

**NAGARJUNA GOVERNMENT COLLEGE,
NALGONDA (AUTONOMOUS)**

(Affiliated to Mahatma Gandhi University)
(www.ngcnalgonda.org)



BOARD OF STUDIES - 2020-21

DEPARTMENT OF CHEMISTRY

**NAGARJUNA GOVT. COLLEGE, NALGONDA
(AUTONOMOUS)**

**NAGARJUNA GOVERNMENT COLLEGE:: NALGONDA
(AUTONOMOUS)**

Date: 04 - 11 - 2020

To
Principal
Nagarjuna Government College (A),
Nalgonda

Sir,

Sub: Grant of Autonomous status – Constitution of the Board of Studies
in Chemistry Department – request for approval – Reg.

Ref: 1. No.F.22-1/2007(AC) Dt.3 Apr 2007
2. OU Lr. NoMR.69/H/2007/Acad, Dt:12-06-07.
3. GORt. No.467 HE. (CE-1) Dept. Dt.29.6.2007.
4. MGU Lr.

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With reference to the subject cited, I am here with submitting the list of committee members for constitution of Board of Studies for the academic year 2020-21 for your approval.

Sl.No.	CATEGORY	NAME & DESIGNATION	CONTACT NOS
1	Chairman, Board of studies	Sri.V.Srinivasulu	9440838371
2	University Nominee	Dr.M. Vasantha, Associate Prof., M.G.University, Nalgonda.	9849216947
3	Subject expert from outside the college	Dr.A.Srinivasulu, Assistant Professor, GDC, Huzurnagar Suryapet, Dist	9440140506
4	Subject expert from outside the college	Dr.Venkatakrishna Assistant Professor, GDC(W), Nalgonda, Nalgonda Dist.	9441993436
5	Members: All The Faculty members of the Dept.	1. Sri, K. Nagireddy 2. Sri.Ch. Muthaiah 3. Sri.Y. Yadagiri Rao 4. Sri.K.Naresh 5. Sri.R. Chandrashekar 6. Dr. P. Balaswamy 7. Dr. B. Bixamaiah	9052454283 9985046563 9959422591 9704295903 9951020987 9704346175 9440522563

Submitted by


In-Charge/Chairman BOS

Proposals approved by


Principal/Chairman academic council

PRINCIPAL
Nagarjuna Govt. College
NALGONDA-508001.

NAGARJUNA GOVERNMENT COLLEGE, NALGONDA
(AUTONOMOUS)

Re. No: 1 / BOS/chem/acad/2020-21

Date: 04-11-2020

To
Smt. M. Vasantha,
Associate Professor,
Mahatma Gandhi University, Nalgonda.

Madam,

Sub:- Nagarjuna Govt. college, Nalgonda (Autonomous)-convening the meeting of Board of studies - Chemistry on 09-11-2020- Intimation-Request-Reg.

-o0o-

I am happy to inform you that you have been nominated as a University Nominee Of Board of studies, Department of Chemistry of this college for the year 2020-21.

The meeting of the Board of studies, Chemistry will be held on 09-11-2020 in the Department of Chemistry to consider the BOS-2020-21 Agenda.

Hence, you are requested to make it convenient to attend the meeting and extend your cooperation.


In-Charge/Chairman BOS
Department of Chemistry


Principal

PRINCIPAL
Nagarjuna Govt. College
NALGONDA-508 001.

NAGARJUNA GOVERNMENT COLLEGE, NALGONDA
(AUTONOMOUS)

Rc. No: 2 / BOS/chem/acad/2020-21

Date: 04-11-2020

To
Dr.A.Srinivasulu,
Assistant Professor,
GDC, Huzurnagar Suryapet, Dist

Madam,

Sub:- Nagarjuna Govt. college, Nalgonda (Autonomous)-convening the meeting of Board of studies - Chemistry on 09-11-2020- Intimation-Request-Reg.

-o0o-

I am happy to inform you that you have been nominated as a Subject expert Of Board of studies, Department of Chemistry of this college for the year 2020-21.

The meeting of the Board of studies, Chemistry will be held on 09-11-2020 in the Department of Chemistry to consider the BOS-2020-21 Agenda.

Hence, you are requested to make it convenient to attend the meeting and extend your cooperation.


In-Charge/Chairman BOS
Department of Chemistry


Principal
PRINCIPAL
Nagarjuna Govt. College
NALGONDA-508 001.

NAGARJUNA GOVERNMENT COLLEGE, NALGONDA
(AUTONOMOUS)

Re. No: 3 / BOS/chem/acad/2020-21

Date: 04-11-2020

To

Dr. Venkatakrishna
Assistant Professor,
GDC(W), Nalgonda,

Sir,


Sub:- Nagarjuna Govt. college, Nalgonda (Autonomous)-convening the meeting of Board of studies - Chemistry on 09-11-2020- Intimation-Request-Reg.


-o0o-

I am happy to inform you that you have been nominated as a Subject expert Of Board of studies, Department of Chemistry of this college for the year 2020-21.

The meeting of the Board of studies, Chemistry will be held on 09-11-2020 in the Department of Chemistry to consider the BOS-2020-21 Agenda.

Hence, you are requested to make it convenient to attend the meeting and extend your cooperation.


In-Charge/Chairman BOS
Department of Chemistry


Principal
PRINCIPAL
Nagarjuna Govt. College
NALGONDA-508 001.

NAGARJUNA GOVT.COLLEGE, NALGONDA
(AUTONOMOUS)


DEPARTMENT OF CHEMISTRY


BOARD OF STUDIES MEETING


The members of Board of studies in Chemistry Department, N.G.College, Nalgonda met under the chairmanship of Sri V.Srinivasulu on 09-11-2020 and discussed the Agenda and passed the following resolutions.

AGENDA

1. To consider and approve the syllabus for B.Sc.- I, II, III years (I, II, III, IV, V & VI semesters) for the academic year 2020-21.
2. To consider and approve the choice based credit system (CBCS) and Cumulative grade Point average (CGPA) system for I, II and III year (all semesters) students for the Academic year 2020-21.
3. To consider and approve the Generic Elective course **Food adulteration** for the V Semester Students for the Academic year 2020-21
4. To Consider and approve the continuation of Internal Assessment for the Students admitted in to I, II & III year UG course during 2020-21.
5. To consider and approve the New syllabus for the CBCS and cumulative grade Point average (CGPA) System for the I, II and III Year Students as per New common core syllabus. As per the guidelines of TSCHE Project in Chemistry/Advanced Chemistry is proposed to introduce from this academic year for VI semester with 4 credits
6. To consider and approve to conduct semester wise practical examination for I, II & III year students for the Year 2020-21
7. To consider and approve the list of examiners for paper setting and evaluation for B.Sc - I,II & III years (I,II,III,IV,V & VI semesters) for the academic year 2020-21.
8. To consider and approve the model Question papers for B.Sc I, II and III Years for the academic year 2020-21.
9. To consider and approve the Syllabus and Model question paper of Skill Enhancement Compulsory Course (SEC)
 - i) Safety Rules in Chemistry Laboratory and Lab Reagents
 - ii) Basic analytical chemistryFor III semester, and
 - i) Food adulteration
 - ii) Chemistry of Cosmetics and Food Processingfor IV semester students in Chemistry for the academic year 2020-21.
10. Any other related academic matter.


