DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

SYLLABUS

B.Sc. (Chemistry) FIRST YEAR SEMESTER SYSTEM

FIRST / SECOND SEMETER - 2009

[Effective from - June, 2009-10 onwards]

	B.Sc. (Chemistr	y) IN SEME	STER PATTERN FOR THRI	EE YEAR DEGRI	EE
YEAR	SEMESTER	PAPER NUMBER	PAPER TITLE	CREDITS	MARKS
First	Ι	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
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B.Sc. Chemistry (Three year Degree Course)

First Year First Semester Paper I **Inorganic Chemistry** 3 Credits (45 Hrs) 3 Hrs. / Week Ι Atomic Structure 15 Hrs. Π **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 Ι Structure and Bonding 6 Hrs. Π 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 1.5 Credits (45 Hrs.) Lab Course I

3 Hrs / Week Paper IV Lab Course II 1.5 Credits (45 Hrs.)

3 Hrs / Week

<u>First Year</u>		Second Semester
Paper V	Physical Chemistry	3 Credits (45 Hrs) 3 Hrs. / Week
Ι	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
Ι	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

Inorganic Chemistry

3 Credits (45 Hrs) 3 Hrs. / Week

Ι **Atomic Structure:**

Paper I

Atomic orbital's, Quantum numbers, Heisenberg uncertainty principle, shapes of s, p, d orbital's. Aufbau and Pauli exclusion principles. Hund's multiplicity rule. Electronic configurations of the elements, Bohr's atomic model (Qualitative aspect only).

Π **<u>Periodic Properties</u>:**

Atomic and Ionic radii, Ionization Energy, Electron affinity and Electro negativity. Trends in periodic table and application in predicting and explaining the chemical behavior.

Ш **S-Block Elements:**

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their functions in biosystems.

IV **P** - Block Elements:

Comparative Study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides oxides of groups 13-16. Interhalogen compounds and its types.

10 Hrs.

10 Hrs.

10 Hrs.

Paper II **Organic Chemistry**

I. **Structure and Bonding:**

Localized and delocalized chemical bond; charge transfer complexes, resonance, hyper conjugation, inductive effect, hydrogen bonding, conjugative effect, steric effect.

Π **Mechanism of Organic Reactions:** 8 Hrs.

Homolytic and heterolytic bond breaking. Types of reagents eletrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates - carbocations, carbanions, free radicals (with two examples each) Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereo - chemical studies with two examples each)

Ш **Stereochemistry of Organic Compounds :**

Concept of Isomerism - Types of isomerism

- Optical Isomerism elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds.
- Relative and absolute configuration, sequence rules, D and L and R and S systems of nomenclature.
- Geometric Isomerism Determination of configuration of geometric isomers. E and Z system of nomenclature, geometric isomerism in oximes and alicylic compounds.

IV Alkanes :

Methods of formation (Koble reaction, Corey - House reaction and decarboxylation of carboxylic acids)

Physical properties and Chemical reactions of alkanes

3 Credits (45 Hrs) 3 Hrs. / Week

8 Hrs.

6 Hrs.

V <u>Alkenes</u>:

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration and oxidation with KMnO₄. Polymerization of alkenes with one example each.

VI <u>Arenes and Aromaticity</u>:

Nomeclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain structure of benzene : molecular formula and Kekule structure. Resonance Structure, MO Picture.

Aromaticity : The Huckel rule, aromatic ions

Aromatic electrophilic substitution: General Pattern of the mechanism (Nitration, halogenations and Sulphonation) and Friedel Crafts reaction.

VII <u>Alkyl and Aryl halides</u>:

Polyhalogen Compounds: Chloroform, Carbon tetrachloride. Methods - formation of aryl halides, nuclear and side chain reaction.

6 Hrs.

6 Hrs.

Paper III	Lab Course I	45 Hrs. 3 Hrs / Week	
Ι	Volumetric Analysis :	15 Hrs.	
	by given oxalic acid so	NaOH solution and its standardization olution. N oxalic acid solution and its	
Π	Inorganic Qualitative Analysis : 30 Hr		
	• Identify two acid and two basic radical from the given binary mixture.		
	a] CdSO ₄ + NH ₄ Cl	b] BaCO ₃ + Al ₂ (NO ₃) ₃	
	c] $ZnCO_3 + KBr$	d] $MnCO_3 + MgSO_4$	

e] NiSO₄ + MgCO₃

First Semester

Paper IV	Lab Course	II 1.5 Credits (45 Hrs.)
		3 Hrs / Week
	• Eudiometer :	Determination of Equivalent weight
		of Mg
	• Viscometer :	To Determine Viscosity of given
		liquid (Water / Ethanol) by
		viscometer
	• Staglanometer :	To determine surface tension of
		given liquid.

 Chemical Kinetics : * To study the effect of acid strength on the hydrolysis of an ester.
* To determine the specific reaction

rate of the hydrolysis methyl / ethyl acetate catalyzed by hydrogen ions at room temperature.

Physical Chemistry

3 Credits (45 Hrs) 3 Hrs. / Week

I <u>Mathematical Concepts</u> :

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like $k^x e^x$, x^n , sin x, log x; maxima and minima, partial differentiation.

II <u>Gaseous States</u>:

Paper V

Postulates of kinetic theory of gases, kinetic gas equation, Deduction of Gas Laws : Boyles Law, Charles Law, Grahams Law of diffusion, Avogadro's hypothesis, deviation from ideal behavior, van der Waals equation of state. Critical Phenomena : PV isotherms of real gases.

