

North Maharashtra University, Jalgaon.

Class- F. Y. B. Sc. Chemistry (Semester Pattern) (With effect from June 2012)

In the Joint meeting of Chairman of Board of studies in all subjects of science

Faculty chaired by Hon. Dean of Science faculty was held on 30 May 2012, the revised syllabus for F.Y.B.Sc. (Chemistry) is accepted and finalised as per guidelines of Academic Council and with reference to the U.G.C. model curriculum. The nomenclature accepted is as follows.

CH-YSC [Y for year, S for semester and C for course number].

The course structure and title of the courses for F.Y.B.Sc. (Chemistry) are as given below

Course Title	Semester	Lectures	Marks	
			Ext.	Int.
CH 111: Physical and Inorganic Chemistry	I	48	40	10
CH-112:-Organic and Inorganic Chemistry	I	48	40	10
CH-121:-Physical and Inorganic Chemistry	II	48	40	10
CH-122:-Organic and Inorganic Chemistry	II	48	40	10
CH-103:-Chemistry Practicals	Annual	-	80	20

Note

1. Each course is having weight-age three lectures per week.
2. Each practical course is having weight age four lectures per week.
3. Examination of practical course shall be held at the end of the academic year.

Chairman
B.O.S. Chemistry

NORTH MAHARASHTRA UNIVERSITY, JALGAON
F. Y. B. Sc. Chemistry Syllabus [With effect from June-2012]
Course Structure

Semester-I

Subject Code: CH-111

Subject Title: Physical and Inorganic chemistry

Name of the Chapter	Number of Lectures	Weight age with option (60 Marks)	Weight age without option (40 Marks)
Mathematical Preparations in Chemistry	13	16	11
Electrolytic conductance.	11	14	09
Liquid State.	08	10	07
Chemical bonding and Structure	07	09	06
Hybridisation and shapes of covalent molecules	09	11	07
Total	48	60	40

Semester-II

Subject code : CH-121

Subject Title : Physical and Inorganic chemistry

Name of Chapter	Number of Lectures	Weight age with option (60 Marks)	Weight age without option (40 Marks)
The Gaseous State	20	27	18
Solid state	12	13	09
General properties of elements	11	14	09
Principles involved in inorganic qualitative analysis	05	06	04
Total	48	60	40

Semester-I**Subject Code : CH-112****Subject Title : Organic and Inorganic chemistry**

Name of Chapter	Number of Lectures	Weight age with option (60 Marks)	Weight age without option (40 Marks)
Basic Principles of organic chemistry	13	16	11
Nomenclature of organic compounds.	08	10	07
Hydrocarbons	11	14	09
Acids and Bases	10	14	09
Solvents and Reagents	06	06	04
Total	48	60	40

Semester-II**Subject Code : CH-122****Subject Title : Organic and Inorganic chemistry**

Name of Chapters	Number of Lectures	Weight age with option (60 marks)	Weight age without option(40 marks)
Halogen derivatives of alkanes	06	09	06
Alcohols and Ethers	06	08	06
Aldehydes and Ketones.	08	09	06
Carboxylic acid and its derivatives	07	08	05
Aromatic Compounds	05	06	04
Basic Concepts in volumetric analysis	16	20	13
Total	48	60	40

NOTE:

1. There are two theory courses for each semester and one annual practical course.
2. Each theory paper carry 50 Marks out of which 10 Marks are allotted for internal assessment. As per the directions given by University, at the end of each semester internal examination will be conducted for 10 marks and University Examination will be conducted for 40 Marks.

3. The practical examination will be conducted at the end of Semester-II. Each practical course will carry 100 Marks out of which 20 Marks will be allotted for internal assessment and University Examination will be conducted for 80 Marks.

Marks for internal examination of Practical courses will be allotted as follows :

The annual examination for the practical courses CH-103 will be held at the end of semester II.

The internal examination of 20 Marks for practical courses will be held before the annual practical examination.

A student is expected to submit a journal certified by the Head of the Department / Head of the Institution.

A student will not be permitted to appear at the practical examination unless he / she produce a certified journal. If the journal is lost ,the student should produce a certificate from Head of the department / Head of the Institution stating that he /she has satisfactorily completed the practical work.