Subject Expert
Dr. V. Srinivasulu
Principal (PAC)
GDC Huzurmagal,
Jampet Dist (T.S.)


Subject Expert-2
Dr. K. VENKATA KRISHNA,
Asst. Prof. of Chemistry
GDC (W), NALGONDA


University Nominee
ASSOCIATE PROFESSOR
College of Science & Informatics
Mahatma Gandhi University - GDC
Nalgonda, Nalgonda District, T.S.


Chairman BOS

Resolutions

1. Discussed and approved the syllabus in to 4 units for each paper.
2. CBCS and CGPA system for UG students are approved.
3. **Food adulteration** is as General elective in semester-V is approved.
4. Discussed and approved to conduct TWO Internal Assessments for 20 marks, one student seminar for 5 marks and one assignment for 5 marks (total 30 marks) for I, II & III year students as per the previous year.
5. Discussed and approved the syllabus for I,II, III & IV semesters as per common core Syllabus and V &VI modified syllabus as per resolutions of Governing Body meeting. As per the guidelines of TSCHE 'Project in Chemistry/Advanced Chemistry'' is approved to introduce from this academic year for VI semester with 4 credits
6. Discussed and approved the Semester wise practical examinations for all UG courses in Chemistry.
7. List of the examiners is approved.
8. Model question papers are approved.
9. Syllabus and Model question paper of Skill Enhancement Compulsory Course (SEC) for II & III Year students in Chemistry for the academic year 2020-21 are approved.
10. Internal examinations are conducted for 30 marks. Semester end exams are conducted for 70 marks, it is mandatory to get a minimum of 28 marks for one to get through it. On the Whole for 100 marks one must get 40 marks to get through the paper.
11. Discussed and approved to design question paper pattern in the following lines for I, II and III year students.

Question Paper Design

Section -A

5 X 2=10 Marks

- To give five very short questions and ask them to answer all questions (at least One Question from each unit)

Section-B

4 X 5=20 Marks

- To give Six Short questions and ask them to answer any four questions(at least One Question from each unit)

Section-C

4 X 10 = 40 Marks

- To give 4 Long Questions with internal choice and ask them to answer all question (One Question from each unit)

1. To Prepare and supply of question banks and model papers to the students
2. Continuous Internal Assessment methods adopted to evaluate the progression of the Student.

Gowder
Subject Expert-1
Principal (AC)
GDC Huzumaganahalli
Suryapet Dist (T.S)

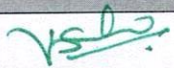
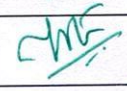
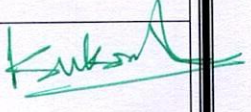


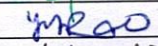
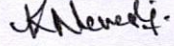
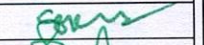

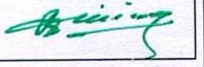
Kankarshah
Subject Expert-2
Dr. K. VENKATA KRISHNA,
Asst. Prof. of Chemistry
GDC (W), NALGONDA.

Chakraborty
University Nominee
ASSOCIATE PROFESSOR
Mahatma Gandhi University
College of Science & Information
Technology
Nalgonda
Chairman BOS

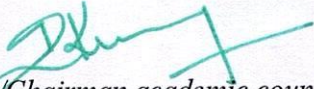
NAGARJUNA GOVT. COLLEGE (A), NALGONDA

DEPARTMENT OF CHEMISTRY

CONSTITUTED COMMITTEE OF BOARD OF STUDIES: 2020-2021


Sl. No.	Designation	Name	Mobile No.	Signature
1	Chairman, Board of studies	Sri. V.Srinivasulu	9440838371	
2	University Nominee	Dr.M. Vasantha, Associate Prof., M.G.University, Nalgonda.	9849216947	
3	Subject expert from outside the college	Dr.A.Srinivasulu, Assistant Professor, GDC, Huzurnagar Suryapet, Dist.	9440140506	
4	Subject expert from outside the college	Dr.Venkatakrisna Assistant Professor, GDC(W), Nalgonda, Nalgonda Dist.	9441993436	
5	Members: All The Faculty members of the Dept.	1. Sri, K. Nagireddy	9052454283	
		2. Sri. Ch. Muthaiah	9985046563	
		3. Sri. Y. Yadagiri Rao	9959422591	
		4.K.Naresh	9704295903	
		5. Sri. R. Chandrashekar	9951020987	
		6. Dr. P. Balaswamy	9704346175	
		7. Dr. B. Bixamaiah	9440522563	



In-Charge/Chairman BOS


Principal/Chairman academic council

PRINCIPAL
Nagarjuna Govt. College
NALGONDA-508 001.


Subject Expert
Dr. A. Srinivasulu
Principal (FAC)
GDC Huzurnagar
Suryapet Dist (T.S)


Subject Expert-2
Dr. K. VENKATA KRISHNA,
Asst. Prof. of Chemistry
GDC (W), NALGONDA.



University Nominee,
Associate Professor
University College of Science & Informatics
Mahatma Gandhi University
Nalgonda, N.T. Dist.


**APPROVED THE PANEL OF EXAMINERS FOR PAPER SETTING AND EVALUATION
FOR THE YEAR 2020-2120.**


SNO	PAPER		NAME	DISIGNATION	CELL NO
1		1	Dr. D. Ramesh	Asst.Professor, M.G.U, Nalgonda	7702638320
2	I	2	Smt. M. Anitha	Asst.Professor, GDC(W), Nalgonda	6281210722
3		3	Sri. P. Ravi kumar	Asst.Professor, GDC(W) Nalgonda	9440208972
4		1	Dr.V.Shekhar	Asst.Professor, GDC(W), Nalgonda	6281210722
5	II	2	Dr. D. Ramesh	Asst.Professor, M.G.U, Nalgonda	7702638320
6		3	Sri. D.Balanarsimha	Asst.Professor, GDC Ramannapet	9491369419
7		1	Sri. B.Jyothi	Asst.Professor, GDC(W), Nalgonda	9550865652
8	III	2	R.Sujith Reddy	Asst.Professor, <u>M.G.U, Nalgonda</u>	9490939336
9		3	Dr.. U.Raghavendar	Assit.Professor, MVS GDC Mahabubnagar	9866219767
10		1	Dr .Y. Prashanthi	Asst.Professor, M.G.U, Nalgonda	9010203857
11	IV	2	Dr. Dayanand	Assit.Professor, GDC,Jadcharlla,MBNR	9492302186
12		3	Sri. D.V. Rao	Asst.Professor, GDC, Hyathnagar	8143288990
13		1	Dr.Annapurna Butti R.S	Associate .Professor, M.G.U, Nalgonda	9885059533
14	V	2	Dr. A. Srinivaslu	Asst.Professor, GDC, Huzurnagar	9440140506
15		3	Dr. K. Venkata Krishna	Asst.Professor, GDC(W) Nalgonda	9441993436


16	1	Dr. A. Srinivasulu	Asst.Professor, GDC, Huzurnagar	9440140506
17	2	N.Saikondalu	Asst. Professor, GDC Malkagigiri	8179561193
18	3	Dr. K. Venkata Krishna	Asst.Professor, GDC(W) Nalgonda	9441993436
19	1	Dr. Vasam Srinivas	Asst. Professor, KDC, Hanamakonda.	9885059533
20	2	Dr. K. Venkata Krishna	Asst.Professor, GDC(W) Nalgonda	9441993436
21	3	Dr. S. Kalyani	Asst.Professor, M.G.U, Nalgonda	9502388232


In-Charge/Chairman BOS


Principal
PRINCIPAL
Nagarjuna Govt. College
NALGONDA-508 001.


