। अंतरी पेटवू ज्ञानज्योत ॥

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

Syllabus for

F.Y.B.Sc. CHEMISTRY.

(W.e.f. Acd.Yr. 2002 - 2003)

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

SYLLABUS FOR F.Y.B.Sc. CHEMISTRY.

(W.e.f. Academic Year 2002-2003)

COURSE STRUCTURE

PAPER - I
PHYSICAL AND INORGANIC CHEMISTRY
90 - PERIODS

PAPER - II
ORGANIC AND INORGANIC CHEMISTRY
90 - PERIODS

CHEMISTRY PRACTICAL
90 - PERIODS

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

SYLLABUS FOR F.Y.B.Sc. CHEMISTRY
(W.e.f. Academic Year 2002-2003)

COURSE STRUCTURE :-

There will be two theory papers of 100 marks each and one practical coruse of 100 marks. Each theory course should be covered in three periods per week. The practical course will require four periods per week per batch. There should not be more than 15 students in a batch. The title of the pepers are as under :-

PAPER-I.
PHYSICAL AND INORGANIC CHEMISTRY

PAPER-II
ORGANIC AND INORGANIC CHEMISTRY

CHEMISTRY PRACTICAL-I

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PAPER-I
PHYSICAL AND INORGANIC CHEMISTRY

1. THE GASEOUS STATE :-

The gas constant R and its value in different units. The kinetic theory of ideal gases, deductions from kinetic theory of gases such as Boyle's law, Charles's law, Avogadro's principle, Graham's law of diffusion. further deductions from the kinetic theory, the velocity of gas molecules, kinetic energy of translation.

Molecular velocities :- Root mean square, average and most probable velocities, distribution of molecular velocities and interrelationship between molecular velocities, Frequency of collisions and mean free path.

Applicability of the ideal gas laws use of compresslibility factors,The van der waals equation of state.
Critical Phenomena:- PV isotherms of CO_2, The principle of continuity of states, application of Van der waals' equation to the isothermals of CO_2, determination of van der waals' constants, relationship between critical constants and van der waals' constants, The law of corresponding states, reduced equation of state.

Ref.1:- Pages 10-12,18-32,47-55 .
Ref.2:- Pages 261,268-278,281-294.
Ref.3:- Relavent pages. [17]

2. THERMODYNAMICS :-

The carnot cycle, Carnot cycle for ideal gases, the thermodynamic efficiency, Entropy,Entropy change in isolated systems, the second law of thermodynamics, Clausius inequality,entropy as a criteria of spontaneity and equilibrium,Entropy change for systems only, Physical significance of entropy. Entropy change in ideal gases,entropy of mixing for ideal gases, Entropy change in Physical transformations.

Ref.1:- Pages 123-128,162-171 & 174-178.
Ref.2:- Pages 223-226,227-228 & 229-237.
Ref.3:- Pages 96-108.
Ref.4:- Relavent Pages [17]

3. THE PHASE RULE :-

Definations :-True equilibrium, metastable equlibirum, unstabel equilibirum, statement and meaning of the terms phase, component and degrees of freedom,The Gibbs phase rule (derivation is not expected),Application of phase rule to one component system-Water system only.

Ref.1:- Pages 344-350

Ref.2:- Pages 509-512,513-515 & 518-519. [06]

4. LIQUID STATE :-

The kinetic molecular description,intermolecular forces inliquids, dipole-dipole attracions, London forces, Hydrogen bonding, Surface tension, determination of surface tension, capilary rise method, viscosity units of viscosity, measurement of viscosity by ostwald method .

Ref.2:- Pages 301-303,306-308,312-315. [08]

5.a] MATHEMATICAL CONCEPTS AND COMPUTERS:

Logarithms,Graphical representation of equations, rectangular coordinates, straight lines, The slope and intercept equations, parallel lines.

Differential calculus, rules for differentitation, (without derivation),powers,added and substracted functions, constants, products,quotients.

Differentiation :- function of a function, logarithms, Differentiation of trigonometrical functions such as sin x integration between limits.