Rules for personal safety:

- 1) A long sleeved, knee length laboratory Apron is recommended. Long pants and closed toed shoes must be worn for individual safety. Loose clothing, open style shoes and sandals are prohibited. Long hair must be tied up. Each student will have to get his / her own necessary protection items.
 - 2) Prior to the practical examination, the teacher-in-charge will check all protective equipment to ensure that they are in order.
 - 3) Pipetting by mouth should be avoided. Use of pro-pipette bulbs is recommended.
 - 4) All laboratories should be equipped with safety chart, adequate first aid requirements and fire extinguishers.
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NORTH MAHARASHTRA UNIVERSITY, JALGAON

F.Y.B.Sc. Chemistry Syllabus

Subject Title: Physical and Inorganic Chemistry

Semester I

Subject Code CH- 111

Part-I Physical Chemistry

Chapter 1 : Mathematical Preparation in Chemistry

(Marks-11, Lectures-13)

Logarithm: Rules of Logarithm (without proof), Characteristic and Mantissa of Logarithm, Negative Logarithm, numerical based on applications of Logarithm in calculating pH with change of base of logarithm, antilogarithm.

Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems.

Derivative: Rules of differentiation (without proof) and partial differentiation, Algebraic, Logarithmic and exponential functions and numerical.

Integration: rules of integration (without proof), Integration with limit, Algebraic, Logarithmic and exponential functions and numerical.
Numerical related to Chemistry.

Ref.1 (Relevant pages)

Chapter 2 : Electrolytic conductance. (Marks-09, Lectures-11)

Electrolytic conductance, determination of conductance, variation of conductance with concentration, equivalent conductance at infinite dilution, Kohlrausch's law and its applications.

Applications of conductance measurement-

- Solubility of sparingly soluble salts.
- Determination of degree of ionization.
- Conductometric titration

Numerical problems relevant to the topic are expected.

Ref. 2,3 (Relevant pages)

Chapter 3 : Liquid State.

(Marks-07, Lectures-08)

Introduction, Surface tension of liquid, units of surface tension, factors affecting surface tension, determination of surface tension of liquids by single capillary method and stalagmometer method. Viscosity of liquid, units of viscosity, measurement of viscosity of liquid by Ostwald's method, related numerical.

Ref. 2,3 (Relevant pages)

Reference Books

1. Mathematical Preparation for Physical Chemistry, Farrington Daniels, Mc Graw-Hill Publication.
2. Principles of Physical Chemistry, S. H. Maron and C. F. Prutton (4th edition).
Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand and Co Ltd.) (25th edition).
3. Elements of Physical Chemistry, S. Glasstone and D. Lewis (The Macmillan Press . Ltd. (2nd edition).

Part - II Inorganic Chemistry

Chapter 1: Chemical Bonding And Structure

(Marks-6, Lectures-7)

Attainment of stable configuration, Types of bonds-

a) Ionic bond- NaCl, CaCl₂

b) Covalent bond (Lewis concept) - H₂, Cl₂, HF, NH₃, H₂O, O₂, N₂ molecules

c) Coordinate bond NH₄⁺, H₃O⁺

d) Metallic bond.

Types of overlap : S-S, S-P, P-P overlaps with examples like H₂, F₂, HF, O₂ and N₂ molecules.

Theories of bonding : Valence Bond theory - Heitler-London theory and Pauling-Slater theory.

Ref. 1, 2, 3, 4 (relevant pages)

Chapter 2: Hybridization and shapes of covalent molecules

(Marks-7, Lectures -9)

Hybridization- Definition, need of hybridization, steps involved in hybridization, characteristics of hybridization. Types of hybridization involving s, p and d orbital – sp^3d , sp^3d^2 and dsp^2 hybridizations. Applications of hybridization concept- geometries of molecules like PCl_5 , SF_6 and $[Ni(CN)_4]^{2-}$ ions.

Valence Shell Electron Pair Repulsion (VSEPR) Theory- assumptions, need of theory, Applications of the theory to explain geometry of irregular molecules like $SnCl_2$, NH_3 , H_2O , ClF_3 , SF_4 , XeF_2 , BrF_5 and XeF_4 .