Subject Expert-1
Dr.A. Srinivasulu
Principal (FAC)
GDC Huzurnagar
Suryapet Dist (T.S)


Subject Expert-2
Dr. K. VENKATA KRISHNA,
Asst. Prof. of Chemistry
GDC (W), NALGONDA.


University Nominee
Associate Professor
University College of Science & Informatics
Mahatma Gandhi University
Warangal, Nalgonda Dist.

Faculty of Science
B.Sc.I,II&III Yr (I To VI semesters) - Papers I To VII
CHEMISTRY- I TO VII (NEW CBCS)

Time: 2 ½ Hrs.

Max.Marks: 70

SECTION – A

Answer All of the following questions:

(5 x 2 = 10)

- 1.
- 2.
- 3.
- 4.
- 5.

SECTION – B

Answer any FOUR of the following questions:

(4 x 5 = 20)

- 6.
- 7.
- 8.
- 9.
- 10.
- 11.

SECTION – C

Answer ALL of the following questions:

(4 x 10 = 40)

12. (a).
(b).

(OR)

- (c).
(d).

13. (a).
(b).

(OR)

- (c).
(d).

14. (a).
(b).

(OR)

- (c).
(d).

15. (a).
(b).

(OR)

- (c).
(d).

Subject Expert-1

Dr. J. Srinivasulu
Principal (FAC)
GDC Huzumagar
Suryapet Dist (T.S)

Subject Expert-2

K. Venkata Krishna
Dr. K. VENKATA KRISHNA,
Asst. Prof. of Chemistry
GDC (W), NALGONDA.

University Nominee

Dr. K. Venkata Krishna
Associate Professor
University College of Science & Informatics
Mahatma Gandhi University
Nalgonda, Andhra Pradesh

NAGARJUNA GOVERNMENT COLLEGE(A) NALGONDA

**PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc., Chemistry 2020-21**

FIRST YEAR- SEMESTER I				
CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 101	Ability Enhancement Compulsory Course AECC-1	ES	2	2
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
BS 104	Optional I	DSC-1A	4T+3P=7	4+1=5
BS 105	Optional II	DSC-2A	4T+3P=7	4+1=5
BS 106	Optional III- Chemistry - I	DSC-3A	4T } = 7 3P }	4 } = 5 1 }
	Laboratory Course - I (Qualitative Analysis - Semi Micro Analysis of Mixtures)			
	Total Credits		31	25
FIRST YEAR- SEMESTER II				
BS 201	Ability Enhancement Compulsory Course AECC-2	BCS	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B	4T+3P=7	4+1=5
BS 206	Optional III- Chemistry - II	DSC-3B	4T } = 7 3P }	4 } = 5 1 }
	Laboratory Course - II (Quantitative Analysis - Titrations)			
	Total Credits		31	25
SECOND YEAR- SEMESTER III				
BS 301	i) Safety Rules in Chemistry Laboratory and Lab Reagents ii) Basic Analytical chemistry	SEC-1 SEC-2	2 2	2 2
BS 302	English	CC-1C	3	3
BS 303	Second language	CC-2C	3	3
BS 304	Optional I	DSC-1C	4T+3P=7	4+1=5
BS 305	Optional II	DSC-2C	4T+3P=7	4+1=5
BS 306	Optional III- Chemistry - III	DSC-3C	4T } = 7 3P }	4 } = 5 1 }
	Laboratory Course - III (Synthesis of Organic compounds)			
	Total Credits		31	25
SECOND YEAR- SEMESTER IV				
BS 401	i) Food Adulteration ii) Chemistry of Cosmetics and Food Processing	SEC-3 SEC-4	2 2	2 2
BS 402	English	CC-1D	3	3
BS 403	Second language	CC-2D	3	3
BS 404	Optional I	DSC-1D	4T+3P=7	4+1=5
BS 405	Optional II	DSC-2D	4T+3P=7	4+1=5
BS 406	Optional III- Chemistry - IV	DSC-3D	4T } = 7 3P }	4 } = 5 1 }
	Laboratory Course - IV (Qualitative Analysis of Organic Compounds)			
	Total Credits		31	25

* AECC: Ability Enhancement Compulsory Course, SEC: Skill Enhancement Course, DSC: Discipline Specific Course, GE: Generic Elective, ES: Environmental Science, BCS: Basic computer skills.

THIRD YEAR- SEMSTER V

BS 501	i) Chemistry of Cosmetics, food processing, drugs and pharmaceuticals ii) Food Adulteration (for non science stream)	GE	4	4
BS 502	English	CC-1E	3	3
BS 503	Second language	CC-2E	3	3
BS 504	Optional I A/B	DSE-1E	4T+3P=7	4+1=5
BS 505	Optional II A/B	DSE-2E	4T+3P=7	4+1=5
BS 506	Optional III- A/B A. Chemistry- V B. Metallurgy, Dyes and Catalysis	DSE-3E		
	Laboratory Course - III (Synthesis and quantitative analysis of Organic compounds,)		4T = 7 3P	4 =5 1
Total Credits			31	25

THIRD YEAR-SEMSTER VI

BS 601	Project in Chemistry/Advanced Chemistry		4T	4
BS 602	English	CC-1F	3	3
BS 603	Second language	CC-2F	3	3
BS 604	Optional I	DSE-1F	4T+3P=7	4+1=5
BS 605	Optional II	DSE-2F	4T+3P=7	4+1=5
BS 606	Optional III- A. Medicinal chemistry B. Agricultural and Fuel Chemistry	DSE-3F	4T = 7 3P	4 = 5 1
	Laboratory Course - IV (Physical Chemistry)			
Total Credits			31	25

G. Srinivasulu
Dr.A.Sreenivasulu
Principal (FAC)
GDC Huzur Nagar
Suryapet Dist (T.S)

K. Venkata Krishna
Dr. K. VENKATA KRISHNA,
Asst. Prof. of Chemistry
GDC (W), NALGONDA.

M. S. Reddy
Associate Professor
University College of Science & Informatics
Mahatma Gandhi University
Rareddyvuda, NALGONDA-508254.

B.Sc. I Yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER I
Paper – I
Chemistry - I

Unit-I (Inorganic Chemistry)

15 h (1hr/week)

S1- I-1. Chemical Bonding

8 h

Ionic solids- lattice and salivation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions. VSPER Theory - Common hybridization-sp, sp^2 , sp^3 , sp^3d , sp^3d^2 and sp^3d^3 , shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of bonds. Criteria for orbital overlap. LCAO concept. π and σ overlapping. Concept of Types of molecular orbitals- bonding, antibonding and non-bonding. MOEDof homonuclear diatomics - H_2 , N_2 , O_2^- , O_2^{2-} , F_2 (unhybridized diagrams only) and hetero nuclear diatomics CO , CN^- , NO , NO^+ and HF . Bond order, stability and magnetic properties.