Ref 5:- Pages [illegible]-15,23-[illegible],[illegible],89-90,114-125,142-143 & 175.

b] COMPUTERS :-

General introduction to computer, Different components of a computer, Hardware and Software, inputand output devices, binary numbers and arithmetic, Introduction to computer languages, programming, operating systems.

Ref.:- Pages 6,7,8 & 9 Relavent pages. [12]

6] LONGFORM OF PERIODIC TABLE AND PERIODIC PROPERTIES :-

i] Outline of long form of periodic table

ii] Classification of elements in terms of s,p,d,f block elements, transition elements.

iii] Periodic law, periodicities in the following properties throughout the periodic tabie [General trends in each block are expected, trends in any particular group or periods are not expected] a] size of atom, b]Ionization energy, c] electron affinity, d] electronegativity, e] metallic character.

Ref.10 :- Pages 20-22,92-103.
Ref.11:- Pages 43-46.
Ref.12:- Pages 25-31. [15]

7. BONDING IN MOLECULES AND THEIR STRUCTURES

A]i] Attainment of stable configuration

ii] Types of bonds

iii] Transition between the main types of bonding:- ionic, covalent, coordinate bonds (double and triple bonds) metallic bonds.

General properties of covalently and ionically bonded compounds.

Ref.10:- Pages 24-32

B]i] Concept of hybridization

ii] Hybridization in the following molecules:- PCl_5, ClF_3, SF_4, SF_6, IF_7.

Ref.10:- Pages 49-50 & 54-58.

C] MOLECULAR SHAPES :-

The valence shell electron pair repulsion (VSEPR) model.

Ref.11:- Pages 83-86. [15]

REFERENCES :

1. Principles of Physical Chemistry
   By S.H.Maron and C.F.Prutton [4th edition]
2. Essentials of Physical Cehmisry
   By B.S.Bahl,G.D.Tuli,Arun Bahl.
   [S.Chand and Co.Ltd.] [25th edition]
3. Elements of Physical Chemistry
   By S.Glasstone and D.Lewis
   (The Macmillan Press Ltd.) [2nd edition]
4. Physical Chemistry
   By Robert A.Alberty
   [John Willey and Sons) [7th edition]
5. Mathematical Preparation of Physical Chemistry
   By F. Daniels (Mc Graw Hill Book and Co.Inc.)
6. Basic Programming with application.
   By V.K.Jain (Tata MacGraw Hill)
7. Computers and Commonsense
   By R.Hunt and Shelly.Printice Hall
8. Microprocessor,Architecture,Programming and Application with 8085.
   By Ramesh S.Gaonkar(Penram International Publishing India)
9. An Introduction to Computer Studies
   By Noel Kalicharan (Cambridge Uni-Press)
10. Concise Inorganic Chemistry
    By J.D.Lee. (3rd eidtion)
11. Basic Inorganic Chemistry
    By Cotton and Wilkinson. (Ist edition)
12. A New Guide to Modern Valency Theory
    By G.I. Brown.(3rd edition)

EXAMINATION STRUCTURE

Paper-I :- Physical & Inorganic Chemistry.

There will be six questions - four questions will carry sixteen marks each and two questions eighteen marks each. The question paper should include 20-25% weightage for numerical problems.

The distribution of questions and marks for Physical and Inorganic Chemistry topics will be as follows.

i] Physical Chemistry :- Three questions of 16 marks each and one question of 18 marks.

ii] Inorganic Chemistry :- One question of 16 marks and one question of 18 marks.

Topicwise division of marks (variation of + 5%)

Ch. No	Title of the Chapter	Marks Out of 100	Total marks with internal options.
1.	Gaseous State	20	30
2.	Thermodynamics	20	30
3	Phase Equilibria	06	09
4.	Liquid State	08	12
5.	Mathematical concept and computer	12	18
6.	Long form of Periodic table and periodic properties	16	24
7.	Bonding in molecule and their structures, concept of hybridisation and molecular shapes.	18	27
	Total	100	150

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(W.e.f. Acd.Yr. 2002-2003)

