry Ice.

Liquid-Liquid Mixture: Raoult's Law and Henry's Law.

Ideal and Non-Ideal system. Azeotropes: $HCl – H_2O$ and Ethanol – Water System.

Partially Miscible Liquids : Phenol –Water, Trimethyl Amine – Water, Nicotine- water System, Lower and Upper Consulate Temperature. Effect of Impurity on Consulate Temperature.

2) Electro Chemistry- I 15 Hrs

Electrical Transport: Conduction in metals and in Electrolyte Solutions. Specific Conductance and equivalent conductance, measurement of equivalent conduction, variation of equivalent and specific conductance with dilution. Numerical problems. Kohlrausch's law and its application. Arrhenius Theory of Electrolyte Dissociation and its limitations. Weak and Strong Electrolytes, Ostwald's Dilution Law, its use and Limitations. Transport Number: Definition, Determination by Hittorf's Method and Moving Boundary Method. Conductometric Titration : Types and its advantages.

3) Electrochemistry – II **15 Hrs**

Types of Reversible Electrodes: Gas-Metal Ion, Metal-Metal Ion, Metal-Insoluble salt Anion and Redox Electrodes. Nernst Equation, Derivation of Cell, E.M.F. and single Electrode Potential, Standard Hydrogen Electrode, Reference Electrodes, Standard Electrode Potential, Sign Conventions, Electro-Chemical Series and its significance. Electrolytic and Galvanic Cells, Reversible and Irreversible Cells, Conventional Representation of Electro Chemical Cells. E.M.F. of a Cell and its Measurement, Calculation of Thermodynamic Quantities of Cell Reactions (ΔG, ΔH and K)

Definition of pH, pKa- Determination of pH using SHE and Glass Electrode by Potentiometer method. Buffer- Acidic and Basic Buffers, Mechanism of Buffer Action, Henderson- Hasselbalch equation.

Corrosion: Dry (Atmospheric) Corrosion and Wet (Electro-Chemical) Corrosion Electrochemical Theory of Corrosion.

B.Sc. (Second Year)

Fourth Semester

Lab Course VII **Paper XV**

(Physical Chemistry) **45 Hrs (3 Hrs/week)**

Instrumentation:

i) To determine normality and strength of HCl using (0.1N) NaOH Solution Conductmetrically.

ii) To determine normality and strength of acetic acid using (0.1N) NaOH solution Conductmetrically.

iii) To determine normality and strength of HCl using (0.1N) NaOH solution by pH-metrically.

iv) To Verify Lambert-Beers Law using $KMnO_4$ solution.

v) To estimate the amount of Sugar using Polarimeter.

vi) To determine refractive index of ethanol water system.

vii) To determine indicator constant of indicator colorimetrically.

B.Sc. (Second Year)

Fourth Semester

Lab Course VIII **Paper XVI**

(Organic Chemistry) **45 Hrs (3 Hrs/week)**

Organic Derivatives:- **Preparation, Crystallization and Physical Constant:-**

i) Acetyl Derivatives	:	a) **Aniline** b) **Salicylic Acid**
ii) Benzoyl Derivatives	:	a) **Aniline** b) **β-naphthol**
iii) Hydrolysis Derivatives	:	a) **Ethyl Benzoate** b) **Aspirin**
iv) Bromo-Derivatives	:	a) **Phenol** b) **Cinnamic Acid**
v) Reduction Derivatives	:	a) **m-dinitrobenzene**
vi) Osazone Derivatives	:	a) **Sucrose** b) **Glucose**

Organic Estimations:-

i) Estimation of nitro group by reduction.

ii) Estimation of glucose

iii) Estimation of ester by hydrolysis

iv) Estimation of amides by hydrolysis.

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