S1-I-2. P-Block Elements1

7 h

Group-13: Structure of diborane and higher Boranes (B_4H_{10} and B_5H_9), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3 . Group - 14: Carbides-Classification - ionic, covalent, interstitial - Structures and reactivity. Industrial applications. Silicones - Classification - straight chain, cyclic and cross-linked. Group - 15: Nitrides - Classification - ionic, covalent and interstitial. Reactivity - hydrolysis. Reactions of hydrazine, hydroxyl amine, phosphazenes.

Unit - II (Organic Chemistry)

15h(1 hr/week)

S1-O-1: Structural Theory in Organic Chemistry

5 h

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity - inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

S1-O-2: Acyclic Hydrocarbons

6 h

Alkanes- Methods of preparation: From Grignard reagent, Kolbe synthesis.

Chemical reactivity- inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX , Markonikov's rule, addition of H_2O , HOX , H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti-Markonikov's addition). Oxidation (cis-additions)-hydroxylation by $KMnO_4$, OsO_4 , anti addition- peracids (via epoxidation),

hydroboration, ozonolysis – location of double bond. Dienes – Types of dienes, reactions of conjugated dienes – 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diels – Alder reaction.

Alkynes– Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of X_2 , HX, H_2O (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation).

Aromatic Hydrocarbons

4h

Introduction to aromaticity: Huckel's rule – Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

Unit – III (Physical Chemistry)

15h(1 hr/week)

S1-P-1: Atomic structure and elementary quantum mechanics

3 h

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect, Limitations of classical mechanics, Compton effect, de Broglie's hypothesis. Heisenberg's uncertainty principle.

S1-P-2:Gaseous State

5h

Deviation of real gases from ideal behavior. van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO_2 . The van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquefaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas.

S1-P-3: Liquid State and Solutions

4 h

Liquid State

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Solutions

3 h

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems.

Azeotropes: HCl- H_2O and $C_2H_5OH - H_2O$ systems. Fractional distillation. Partially miscible liquids: Phenol – Water, Trimethyl amine – Water and Nicotine – Water systems.

Unit – IV (General Chemistry)

15h (1 hr/week)

S1-G-1. General Principles of Inorganic Qualitative Analysis

6 h

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions- CO_3^{2-} , Cl^- , Br^- , SO_4^{2-} , PO_4^{3-} , BO_3^{3-} , CH_3COO^- , NO_3^- . Interfering ions. Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations (Hg_2^{2+} , Ag^+ , Pb^{2+}) with flow chart and chemical equations. Principle involved in separation of group II & IV cations. General discussion for the separation and identification of group II (Hg^{2+} , Pb^{2+} , Bi^{3+} , Cd^{2+} , Sb^{3+}), III (Al^{3+} , Fe^{3+}), IV (Mn^{2+} , Zn^{2+}) individual cations with flow chart and chemical equations. General discussion for the separation and identification of group V individual cations (Ba^{2+} , Sr^{2+} , Ca^{2+}) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^{2+} , NH^+).

S1-G-2. Isomerism

5 h

Isomerism: Definition of isomers. Classification of isomers: Constitutional and Stereoisomers - definition and examples. Constitutional isomers: chain, functional and positional isomers. Stereoisomers: enantiomers and diastereomers – definitions and examples. Representation of stereoisomers – Wedge, Fischer projection, Sawhorse, Newmann formulae.

Conformational analysis : Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, n-butane, 1,2- dichloroethane, 2-chloroethanol .Cyclic compounds: Baeyer's strain theory, Conformational analysis of cyclohexane Cis-trans isomerism: E-Z-Nomenclature

S1-G-3: Solid state Chemistry

4h

Laws of Crystallography: (i) Law of Constancy of interfacial angles (ii) Law of Symmetry- Symmetry elements in crystals (iii) Law of rationality of indices. Definition of space lattice, unit cell. Bravais Lattices and Seven Crystal systems (a brief review). X-ray diffraction by crystals; Derivation of Bragg's equation. Determination of structure of NaCl, KCl and CsCl (Bragg's method and Powder method).

References

General reference: B.Sc I Year Chemistry : Semester I, Telugu Academy publication, Hyd

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.Chem.

5. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press 1989.
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.
9. Textbook of Inorganic Chemistry by R Gopalan.

Unit- II

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Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry by Lewis Glasstone.

Unit IV

1. Qualitative analysis by Welcher and Hahn.
2. Vogel's Qualitative Inorganic Analysis by Svehla.
3. Text Book of Organic Chemistry by Morrison And Boyd.
4. Text Book of Organic Chemistry by Graham Solomons.
5. Text Book of Organic Chemistry by Bruce Yuranis Powla.
6. Text Book of Organic Chemistry by Soni.
7. Text Book of Physical Chemistry by Soni And Dharmahara..
8. Text Book of Physical Chemistry by Puri And Sharma.
9. Text Book of Physical Chemistry by K. L. Kapoor.

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Laboratory Course

45h (3 h /week)

Paper I - Qualitative Analysis - Semi micro analysis of mixtures

Analysis of two anions (one simple, one interfering) and two cations in the given mixture.

Anions: CO_3^{2-} , SO_3^{2-} , S^{2-} , Cl^- , Br^- , I^- , CH_3COO^- , NO_3^- , PO_4^{3-} , BO_3^{3-} , SO_4^{2-} .

Cations: Hg_2^{2+} , Ag^+ , Pb^{2+}

Hg^{2+} , Pb^{2+} , Bi^{3+} , Cd^{2+} , Cu^{2+} , $As^{3+/5+}$, $Sb^{3+/5+}$, $Sn^{2+/4+}$

Al^{3+} , Cr^{3+} , Fe^{3+}

Zn^{2+} , Ni^{2+} , Co^{2+} , Mn^{2+}

Ba^{2+} , Sr^{2+} , Ca^{2+}

Mg^{2+} , NH_4^+

Scheme of valuation

(Max.marks50)

I.	Procedures for identification of two cations (5+5)	10	
II.	Solubility of anions Solubility of cations (2+2)	04	} 30marks
	Flame test	02	
	2anions (2x4)	08	
	2cations(2x6)	12	
	Group separation table &Report	04	
III.	Record and Viva voce (5+5)	10	

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B.Sc I Yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER II
Paper – II
Chemistry –II

Unit-I (Inorganic Chemistry) 15 h (1hr/week)
S2-I-1 P-block Elements-II 7 h

Oxides: Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed (b) sub oxide d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Oxy acids: Structure and acidic nature of oxyacids of B, C, N, P, S, Cl and I. Redox properties of oxyacids of Nitrogen: HNO_2 (reaction with FeSO_4 , KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$), HNO_3 (reaction with H_2S , Cu), HNO_4 (reaction with KBr, Aniline), $\text{H}_2\text{N}_2\text{O}_2$ (reaction with KMnO_4). Redox properties of oxyacids of Phosphorus: H_3PO_2 (reaction with HgCl_2), H_3PO_3 (reaction with AgNO_3 , CuSO_4). Redox properties of oxyacids of Sulphur: H_2SO_3 (reaction with KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$), H_2SO_4 (reaction with Zn, Fe, Cu), $\text{H}_2\text{S}_2\text{O}_3$ (reaction with Cu, Au), H_2SO_5 (reaction with KI, FeSO_4), $\text{H}_2\text{S}_2\text{O}_8$ (reaction with FeSO_4 , KI). Redox properties of oxy acids of Chlorine.