COURSE STRUCTURE

PAPER - I
PHYSICAL AND INORGANIC CHEMISTRY
90 - PERIODS

PAPER - II
ORGANIC AND INORGANIC CHEMISTRY
90 - PERIODS

CHEMISTRY PRACTICAL
90 - PERIODS

COURSE STRUCTURE

FIRST YEAR B.Sc. CHEMISTRY

PAPER-I
PHYSICAL AND INORGANIC CHEMISTRY
90 - PERIODS

PAPER-II
ORGANIC AND INORGANIC CHEMISTRY
90 - PERIODS

CHEMISTRY PRACTICAL
90 - PERIODS

PAPER-II

ORGANIC AND INORGANIC CHEMISTRY

CONTENTS

I. STRUCTURE, BONDING AND REACTIVITY
II. MECHANISM OF ORGANIC REACTIONS
III. ALKYL HALIDES
IV. ALCOHOLS
V. PHENOLS
VI. ALDEHYDES AND KETONES
VII. CARBOXYLIC ACIDS AND DERIVATIVES
VIII. ORGANIC COMPOUNDS OF NITROGEN
IX. S-BLOCK ELEMENTS
X. P-BLOCK ELEMENTS

SYLLABUS

I. STRUCTURE, BONDING AND REACTIVITY [10]

i. Covalent bond Hybridization - sp3, sp2, sp with example of ethane, ethene and ethyne molecules

Ref. 1 1.8, 1.9, 1.10, 1.11.

Ref. 1

ii. Bond lengths and bond angles, bond energy, bond polarity of molecules

Ref. 1 1.15, 1.16.

Ref. 1 2.7, 2.8. Ref. 3 1.3.1, 1.3.2, 1.3.3

iii. Inductive effect, resonance effect, hyper conjugation structure of benzene and its aromaticity.

Ref. 1 5.21, 10.14, 10.16, 13.1, 13.2, 13.3

Ref. 2 7.1

Ref. 1 1.5.1, 1.5.2, 1.5.4, 1.3.6, 1.3.7, 10.4.1

iv. Empirical formula and molecular formula along with simple numerical problems

Ref. 1 2.28, 2.29.

II. MECHANISM OF ORGANIC REACTIONS [3]

i. Meaning - Fission of co-valent bond: Types of reagents - electrophiles and nucleophiles

Types of organic reactions-addition, elimination, substitution and rearrangement [pinacol-pinacolone].

Ref. 2 4.2, 5.1

Ref. 3 1.4, 1.7, 1.8.

ii. Electrophilic aromatic substitution [nitration only]

Ref. 2 18.1

Ref. 3 6.1, 6.2

III. ALKYL HALIDES [8]

i. Structure, classification and nomenclature
Ref 1 5.2, 5.4

ii. Methods of synthesis from alkenes and alcohols
Ref. 1 8.5, 8.6, 8.7, 5.7, 5.25

iii. Reactions of alkyl halides
Formation of alcohols, ethers,alkenes, nitriles, esters, amines, thiols and Grignard reagents
Ref. 1 5.8.

IV ALCOHOLS[4]

i. Introduction, Classificationand Nomenclature
Ref 1 17.1, 17.3, 17.4, 17.2

ii. Monohydric alcohols-
Methods of synthesis by reduction of aldehydes and ketones, from Grignard reagents
Ref. 1 21.9, 17.8, 17.14, 17.15
Reaction with active metals, oxidation of alcohol
Ref. 1 18.2, 18.6

iii. Dihydric alcohols-
Method of synthesis and reaction [one each]
Ref. 1 8.12, 18.10

iv. Trihydric alcohols-
Method of synthesis and reaction [on each]
Ref. 1 24.16, 35.15, 18.10

V. PHENOLS [8]

i. Nomenclature and structure.

ii. Preparation of phenol [one method]
Ref. 1 28.5

iii. Acidic nature of phenol, study of acidic strength of alcohols and phenols
Ref. 1 28.7

iv. Resonance, stabilization of phenoxide ion. Reaction - electrophilic aromatic substiution. acylation and Reimer - Tiemann reaction.
Ref. 1 28.6, 28.9, 28.10, 28.12.