Ref. 1,2,3,4 (relevant pages)

Reference Books

- 1) Concise Inorganic Chemistry – J. D. Lee (5th edition)
 - 2) A new guide to Modern Valency theory – G. I. Brown
 - 3) Advanced Inorganic Chemistry (Volume 1) – Satyaprakash, Tuli, Basu and Madan (S. Chand and Co. Ltd)
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Subject Title: Organic and Inorganic Chemistry

Semester I

Subject Code CH-112

Part-I Organic Chemistry

Chapter 1: Basic Principles of organic chemistry

(Marks-11, Lectures- 13)

Introduction of organic chemistry, general properties of organic compounds, applications of organic compounds. Covalent bond, tetravalency of carbon, hybridization (SP^3 , SP^2 , SP)

Structural effects - Inductive effect, resonance, hyperconjugation, steric effect, electromeric effect. Role of inductive effect and resonance is strength of acids and bases.

Fundamentals of organic reaction mechanism - Fission of covalent bond (Homolytic and Heterolytic fission) , reactive intermediates (carbonium ion, carbanion and carbon free radicals), types of reagents (electrophiles and nucleophiles), types of organic reactions.

Isomerism - concept of isomerism, types of isomerism (structural and stereoisomerisms)

Ref. 1, 2, 3, 4 (Relevant pages)

Chapter 2 : Nomenclature of organic compounds

(Marks-7, Lectures -8)

Common and IUPAC nomenclature of -

Alkanes & cycloalkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, aldehydes, Ketones, carboxylic acids, esters and amines.

Ref. 1, 2, 4 (Relevant pages)

Chapter 3 : Hydrocarbons

(Marks- 9 , Lectures -11)

Classification of hydrocarbons.

Alkanes and cycloalkanes

Preparation of alkanes by Wurtz reaction, hydrogenation of alkenes and alkynes, decarboxylation of carboxylic acids, chemical properties of alkanes - Halogenation, combustion, pyrolysis, preparation of cycloalkanes from alkanes (by cyclization) and dihaloalkanes, by reduction of benzene and alkyl benzenes.

Alkenes

Preparation of alkenes - by dehydration of alcohols, dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides, reduction of alkynes, reactions of alkenes - Addition of halogen, hydrogen halide, hydration, hydroxylation, ozonolysis.

Alkynes

Preparation of alkynes- by double dehydrohalogenation of vicinal and geminal dihalides, alkylation of acetylene. Reactions - Addition of halogens, HX, hydration.

Ref. 1, 2, 4 (Relevant pages)

Part - II Inorganic Chemistry

Chapter 1 : Acids and Bases

(Marks- 9 , Lectures -10)

Theory of acids and bases - Arrhenius theory, Bronsted- Lowery theory, conjugate acid base pairs, Lewis theory, strong and weak acid and bases, degree of dissociation, dissociation constant of acid and bases, P^H and P^{OH} , ionic product of water, numerical.

Buffer solutions - Definition, types, mechanism of acidic and basic buffer, Henderson equation, numerical.

Ref. 5,7,8 (Relevant pages)

Chapter 2 : Solvents and reagents

(Marks- 4 , Lectures -6)

Solvents - Properties of solvents, classification of Solvents i) Protic and aprotic.

ii) Acidic, basic, amphoteric and neutral

iii) Aqueous and non aqueous.

iv) Polar and nonpolar (explanation and examples only.)

Reagents - Classification of reagents according to their action (explanation and examples only.)

i) Acids,

ii) Bases,

iii) Salts

iv) Complexing agents

v) oxidizing agents

vi) reducing agents

vii) Precipitating agents

Ref. 5, 7, 8 (Relevant pages)

Reference Books

- 1) Organic chemistry - Francis A Carey (3rd Edition)
Tata McGraw Hill (1999)
- 2) Organic chemistry - Morrison and Boyd (6th Edition)
- 3) Guide book to mechanism in organic chemistry -Peter Sykes (6th Edition)
- 4) Organic chemistry - Stanley H pine (5th Edition)

- 5) Analytical Chemistry - G.D. Christian (5th Edition)
 - 6) Vogel's textbook of quantitative chemical analysis.
 - 7) Advanced inorganic chemistry - Satyaprakash, Tuli, Basu & Madan
- S. Chand & Company.
 - 8) Principles of inorganic chemistry - B.R. Puri, L.R. Sharma, K.S. Kalia.
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Subject Title : Physical and Inorganic Chemistry