Interhalogens- Classification- general preparation- structures of AB , AB_3 , AB_5 and AB_7 type and reactivity.

Poly halides- Definition and structure of ICl_2^- , ICl_4^- and I_3 .

Pseudohalogens: Comparison with halogens.

S2-I-2: Chemistry of Zero group elements 2 h
Isolation of noble gases, Structure, bonding and reactivity of Xenon compounds – Oxides, Halides and Oxy-halides. Clathrate compounds and Anomalous behavior of He (II)

S2-I-3: Chemistry of d-block elements 6 h
Characteristics of d-block elements with special reference to electronic configuration, variable valence, ability to form complexes, magnetic properties & catalytic properties. Stability of various oxidation states and standard reduction potentials. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu triads. Titanium triad – electronic configuration and reactivity of +3 and +4 states – oxides and halides. Chromium triad – reactivity of +3 and +6 states. Copper triad – reactivity of +1, +2 and +3 states.

Unit – II (Organic Chemistry) 15h(1 hr/week)

S2-O-1: Halogen compounds 4 h

Classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX , Nucleophilic substitution reactions – classification into $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$. Mechanism and energy profile diagrams of $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions. Stereochemistry of $\text{S}_{\text{N}}2$ (Walden Inversion) 2-bromobutane, $\text{S}_{\text{N}}1$ (Racemisation) 1-bromo-1-phenylpropane Structure and reactivity – Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

S2-O-2: Hydroxy compounds and ethers

6 h

Alcohols: Preparation: 1°, 2° and 3° alcohols using Grignard reagent, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/ZnCl₂ (Lucas reagent), esterification, oxidation with PCC, alk. KMnO₄, acidic dichromates, conc. HNO₃ and Oppenauer oxidation (Mechanism).

Phenols: Preparation: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide.

Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution; halogenations, Reimer Tiemann reaction (Mechanism), Kolbe reaction (Mechanism), Gattermann-Koch reaction, Azo-coupling reaction, Schotten-Boumann reaction, Houben-Hoesch condensation, .

Ethers: Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H₂SO₄. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of conc. H₂SO₄ and HI.

S2-O-3 Carbonyl compounds

5h

Preparation of aldehydes & ketones from acid chloride, 1,3-dithianes, nitriles and from carboxylic acids. Special methods of preparing aromatic aldehydes and ketones by (a) Oxidation of arenes (b) Hydrolysis of benzal halides Physical properties – absence of Hydrogen bonding. Reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of (a) NaHSO₃ (b) HCN (c) RMgX (d) NH₃ (e) RNH₂ (f) NH₂OH (g) PhNHNH₂ (h) 2,4-DNP (Schiff bases). Addition of H₂O to form hydrate, chloral hydrate (stable), addition of alcohols - hemiacetal and acetal formation. Cannizzaro reaction. Oxidation reactions – KMnO₄ oxidation and auto oxidation, reduction – catalytic hydrogenation, mechanism of Clemmenson's reduction, Wolf-kishner reduction, Meerwein Ponnoff Verly reduction. Reduction with LAH, NaBH₄.

Unit – III (Physical Chemistry)

15h(1hr/week)

S2-P-1: Electrochemistry

15 h

Electrical transport – conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kohlrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law - its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method for attackable electrodes. Applications of conductivity measurements: Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. Electro motive force (EMF) of a cell and its measurement. Computation of EMF. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble

salt and redox electrodes. Electrode reactions, Nernst equation, cell EMF and Single electrode potential, Standard Hydrogen electrode – reference electrodes (calomel electrode) – standard electrode potential, sign conventions, electrochemical series and its significance. Applications of EMF measurements. Calculation of thermodynamic quantities of cell reactions (Gibbs free energy G , Helmholtz free energy and Equilibrium constant K). Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode. Solubility product of AgCl. Potentiometric titrations.

Unit – IV (General Chemistry)

15 h (1hr/week)

S2-G-1: Theory of Quantitative Analysis

6 h

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid –weak base, weak acid-strong base and weak acid –weak base. Theory of redox titrations - internal(KMnO_4) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations – use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations – theory of adsorption indicators.

Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, coprecipitation and post precipitation. Determination of Ni^{2+}

S2-G-2: Stereoisomerism

5 h

Optical activity: Definition, wave nature of light, plane polarised light, optical rotation and specific rotation, chiral centers. Chiral molecules: definition and criteria- absence of plane, center and S_n axis of symmetry – asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and dissymmetric molecules (trans-1,2-dichlorocyclopropane). Molecules with constitutionally symmetrical chiral carbons (Tartaric acid) Molecules with constitutionally unsymmetrical chiral carbons (2,3-dibromopentane). D, L configuration – examples. R, S – configuration: Cahn-Ingold-Prelog rules, examples for asymmetric and dissymmetric molecules.

S2-G-3: Dilute Solutions & Colligative Properties

4h

Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.

References

General reference: B.Sc I Year Chemistry : Semester II, Telugu Academy publication, Hyderabad

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1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
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6. Physical Chemistry through problems by S.K. Dogra.
7. Elements of Physical Chemistry by Lewis and Glasstone.
8. Material science by Kakani & Kakani

Unit IV

1. Vogel's Text Book of Quantitative Analysis by G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999.
2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..
3. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
4. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et al.
5. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
6. Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati.

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Laboratory Course

45hrs (3 h /week)

Paper II- Quantitative Analysis

Acid - Base titrations

1. Estimation of Carbonate in Washing Soda.
2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.
4. Estimation of Alkali content in Antacid using HCl.
5. Estimation of NH_4^+ by back titration

Redox Titrations

1. Determination of Fe(II) using $K_2Cr_2O_7$
2. Determination of Fe(II) using $KMnO_4$ with sodium oxalate as primary standard.
3. Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard

Complexometric Titrations

1. Estimation of Mg^{2+}
2. Estimation of Cu^{2+}

B.Sc. II SEMISTER PRACTICALS

Scheme of valuation 50marks

- | | | |
|--|------------|------|
| 1. Procedure: Principle and model table for one quantitative analysis- | --10 marks | } 30 |
| 2. Experiment: a) Experiment performance with tabulation | --08 marks | |
| b) Weighing & Standardization | --05marks, | |
| c) Estimation | --05marks | |
| d) Calculation | --10marks | |
| e) Result | --02mark) | |
| 3. Record | --05 marks | |
| 4. Viva voce | --05marks | |

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B.Sc II Yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER III
Paper-III
Chemistry - III

Unit-I (Inorganic Chemistry)

15 h (1hr/week)

S3-I-1: Chemistry of f-block elements:

5 h

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides-complexation- type of donor ligands preferred. Magnetic properties- paramagnetism. Colour and spectra, f-f transitions –occurrence and separation– ion exchange method, solvent extraction.