VI ALDEHYDES AND KETONES [8]

i. Nomenclature and structure
Ref. 1 21.1, 21.2

ii. Synthesis of aldenhydes and ketones from acid chlorides, nitriles and from alcohol.
Ref. 1 21.4
Ref. 3 8.7,B

iii. Reactions - oxidation of aldehydes and ketones, Bayar - Villager oxidation reduction with $LiAlH_4$, $NaBH_4$, Clemmension redcution, Alcol condensation, condensation with ammonia and its derivatives. Cannizaro, Wolff-Kishner reaction.
Ref. 1 21.7, 21.9

VII. CARBOXYLIC ACIDS AND THEIR DERIVATIVES

i. Structure and Nomenclature [8]
Ref. 1 23.1, 23.2.

ii. Acidity of carboxylic acid, effect of substituent Preparation of carboxylic acid-carbonation of Grignard reagents and hydrolysis of nitriles.
Ref. 1 23.12, 23.13, 23.14, 23.6.

iii. Reactions - Hell-Volhard - Zelinsky reaction, formation of acid chlorides, esters and amides.
Ref. 1 23.9.

VIII. ORGANIC COMPOUNDS OF NITROGEN [8]

i. Structure, Classification and Nomenclature
Ref. 1 26.1, 26.2, 26.3

ii. Preparation of alkyl and aryl amines by reduction of nitro compounds and nitriles. Reductive amination of aldyhydes and ketones. Hoffman Bromoamide reaction.

Ref. 1 26.8

iii. Reactions - Distinguishing test of primary, secondary and tertiary amines. Synthetic transformation aryl diazonium salts, azocoupling.

Ref. 1 27.1

IX S - BLOCK ELEMENTS [10]

Alkali metals -

a) Occurrence and abundance
b) Uses of group I metals and their compds.
c) Electronic structure
d) Size of atoms and ions
e) Density, ionization energy
f) Electronegativity and bond type
g) Melting and boiling points
h) Flame and colour spectra
i) Chemical properties - reaction with water and air.
j) Solutions of metals in liquid ammonia
k) Biological importance of alkali metal ions
l) Difference between lithium and other group-1 elements.
m) Diagonal relationship between lithium and magnesium.

Ref 9 pages 275-82, 286-89, 302-3, 308.11.

Alkaline earth metals -

a) Occurrence and abundance
b) Electronic structure
c) Size of atoms and ions
d) Ionisation energy and electronegativity
e) Biological role of Mg and Ca
f) Difference between beryllium and other group - 2 elements.

Ref. 1 9 pages 326-27, 329-31, 353-54.

X P - BLOCK ELEMENTS [13]

Group IIIA to VIIA

a) Electronic structure
b) Oxidation state
c) General properties
d) Metallic (electropositive) and Non-metallic character of the elements.
e) Group IIIA - Diborane
f) Group IVA - difference between carbon, silicon and the remaining elements, inert pair effect and allotrops of carbon, diamond and graphite.
g) Group VA - fertilizers and nitrogen fixation.
h) Group VIA - difference between oxygen and Other elements.
i) Group VIIA - Oxidizing power and reactivity of Elements.

Ref. 6 154-56, 161-62, 171-75, 195-97, 201-02, 204-5, 229-31, 254, 256-58.

REFERENCES :

1. Organic Chemistry (fifth edition) R.T. Morrision and R.N. Boyd. Prentice-Hall International New Delhi.

2. Organic Chemistry (fifth edition) Stanley H. Pine. Mc Graw Hill nternational.

3. A Guide Book to Reaction Mechanism in Organic Chemistry (sixth edition) Peter Sykes. Orient Longman.

4. Vogel's Text Book of Practical Organic Chemistry (forth edition)

5. Fundamentals of Organic Chemistry (second edition) T.W.G.Solomans. John Wley & Sons.

6. A New Concise Inorganic Chemistry (third edition) J.D. Lee.

7. A New Guide to Modern Valency Theory (third edition) G.I. Brown.

8. Basic Inorganic Chemistry (first edition) Cotton and Wilkinson.

9. Concise Inorganic Chemistry (fifth eidtion) J.D.Lee.

EXAMINATION STRUCTURE

Paper-II :- Organic & Inorganic Chemistry.