Semester II

Subject code CH-121

Part-I Physical Chemistry

Chapter 1 : The Gaseous State

(Marks-18, Lectures-20)

The kinetic theory of ideal gases. Assumptions of kinetic theory of gases. Derivation of kinetic gas equation. Deductions of Avogadro's principle, Graham's law, kinetic energy of translation. Deviations of real gases from ideal behavior. Reasons for deviation, compressibility factor, Van der Waal's equation, its applications. Andrew's isotherms of CO_2 , application of Van der Waal's equation to the isotherms of CO_2 , relation between critical constants and Van der Waal's constants, The law of corresponding states, Reduced equation of state, related numerical.

Ref. 1, 2 (Relevant pages)

Chapter 2 : Solid state

(Marks-09, Lectures-12)

Introduction, Types of solids: Amorphous, Crystalline and difference between them, Crystallisation and fusion, Crystallography, Laws of crystallography - (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of elements of symmetry, Weiss and Miller Indices, Crystal system, Seven system, Space lattice and Bravais lattice, Unit cell, Properties of the crystal, Etch figures, Types of cubic lattice, Inter-planer distance (d_{hkl}) in cubic crystal and its calculations, related numerical.

Ref. : 1, 2 (Relevant pages)

Reference Books

1. Principles of Physical Chemistry, S. H. Maron and C. F. Prutton (4th edition).
2. Essentials of Physical Chemistry, B. S. Bahl, G. D. Tuli, Arun Bahl (S. Chand and Co Ltd.) (25th edition).
3. Elements of Physical Chemistry, S. Glasstone and D. Lewis (The Macmillan Press Ltd. (2nd edition).

Part - II Inorganic Chemistry

Chapter 1 : General Properties of Elements (Marks 09, Lectures 11)

Periodic law, periodicity in following properties right through the periodic table (General trends in each block are expected, trends in any particular group or period not expected) a) size of atoms b) ionization energy c) electron affinity d) electronegativity, determination of electronegativity by Mulliken method and Pauling method e) metallic character f) lattice energy, Born-Haber cycle.

Reference 1, 4 (relevant pages)

Chapter 2 : Principles involved in Inorganic Qualitative Analysis

(Marks 04 , Lectures 05)

Solubility product, common ion effect.

Use of Cobalt nitrate, Sodium carbonate, Hydrogen sulphide and Ammonium chloride in qualitative analysis.

Reference 2, 3 (relevant pages)

Reference Books

- 1) Concise Inorganic chemistry – J. D. Lee (5th Edition)
 - 2) Inorganic Qualitative Analysis—A I Vogel
 - 3) Practical chemistry (for B.Sc. I,II and III year students) – O P Pandey , D. N. Bajpai and S. Giri (S Chand and company Ltd)
 - 4) Advanced Inorganic Chemistry (vol. I) – Satyaprakash, Tuli, Basu and Madan 19th edition (S Chand and company Ltd.)
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Subject Title : Organic and Inorganic Chemistry
Semester II **Subject code CH-122**

Part-I Organic Chemistry

Chapter 1 : Halogen derivatives of alkanes (Marks- 6 , Lectures- 6)

Introduction, Classification, Methods of preparation- from alcohols (using HX, PX_3 , PX_5 , $SOCl_2$), from alkenes.

Reactions of haloalkanes with aqueous alkali, sodium alkoxide, alc.KCN, silver salt of acid, alc.ammonia, NaSH/KSH, dehydrohalogenation, formations of Grignard's reagent. SN^1 and SN^2 mechanism of alkaline hydrolysis of alkyl halides.

Ref. 1, 2, 4 (Relevant pages)

Chapter 2 : Alcohols and Ethers (Marks-6 , Lectures-6)

Alcohols - Introduction, classification, Methods of preparation from Grignard's reagent (using aldehydes, ethylene oxide and Ketones) , by reduction of aldehydes and ketones (using $LiAlH_4$ & $NaBH_4$), by hydroboration - oxidation of alkenes.

Reactions of alcohols - Dehydration, oxidation.