Chemistry of actinides- general features – electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

S3-I-2: Coordination Compounds-I

6 h

Simple inorganic molecules and coordination complexes. Nomenclature – IUPAC rules, 1. Coordination number, coordination geometries of metal ions, types of ligands. 2. Brief review of Werner's theory, Sidgwick's electronic interpretation and EAN rule and their limitations. (Valence bond theory (VBT) – postulates and application to (a) tetrahedral complexes $[\text{Ni}(\text{NH}_3)_4]^{2+}$, $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CO})_4]$ (b) Square planar complexes $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cu}(\text{NH}_3)_4]^{2+}$, $[\text{PtCl}_4]^{2-}$ (c) Octahedral complexes $[\text{Fe}(\text{CN})_6]^{4-}$, $[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{FeF}_6]^{4-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{CoF}_6]^{3-}$. Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism – (a) geometrical isomerism in (i) square planar metal complexes of the type $[\text{MA}_2\text{B}_2]$, $[\text{MA}_2\text{BC}]$, $[\text{M}(\text{AB})_2]$, $[\text{MABCD}]$. (ii) Octahedral metal complexes of the type $[\text{MA}_4\text{B}_2]$, $[\text{M}(\text{AA})_2\text{B}_2]$, $[\text{MA}_3\text{B}_3]$ using suitable examples, (b) Optical isomerism in (i). tetrahedral complexes $[\text{MABCD}]$, (ii). Octahedral complexes $[\text{M}(\text{AA})_2\text{B}_2]$, $[\text{M}(\text{AA})_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

S3-I-3: Metal carbonyls and Organometallic Chemistry

4 h

Metal carbonyls: Preparation and properties of $\text{Ni}(\text{CO})_4$. Structural features of $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$, $\text{Fe}_3(\text{CO})_{12}$ and $\text{Cr}(\text{CO})_6$ -18 valence electron rule.

Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al.

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Unit – II (Organic Chemistry)

15h(1hr/week)

S3-O-1: Carboxylic acids and derivatives

5h

Preparation: a) Hydrolysis of Nitriles, amides and esters. b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids - Oxidation of Arenes. Physical properties- hydrogen bonding, dimeric association, Chemical properties – Reactions involving H, OH and COOH groups -salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Degradation of carboxylic acids by Huns Diecker reaction, Schmidt reaction (Decarboxylation). Arndt – Eistert synthesis, Halogenation by Hell – Volhard - Zelensky reaction. Carboxylic acid Derivatives – Hydrolysis and Amonolysis of acid halides, Acid anhydrides and esters (mechanism of ester hydrolysis by base and acid). Hydrolysis and dehydration of amides.

S3-O-2: Nitrohydrocarbons

3h

Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO₂ (Nitrous acid), Nef reaction, reduction. Aromatic Nitrohydrocarbons: Preparation of Nitrobenzene by Nitration. Physical properties, chemical reactivity –Reduction of Nitrobenzenes in different media.

S3-O-3: Amines, Cyanides and Isocyanides

7 h

Amines: classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines–Bromination and Nitration, oxidation of aryl and 3° Amines, diazotisation. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl)-

Sandmeyer and Gatterman reaction, by fluorine (Schiemann's reaction), by iodine, CN, NO₂, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides: Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

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Unit III (Physical Chemistry)

15 h (1hr/week)

S3-P-1: Thermodynamics-I

10 h

A brief review of - Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. First law of thermodynamics statement- various forms mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function and path functions. Energy as a state function and exact differential. Work of expansion and heat absorbed as path function.

Expression for work of expansion, sign convention problems on first law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation of $C_p - C_v = R$. Isothermal adiabatic processes.

Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Problems. Internal energy of an ideal gas. Joules experiment. Joule-Thompson coefficient. Adiabatic changes in ideal gas, derivation of equation, $PV^\gamma = \text{constant}$. P-V curves for isothermal and adiabatic processes.

Heat of a reaction at constant volume and at constant pressure, relation between ΔH and ΔV .

Variation of heat of reaction with temperature. Kirchhoff's equation and problems. Limitations of first law and need for second law. Statement of second law of thermodynamics. Cyclic process.

Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine.

Problems. Thermodynamic scale of temperature.

S3-P-2: Thermodynamics-II

5 h

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non-spontaneous processes & equilibrium processes. Entropy changes in i). Reversible isothermal process, ii). Reversible adiabatic process, iii). Phase change, iv). Reversible change of state of an ideal gas. Problems. Entropy of mixing of ideal gases. Free energy Gibbs' function (G) and Helmholtz' function (A) as thermodynamic quantities. Concept of maximum work and network ΔG as Criteria for spontaneity. Derivation of equation $\Delta G = \Delta H - T\Delta S$. Significance of the equation. Gibbs equations and Maxwell relations. Variation of G with P, V and T.

Unit - IV (General Chemistry)

15 h (1hr/week)

S3-G-1 Evaluation of analytical data

4 h

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors. Problems based on mean, median, range, standard deviation

S3-G-2: Carbanions-I

5 h

Introduction, acidic nature of α -hydrogens and tautomerism in carbonyl compounds, nitro hydrocarbons, ethyl acetoacetate, diethyl malonate. Terminal alkynes. Stability of carbanions
Reactions : Aldol reaction, Perkin reaction, Benzoin condensation, haloform reaction, conversion of smaller alkynes to higher alkynes.

S3-G-3: Phase Rule

6 h

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibb's Phase rule, phase equilibria of one component system – water system. Phase equilibria of two-component system – Solid-Liquid equilibria, simple eutectic –Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H₂O system.

References

General reference: B.Sc II Year Chemistry : Semester III, Telugu Academy publication, Hyd

Unit- I

1. Analytical chemistry by G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C.Sudhakar
2. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
3. Concise Inorganic Chemistry by J.D. Lee 3rd edn Van Nostrand Reinhold Company(1977)
4. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers(2001).
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press(1989).
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press(1999).
8. Textbook of Inorganic Chemistry by R Gopalan(Universities Press(2012)
9. College Practical chemistry by V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati Universities Press (India) Limited(2012)

Unit- II

1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition(2012)
2. General Organic chemistry by Sachin Kumar Ghosh. New Age Publishers Pvt Ltd(2008).
3. Text book of organic chemistry by Morrison and Boyd.Person(2009)
4. Text book of organic chemistry by Graham Solomons.Wiley(2015)
5. Text book of organic chemistry by Bruce Yuranis Powla.(2012)
6. Text book of organic chemistry by C N pillai CRC Press(2012)
7. Organic Chemistry by L. G. Wade Jr.
8. Organic Chemistry by M. Jones, Jr
9. Organic Chemistry by John McMurry.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th Edn.(1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand and Sons.(2011)
3. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chand and Co.(2017)
4. Text Book of Physical Chemistry by K. L. Kapoor.(2012)
5. Colloidal and surface chemistry , M. Satake, Y. Hayashi, Y.Mido, S.A.Iqbal and
6. M.S.sethi, Discovery Publishing Pvt.Ltd(2014)
7. Material science by Kakani & Kakani, New Age International(2016)
8. Physical Chemistry by Ira Levine (Author) McGraw-Hill Education; 6 edition (May 9,2008)

Unit IV

1. Text book of organic chemistry by Morrison and Boyd, Person(2009)

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- Text book of organic chemistry by Graham solomons, Wiley(2015)
- Text book of organic chemistry by Sony, Sultan Chand & Sons; 29th edition(2012)
- Text book of organic chemistry by Bruice yuranis Powla,(2012)
- General Organic chemistry by Sachin kumar Ghosh, New Age Publishers Pvt Ltd(2008)

Laboratory Course

Paper III(OrganicSynthesis)

45 h (3h/week)

1. Synthesis of Organic compounds:

Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.

Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene and m-dinitro benzene.

Halogenation: Preparation of p-bromo acetanilide, Preparation of 2,4,6-tribromo phenol

Oxidation: Preparation of benzoic acid from benzylchloride.

Esterification: Preparation of n-butyl acetate from acetic acid.

Methylation: Preparation of - naphthyl methyl ether.

Condensation: Preparation of benzilidene aniline and Benzaldehyde and aniline.

Diazotisation: Azocoupling of β -Naphthol.

2. Microwave assisted synthesis of Asprin – DEMO (demonstration only)

Scheme of valuation

- | | |
|---|----------|
| 1. Principle writing:
(Brief procedure, reaction and mechanism for the synthesis of an organic molecule) | 15 marks |
| 2. Synthesis: experiment and submission of crude sample | 25 marks |
| 3. Record & viva | 10 marks |

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B.Sc. II yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER IV
Paper-IV
Chemistry - IV

Unit-I (Inorganic Chemistry)

15h (1h/week)

S4-I-1: Coordination Compounds-II

11h

Crystal field theory (CFT)- Postulates of CFT, splitting patterns of d-orbitals in octahedral, tetrahedral, square planer with suitable examples. Crystal field stabilization energies and its calculations for various dn configurations in octahedral complexes. High Spin Low Spin complexes. Colour and Magnetic properties of transition metal complexes. Calculations of magnetic moments spin only formula. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Hard and soft acids bases (HSAB) - Classification, Pearson's concept of hardness and softness, application of HSAB principles - Stability of compounds / complexes, predicting the feasibility of reaction. Thermodynamic and kinetic stability of transition of metal complexes. Stability of metal complexes -stepwise and overall stability constant and their relationship and chelate effect determination of composition of complex by Job's method and mole ratio method.

Applications of coordination compounds: Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization - Ziegler Natta catalyst d) water softening.

S4-I-2: Bioinorganic Chemistry

4h

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl-). Toxic metal ions As, Hg & Pb Oxygen transport and storage - structure of hemoglobin, binding and transport of oxygen. Fixation of CO₂ in photosynthesis- overview of light and dark reactions in photosynthesis. Structure of chlorophyll and coordination of magnesium. Electron transport in light reactions from water to NADP⁺ (Z-scheme).

Unit - II (Organic Chemistry)

15h(1hr/week)

S4-O-1: Carbohydrates

6h

Introduction: Classification and nomenclature. Monosaccharides: All discussion to be confined to (+) glucose as an example of aldohexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure. Number of optically active, isomers possible for the structure, configuration

of glucose based on D-glyceraldehyde as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure. Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: : Arabinose to D-glucose, D- mannose (kiliani – Fischer method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. D-glucose to D-arabinose by Ruff's degradation. Aldohexose(+) (glucose) to ketohexose (-) (fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

S4-O-2: Amino acids and proteins **5 h**

Classification. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, Valine and Leucine) by following methods: a) From halogenated Carboxylic acid b) Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids. Zwitter ion structure – salt like character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups – Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides. Primary structure of proteins, dipeptidesynthesis

S4-O-3: Heterocyclic Compounds **4h**

Introduction and definition: 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems –Numbering. Aromatic character

Resonance structures: Explanation of feebly acidic character of pyrrole, electrophilic substitution, Halogenation, Nitration and Sulphonation. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal tar). Preparation of furan, Pyrrole and thiophene Paul-Knorr synthesis. Structure of pyridine, Basicity – Aromaticity – Comparison with pyrrole – preparation by Hantsch method and properties – Reactivity towards Nucleophilic substitution reaction – chichibabin reaction.

Unit III (Physical Chemistry) **15h (1hr/week)**

S4-P-1: Chemical Kinetics **11 h**

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples. Order of areaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Examples- Decomposition of H_2O_2 and decomposition of oxalic acid, Problems.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems.

Second order reaction, derivation of expression for second order rate constant, examples-

Saponification of ester, $2O_3 \rightarrow 3O_2$, $C_2H_4 + H_2 \rightarrow C_2H_6$. Characteristics of second order reaction, units for rate constants, half- life period and second order plots. Problems

S4-P-2: Photochemistry

4 h

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthus Draper law, Stark–Einstein's Law of photochemical equivalence. Quantum yield. Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of H_2-Cl_2 and H_2-Br_2 reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency. Consequences of light absorption. Singlet and triplet states. Jablonski diagram. Explanation of internal conversion, inter- system crossing, phosphorescence, fluorescence.

Unit III (General Chemistry)

15h (1hr/week)

S4-G-1: Theories of bonding in metals

4 h

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

S4-G-2: Carbanions-II

5 h

Mannich reaction, Michael addition and Knoevenagel condensation Synthetic applications of Aceto acetic ester. Acid hydrolysis and ketonic hydrolysis: Preparation of ketones, monocarboxylic acids and dicarboxylic acids Malonic ester– synthetic applications. Preparation of (i) substituted mono carboxylic acids and (ii) substituted dicarboxylic acids.

S4-G-3: Colloids & Surface Chemistry

6 h

Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations and properties – Kinetic, Optical and Electrical stability of colloids. Protective action. Hardy–Schultz law, Gold number. Liquids in liquids (emulsions): Types of emulsions, preparation and emulsifier. Liquids in solids(gels): Classification, preparations and properties, General applications of colloids.

Adsorption: Types of adsorption. Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications.

References

General reference: B.Sc II Year Chemistry : Semester IV, Telugu Academy publication, Hyd

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company(1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers(2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
5. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press(1989).
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Unit- II

1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition(2012)
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3. Text book of organic chemistry by Morrison and Boyd. Person(2009)
4. Text book of organic chemistry by Graham Solomons. Wiley(2015)
5. Text book of organic chemistry by Bruice Yuranis Powla.(2012)
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1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th edn. (1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & sons.(2011)
3. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chand and Co.(2017)
4. Text Book of Physical Chemistry by K. L. Kapoor.(2012)
5. Physical Chemistry through problems by S.K. Dogra.(2015)
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan(1966)
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall, London, 1990

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications(1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company(1977)
3. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers(2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
5. Text book of organic chemistry by Morrison and Boyd, Person(2009)
6. Text book of organic chemistry by Graham solomons, Wiley(2015)
7. Fundamentals of organic synthesis and retrosynthetic analysis by Ratna Kumar Kar, CBA,(2014)
8. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav, Pragati Prakashan, 2010
7. Stereochemistry of organic compounds by D. Nasipuri, New Academic Science Limited, 2012
8. Organic chemistry by Clayden, Greeves, Warren and Wothers, Oxford University Press, 2001
9. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam, Universities, Press 2014

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Laboratory Course

Paper IV-

Qualitative Analysis of Organic Compounds:

45hrs (3 h/week)

Qualitative analysis: Identification of organic compounds through the functional group analysis - ignition test, determination of melting points/boiling points, solubility test, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene

Scheme of valuation

Max.marks: 50 marks

1. Principle writing:

10 marks

(Identification and conformation tests two functional groups)

2. Identification of organic compound

- a) ignition test— 2 marks
- b) physical constants:2marks
- c) solubility: 05marks
- d) function group tests(minimum 2 tests $2 \times 8 = 16$)
- e) derivative-05marks