There will be six questions. Four questions will carry sixteen marks each and two questions eighteen marks each. The distribution of questions & marks in the question paper for Organic & Inorganic topics will be as under .

i] Organic Chemistry :- [Chapter 1 to 8] Three questions of 16 marks each and one question of 18 marks.
ii] Inorganic Chemistry :- [Chapter 9 & 10] One question of 18 marks and one question of 16 marks.

*NOTE:- In a question paper, 6 to 8 marks are alloted for nomenclature of alcohols, alkyl halides, phenols, aldehydes & ketones, carboxylic acids, amines.
Topics wise division of marks (variation of ± 5%)

Ch. No.	Title of the Chapter	Marks Out of 100	Total marks with internal option
1.	Structure,bonding, & reactivity.	16	24
2.	Mechanism of organic reactions.	10	15
3.	Alkyl halides	06	09
4.	Alcohols	06	09
5.	Phenols	04	06
6.	Aldehydes and Ketones	08	12
7.	Carboxylic acids and their derivatives	08	12
8.	Organic compounds of nitrogen.	08	12
9.	s-block elements	12	18
10.	p-block elements.	22	33
	Total	100	150

F.Y.B.Sc.
Chemistry Practical-I

A) Physical Chemistry :
(Any five of the following experiments)

1] Determination of water equivalent of thermos flask, Heat of neutralization and heat of ionisation of weak acid.

2] Determination of heat of solution of KNO_3/NH_4Cl.

3] Determination of equivalent weight of Al/Mg/Zn using eudiometer.

4] Determine relative viscosity of any two of the following liquids using Ostwald viscometer. (Density is given)
(a) Acetone (b) Toluene (c) Ethyl acetate.

5] Determine the coefficient of viscosity of a liquid such as ethyl acetate using Ostwald viscometer. (Density must be determined by sp.gravity bottle)

6] Conductometric titration of NaOH and HCl.

B] Inorgaic Chemistry :-

1] Gravimetric analysis :

a] To determine the loss per gram and hence percentage purity of $ZnCO_3$

b] To determine the loss per gram and percentage composition of $NaHCO_3$ & Na_2CO_3

2] Volumetric analysis :-

a] Standerdisation of given $KMnO_4$ solution by given standard oxalic acid solution and estimation of Fe(II).

b] Standardisation of given EDTA solution by given standard $ZnSO_4$ solution and estimation of total hardness of water.

c] Standardisation of given $Na_2S_2O_3$ solution by given standard $K_2Cr_2O_7$ solution and estimation of Cu (II) iodometrically.

3] Qualitative analysis :-
Qualitative analysis of a solid compound containing one cation and one anion. (excluding phosphate and borate)
** Minimum 8 compounds are to be analysed by each student.

C] Organic Chemistry :-

1] Volumetric estimation of :- a] Aniline/Phenol b]Acetone.

2] Organic qualitative analysis :-
Determination of :-
- i) Preliminary test
- ii) Physical constnat (m.p./b.p.)
- iii) Type
- iv) functional group of single organic compound.

* <u>At least 8 organic compounds are to be analysed by each student form the following :-</u>

a] Acids-benzoic acid, cinnamic acid,oxalic acid,phthalic acid, salicylic acid.
b] Phenols - α and β naphthols, resorcinol
c] Bases- Aniline, P-Toludiene, o/m/p-nitroaniline
α– naphthylamine,N,N-dimethylaniline,cyclohexylamine, diphenyl amine.
d] Neutrals-Hydrocarbons-Naphthalene, anthracene.
Aldehydes-Benzaldehyde, cinnamaldehyde.

Ketones-Acetone,ethyl methylketone, acetophenone.
Esters-Ethyl acetate,ethylbenzoate,methyl acetate.
Nitro compounds-Nitrobenzene,m-dinitrobenzene
Amides-Acetamide,benzamide,urea.
Alcohols-Ethanol,methanol.

3] Purification of organic compounds :-
Purification of water soluble organic compound by recrystallisation and determination of its melting point. (only two compounds are to be purified by each student.)