Ethers - Introduction, classification, Methods of preparation- by Williamson's synthesis, by dehydration of alcohols, Reactions of ethers with cold and hot HI, with dil. H_2SO_4

Ref.1,2,4 (Relevant pages)

Chapter 3 : Aldehydes and Ketones (Marks- 6 , Lectures-8)

Introduction, methods of preparation of aldehydes by reduction of acid chlorides, from Grignard's reagent and HCN, from terminal geminal dihalides. Methods of Preparation of Ketones from Grignard's reagent and R-CN, from nonterminal geminal dihalides. Reaction of aldehydes & Ketones-Reducing properties of aldehydes, reduction with H_2 /metal catalyst, Na-Hg/ H_2O , Clemmenson reduction, Wolff Kishner reduction, Aldol condensation, Cannizzaro reaction, addition of HCN, addition of derivatives of ammonia (NH_2OH , $C_6H_5NHNH_2$, $NH_2-NH-CO-NH_2$)

Ref. 1, 2, 4 (Relevant pages)

Chapter 4 : Carboxylic acids and their derivatives (Marks-5 , Lectures-7)

Introduction, Methods of preparation by carbonation of Grignard's reagent, by hydrolysis of nitriles, Reactions of carboxylic acids- formation of salt (with NaOH, KOH, Na_2CO_3 , $NaHCO_3$, NH_4OH and active metals), Hell-Volhard-Zelinsky reaction.

Derivatives of acids

Esters - Preparation from alcohol & acid, alcohols & acid chloride, hydrolysis (alkaline and acidic)

Acid chlorides - preparation -from acids and PCl_3 , PCl_5 , SOCl_2 , reaction- with benzene.

Amides - Preparation from acid chloride and NH_3 , reactions - hydrolysis, reaction with Br_2 and NaOH

Ref. 1, 2, 4 (Relevant pages)

Chapter 5 : Aromatic Compounds

(Marks-4 , Lectures- 5)

Introduction, stability of benzene, Huckel's rule of aromaticity, nomenclature of derivatives of benzene (mono and disubstituted only) , reactions of benzene - Nitration, halogenation, sulphonation, Friedel Craft reaction, diazotization (Mechanism not expected).

Ref. 1, 2, 4 (Relevant pages)

Part - II Inorganic chemistry

Chapter 1 : Basic Concepts in volumetric analysis

(Marks-13 , Lectures- 16)

Molecular weight, formula weight, equivalent weight, calculation of equivalent weight of acids, bases, oxidizing and reducing agents, millimoles, milliequivalents, units of concentration - molarity, normality, formality, molality, related numerical,

Standard solution, primary and secondary standards, titrant, analyte, end point, equivalence point.

Apparatus for measurement of volume - burette, pipette, volumetric flask, calibration of pipettes and volumetric flask.

Ref. 5,6,7 (Relevant pages)

Reference Books

- 1) Organic chemistry - Francis A Carey (3rd Edition)
Tata Mcgraw Hill (1999)
- 2) Organic chemistry - Morrison and Boyd (6th Edition)
- 3) Guide book to mechanism in organic chemistry -Peter Sykes (6th Edition)

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F. Y. B. Sc. CHEMISTRY PRACTICALS

Annual Course

Subject code: CH-103

Subject Title : Chemistry Practical

A) Physical Chemistry Experiments (Any five)

1. Determination of relative and absolute viscosity of liquid A and B by viscometer.
2. Determination of percentage composition (v/v) of given mixture of ethyl alcohol and water by viscometer.
3. Determination of equivalent weight of Mg by eudiometer.
4. Determination of heat of solution of $\text{KNO}_3/\text{NH}_4\text{Cl}$.
5. Determination of surface tension of given liquid by stalagno-meter.
6. Conductometric titration - NaOH Vs HCl/ CH_3COOH .
7. Determination of dissociation constant of weak monobasic acid (CH_3COOH) by conductance measurement.
8. Calibration of volumetric apparatus Pipette / Volumetric flask.

B) Inorganic Chemistry Experiments

Inorganic Qualitative Analysis (Any Five compounds)

Analysis of inorganic compound containing one cation and anion (excluding phosphate & borate)

C) Organic Chemistry Experiments

Organic Qualitative Analysis. (Any Four Compounds)

- | | |
|------------------------|----------------------------|
| i) Type determination | ii) Preliminary tests |
| iii) Physical Constant | iv) Functional group tests |

* At least one compound from each type.