III <u>Chemicals Kinetics and Catalysis</u>:

Chemical Kinetics and its scope, rate of reaction, factors influencing the rate of reaction - concentration, temperature, pressure, solvent, light, catalyst concentration dependence of rates. Derivation of rate law and characteristics of simple chemical reactions - zero order, first order, second order, Pseudo order, half life. Effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy.

Catalysis : Definition, types, and characteristics of catalysis, homogeneous, heterogeneous catalysis - Enzyme catalysis and its application.

IV Liquid State:

Intermolecular forces, structure of liquids (a qualitative description). Differnce between solids, liquids and gases.

Liquid Crystals: Classification, structure of nematic and cholestric phases.

12 Hrs.

6 Hrs.

10 Hrs.

V Solid State :

Types of solids, Amorphous, crystalline and difference between them, Miller Indices.

Laws of crystallography - (i) Law of constancy of interfacial angels (ii)Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg equation.

VI <u>Colloidal State :</u>

5 Hrs

- Definition of colloids, classification of colloids.
- Solids in liquids (sols) : properties kinetic, optical and electrical; stability of colloids, protective action. Hardy Schulze Law.
- Liquids in liquids (emulsions) : types of emulsions, preparation.
- Liquids in Solids (gels) : classification, preparation and properties, general applications of colloids.

Paper VIInorganic Chemistry - II3 Credits

3 Credits 3 Hrs. / Week

I <u>Chemistry of noble gases</u> :

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

II Chemical Bonding:

- (A) <u>Covalent Bond</u> Valence theory and its limitations, directional characteristic of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, Valence shell electron pair repulsion (VSEPR) theory of NH₃, SF₄, CIF₃, ICI₂ and H₂O. MO theory, homonuclear (He, N₂ and O₂) and heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro negativity difference.
- (B) Ionic Bonds Definitions, Factors affecting ionic bond formation.
- (C) Hydrogen bonding, Van-der-Waals forces, Metallic bond and its free electron concept.

III <u>Nuclear Chemistry</u>:

Definition; Atomic number, mass number, Isotopes, Isobars mass defect and Binding Energy, Packing fraction N/Z ratio, Radio activity, properties of α , β and γ , Artificial transmutation. Applications with respect to trans-uranic elements, carbon dating.

IVTheory of volumetric Analysis:10 Hrs.Types of titrations, volumetric apparatus, calibration of pipette and burette.Indicators used in pH - titrations, oxidizing agents used in titrations.Theory of Internal, External and self indicators for redox titration.

10 Hrs.

20 Hrs.

Paper VII

Lab Course III

45 Hrs (3 Hrs. / Week)

I <u>Inorganic Preparation</u> :

24 Hrs.

- Preparation of tetramine Cupric Sulphate
- Preparation of Nickel Demethyl Glyoxime (Ni-DMG)
- Preparation of Tris-ethylene diamine Nickel (II) thiosulphate

II <u>Estimation:</u>

- Standardization of NaOH solution by (0.1 N) oxalic acid solution and estimation of given HCl solution.
- Standardization of KMnO₄ solution by (0.1 N) oxalic acid solution and estimation of Ferrous ion (Fe²⁺) from the given solution.
- Preparation of (0.1 N) Sodium Thiosulphate and standardization by given iodine solution.

Paper VIII

Lab Course IV

45 Hrs (3 Hrs. / Week)

IOrganic Qualitative Analysis:30 Hrs.Nature / Functional group / Element / Derivative / Physical constant* Benzoic acid, * salicylic acid, * β-naphthol, * p-nitroaniline,* Naphthalene, * Acetanilide.

II Organic Estimation:

- Phenol by Bromination
- Estimation of basicity, molecular weight of organic acid (oxalic/acetic acid)

First / Second Semester

Question Paper Pattern for Theory Paper - I, II, V, VI

Time : 2 Hrs.		Maximum Marks : 50	
Note : All Questions are Compulsory			
Q.1	Attempt any seven of the following [(i) to (x)]	14 Marks	
Q.2	Attempt any Two of the following [(i) to (iv)]	12 Marks	
Q.3	Attempt any Three of the following [(i) to (iv)]	12 Marks	
Q.4	Attempt any Three of the following [(i) to (IV)]	12 Marks	

Question Paper Pattern for Practical

Lab. Course - I Paper - III		Time : 3 Hrs. Max. Marks : 50
Q.1	Calibration / Volumetric analysis	20 Marks
Q.2	Inorganic Qualitative Analysis	20 Marks
Q.3	Record Book and Viva - Voce	10 Marks
Lab. Course - II Paper - IV		Time : 3 Hrs. Max. Marks: 50
Q.1	Eudiometer / Viscometer / Staglanometer	20 Marks
Q.2		
	Kinetics (Hydrolysis)	20 Marks

Question Paper Pattern for Practical

Lab. Course - III Paper - VII		Time : 3 Hrs. Max. Marks : 50
Q.1	Estimation	20 Marks
Q.2	Inorganic Preparation	20 Marks
Q.3	Record Book and Viva - Voce	10 Marks

B.Sc. (Second Semester)

Question Paper Pattern for Practical

Lab. Course - IV Paper - VIII		Time : 3 Hrs. Max. Marks : 50
Q.1	Organic Qualitative Analysis (Single Component)	20 Marks
Q.2	Organic Estimation	20 Marks
Q.3	Record Book and Viva - Voce	10 Marks