REFERENCE BOOKS :

1. Advanced Practical Physical Chemistry
   By J.B.Yadav (Goel publishing house,Meerut)
2. Findlay's Practical Physical Chemistry
   (Revised By B.P.Levitt and J.K.Kirthner,Longman Group Ltd)
3. Systematic Experimental Physical Chemistry
   By Rajbhoj and Chondekar(Anjali Publication,Aurangabad)
4. Vogel's Text Book of Practical Organic Chemistry.
   (5th edition).
5. Vogel's Text Book of Quantitative Chemical Analysis.
6. A Text Book of Practical Chemistry.
   By Kulkarni, Wani, Oswal
   (Vidya Book Publishers,Aurangabad)

Scheme for Practical Examination :-

The examination will be of 6 hours duration. It will be conducted as follows :

A]	Physical Chemistry Experiment	35 marks
B]	Any one of the following	30 marks
i]	Inorganic Volumetric Analysis	
ii]	Inorganic Gravimetric Analysis	
iii]	Organic estimation	
C][i]	Inorganic Qualitative Analysis	25 marks
	OR	
II]	a] Organic Qualitative Analysis	15 marks
	b] Purification of Organic compound by crystallization.	10 marks
D]	Journal	10 marks

Important Note:-

Book/Typed/Cyclostyled/Printed material will be allowed during the examination.

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CORRIGENDUM

The following corrections may be carried out to the Syllabus for **B.Sc. Part-I** Circulated vide Circular No.37/2002, No.NMU/12/Sci.Faculty/581/2002, Dated 11\07\2002.

PAPER-I (PHYSICAL AND INORGANIC CHEMISTRY)

Sr. No.	Page No.	Particulars of Corrections.
1.	2	The word under Paper-I in para 1 in the first line appears as "Rand" be read as "R and".
2.	2	The word in the third line appears as "Charles's" be read as " Charles' ".
3.	3	**The word, infront of Ref.3 :-** appears as " Relavent" be read as "Relevant".
4.	4	**In the Para No.3 :-** The correct spelling be read as shown now :- Instead of "Defination**s**" read as "Definitions". Instead of "Unstabel" read as "Unstable".
5.	4	**In the Para No.4 :-** Instead of "inliquids" read as "in liquids". Instead of "attracions" read as "attractions".
6.	4	In the fourth line in between the words viscosity and units comma (,) be inserted.
7.	5	The word appear in third line as "inputand" be read as "input and". Tha word under Ref.:- appears as "Relavent" be read as "Relevant".
		PAPER-II (ORGANIC AND INORGANIC CHEMISTRY)
8.	6	**The corrects spelling be read as :-** i) Instead of "Bayar" read as "Bayer". ii) Instead of "Clemmension" read as "Clemmenson".

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P.T.O.

CORRIGENDUM

The following corrections may be carried out to the Syllabus for **M.Sc. Part-I** Circulated vide Circular No.49/2002, No.NMU/12/Sci.Faculty/717/2002, Dated 23\07\2002.

CH-110 PHYSICAL CHEMISTRY-I.

Sr. No.	Page No.	Particulars of Corrections.
1.	4	i) The figure of total Period under Sr.2 2. STATISTICAL THERMODYNAMICS :- be read as "10" instead of "8". ii) The figure of total Period under Sr.3 3. DYNAMIC ELECTROCHEMISTRY :- be read as "6" instead of "8".
2.	5	**The portion :-** " and probability, Entropy in terms of partition function, Separation of partition functions, translational partition function, translational energy heat capacity and entropy for monoatomic gases, Sackur-tetrode equation, Rotational partition function, Rotational energy, heat capacity and entropy, vibrational partition function vibrational energy heat capacity and entropy, Electronic partition function, statistical calculation of equalibraum constant. [8] Ref.:- 2 Pages 751-771. Ref.:- 3 Pages 183-185, 186-191, 193-196, 100-105, 109-111 & 113-116. 3] DYNAMIC ELECTROCHEMISTRY :- Introduction, processes at electrodes, Electrical double layer. rate of charge transfer, rate laws, activation Gibbs energy, Butler-Volmer equation, Overpotential, low and high overpotential limits, Polarization, Concentration polarization, Electrochemical processes, Electrolysts, Characteristics of working cells, Potentials of working cells, Power output of working cells, corrosion, Rate and inhibition of corrosion. Ref.:- 1 Pages 877-887 & 890-895. [8] " shall be deleted.

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