* Elemental detection using sodium fusion test and structural formula not expected

D) Analytical Chemistry Experiments (Any Four)

- 1) Preparation of std. 0.1N Na_2CO_3 solution and standardization of HCl solution.
- 2) Preparation of std. 0.1N oxalic acid (or Na-oxalate) and standardization of KMnO_4 solution.

- 3) Preparation of std. 0.1N NaCl solution and standardization of AgNO₃ solution.
- 4) Preparation of std. 0.1N ZnSO₄ solution and standardization of EDTA solution.
- 5) Determination of molecular weight of monobasic/dibasic acid.
- 6) Determination of loss per gram and percentage purity of Zinc Carbonate gravimetrically.
- 7) Determination of water of crystallization of given salt gravimetrically
(BaCl₂.2H₂O/MgSO₄.7H₂O)

E) Purification Techniques (Any Two)

- 1) Sublimation.
- 2) Recrystallisation
- 3) Fractional Distillation

IMPORTANT NOTE

***In volumetric analysis, volume of pipette solution should be 10 ml instead of 25 ml. Similarly preparation of 100 ml solution by using 100 ml volumetric flask instead of 250 ml. (To avoid wastage of chemicals)**

***Examination Pattern.
Chemistry Practical CH-103**

1. Physical Chemistry experiment	OR	35 Marks
Analytical Chemistry experiment (25 Marks) and Purification Technique (10 Marks)		
2. Inorganic Qualitative analysis	OR	
Organic Qualitative analysis		25 Marks
3. Oral		10 Marks
4. Journal		10 Marks
Total		80 Marks

Formate of Question Paper F. Y. B.Sc.
CHEMISTRY PAPER-I CH-111 and CH-121
Physical and inorganic chemistry

Instructions : 1. All questions are compulsory.
2. Scientific (Programmable) calculators are not allowed.

Q.1 Multiple choice questions (1 mark each) Any 8 8 Marks

1. Physical chemistry
2. Physical chemistry
3. Physical chemistry
4. Physical chemistry
5. Physical chemistry
6. Physical chemistry
7. Inorganic chemistry
8. Inorganic chemistry.
9. Inorganic chemistry
10. Inorganic chemistry

Q.2 Attempt any four (2 marks each) 8 Marks

1. Physical chemistry.
2. Physical chemistry
3. Physical chemistry
4. Physical chemistry
5. Inorganic chemistry
6. Inorganic chemistry

Q.3 Answer any two (4 Marks each) 8 Marks

1. Physical chemistry
2. Physical chemistry
3. Physical chemistry (Numerical)

Q.4 Answer any two (4 marks each) 8 Marks

1. Inorganic chemistry
2. Inorganic chemistry
3. Physical chemistry

Q.5 A) Answer any one (6 marks)

8 Marks

1. Physical chemistry
2. Inorganic chemistry

B) Physical chemistry (2 marks)

CHEMISTRY PAPER II CH-112 and CH-122
ORGANIC AND INORGANIC CHEMISTRY

Q.1 Multiple choice questions (1 mark each) Any 8

8 Marks

1. Organic chemistry
2. Organic chemistry
3. Organic chemistry
4. Organic chemistry
5. Organic chemistry
6. Organic chemistry
7. Inorganic chemistry
8. Inorganic chemistry
9. Inorganic chemistry
10. Inorganic chemistry

Q.2 Attempt any four (2 marks each)

8 Marks

1. Organic chemistry
2. Organic chemistry
3. Organic chemistry
4. Organic chemistry
5. Inorganic chemistry
6. Inorganic chemistry

Q.3 Answer any two (4 marks each)

8 Marks

1. Organic chemistry
2. Organic chemistry
3. Organic chemistry

Q.4 Answer any two (4 marks each)

8 Marks

1. Inorganic chemistry
2. Inorganic chemistry
3. Organic chemistry

Q.5A) Answer any one (6 marks)

8 Marks

1. Organic chemistry
2. Inorganic chemistry

B) Organic chemistry (2 marks)

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