30 marks

3. Viva & record-

10marks

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B.Sc. Chemistry II Year Semester-III
Skill Enhancement Course- I (2 Credits)
Rules in Chemistry Laboratory and Lab
Reagents

Unit I: Laboratory Safety Rules and Regulations **15 h (1 hr/week)**

General rules and regulations for lab safety: Minimizing Risks of Hazards, Personal Protective Equipment (PPE) - Hair, Dressing for the Laboratory, Eye Protection, Eyewash fountain, Gloves, Laboratory Protocols, Labeling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals, Guide to Chemical Hazards, Chemical Spills etc., Accidents use of fire extinguisher and first aid kit in the laboratory, safety symbols- Preparation of the charts by the students and display of charts in chemistry labs. Calibration of fractional weights, calibration of glass ware - burette, pipette, standard flask, Normality/Molarity and specific gravity of concentrated acids – Preparation of dilute solutions (Numerical problems). Precautions to be taken in the preparation of dilute acids and bases and bases. Preparation of stock solutions of salts with specific examples. Properties of primary standard salt and preparation of standard solution. Good laboratory practices-maintenance of observation bookrecord.

UNIT 2: Preparation of Lab Reagents **15 h (1 hr/week)**

Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation titrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc). Preparation of buffers – pH 10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents : Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bayer's reagent, Benedict's solution, Bromine water, Dimethyl glyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch's reagent, Nessler's reagent, Neutral FeCl₃, Schiff's reagent, Silver nitrate solution, Sodium carbonate solution , Sodium hydroxide (Caustic soda) solution, Starch solution, Tollen's reagent. (reference work and submission of assignments). Charts preparation depicting coursecontent.

RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th edition.
2. Vogel's Text Book of macro and semimicro qualitative inorganic analysis. G. Svehla, 5th edition.
3. Chemistry Reagent Manual Prepared by Chemistry Department, SGTB Khalsa College under DBT's Star College Scheme, University of Delhi (Available: online)
4. American Chemical Society Safety in Academic Chemistry Laboratories 8th edition.

[Course objectives (CO)]: To improve the skills of students in the application of theory and practical knowledge. To fill the gap between theory and practicals. To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents

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B.Sc. Chemistry II Year Semester III
Skill Enhancement Course- II (2 Credits)

Basic Analytical Chemistry

Unit I: Titrimetric Methods in Analysis

Introduction to Analytical Chemistry and its interdisciplinary nature, Definitions: Standard solutions, Equivalence Point, Indicators, End point, Titration General Aspects of: Primary standards, Desirable properties of standard solution. Volumetric calculations: Molarity, Normality, percentage concentration, parts per million, Neutralization Titration, Standard solution and acid-base indicators. Titration curve for strong acid-strong base Systematic equilibrium concentrations for SA-SB titration. Acid-Base indicators, color change range of an indicator, Indicator error. Data Analysis: Analytical data evaluations: Errors, Accuracy and precision, Normal distribution curve, Mean and standard deviation.

UNIT II: Water & Soil pollutant

Water pollution: Introduction. Classification of water pollutants, Sources of water pollution. Origin of waste water, Effect of water pollutants, Water analysis: colour, turbidity, total dissolved solids, conductivity, acidity, alkalinity, hardness (total, permanent, temporary, calcium and magnesium hardness), chlorides, sulfates, fluorides and Dissolved Oxygen. Drinking water standards, Composition of soil, Concept of pH and pH measurement, Determination of pH of soil & water samples.

Reference Books:

1. Fundamentals of Analytical Chemistry, 7th Edition by Skoog, West, Holler.
2. Quantitative Analysis 6th Edition - R.A. Day, Jr., A.L. Underwood.
3. Analytical Chemistry –Dr. Alka Gupta, Pragati Prakashan.
4. Analytical Chemistry : Principles, 2Ed –John H. Kennedy.
5. Analytical Chemistry –VI Ed. Gary D. Christian.
6. Environmental Chemistry- *Anil Kumar De*, *Arnab Kumar De 7th Edition*
7. Vogel's Textbook of Quantitative Chemical Analysis- by G.H.Jeffery, J.Mendham, R.C.Denney, 5th edition, 1998.

Suggested Applications:

- a..Determination of Acetic acid in vinegar.
- b..Determination of Alkalinity of soda ash

Suggested Instrumental demonstrations:

- a. Estimation of Mn, Cr, Fluoride and Phosphates in water samples by Spectrophotometer

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B.Sc. Chemistry II Year
Semester - IV
Skill Enhancement Course- III (2 Credits)
Materials and their Applications

Unit – I: Types of Materials

15 h (1hr/week)

Introduction: Materials and their importance. Classification of Materials, Advanced materials and their need. Types of Materials: Metals, ceramics, polymers and composites; Nature of bonding (Type of bond present). Types and applications of metal alloys: Classification- ferrous and non-ferrous alloys. Ferrous alloys -types and their applications. Non-ferrous alloys – Cu, Al, Ti alloys, their applications and super alloys. Field Work- Collection of Metal Alloy Samples.

Types and Applications of Ceramics: Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements, and advanced ceramics. Glasses: Compositions and Characteristics of Some of the Common Commercial Glasses; Properties and applications of glass ceramics - preparation of charts depicting various types of glass and their use. Clay products: Structural clay products and the white wares. Refractories: Compositions of four Common Ceramic Refractory Materials, fireclay, silica, basic refractories ex. MgO and special refractories ex. Alumina and Zirconia Cements: Classification, preparation of cement and the setting process; quick setting cements; applications.

Field Work-Visit to industries and collection of samples of materials

Unit – II: Types of Polymers and Applications

15 h (1hr/week)

Classification of Polymeric materials based on application: Coatings, adhesives, films, foams with examples Polymer Additives: Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants with examples.

Advanced Materials: Types of advanced materials - semiconductors, bio-compatible materials, smart materials, advanced polymeric materials and nano-engineered materials. Biocompatible materials: Definition. Materials used as biomaterials and their properties. Metals and alloys used in bone and joint replacement. Filling and restoration materials – dental cements, dental amalgams, dental adhesives.

Field Work- Visit to Dental Clinics and interaction with Doctors regarding materials used in Dental treatments.

Smart materials: Shape memory alloys- definition and examples (Ni-Ti alloys, Cu based alloys), applications. Conducting polymers: - Introduction, Electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene).

References

1. William D. Callister Materials Science and Engineering An Introduction, John Wiley & Sons, Inc, 2006.
2. Material science by Kakani and Kakani.
3. Sujata V., Bhat., —Biomaterials, Narosa Publication House, New Delhi, 2002.
4. M. V. Gandhi and B. S. Thompson, —Smart Materials and Structures, Chapman and Hall, London, First Edition, 1992.
5. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., —Engineering aspects of Shapememory Alloys, Butterworth – Heinemann, 1990.
6. Conducting Polymers, Fundamentals and Applications A Practical Approach Authors: Chandrasekhar, Prasanna Ashwin-Ushas Corp., Inc. Kluwer Academic Publishers. Boston

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B.Sc. Chemistry II Year
Semester - IV
Skill Enhancement Course- III (2 Credits)
Food Adulteration

Unit-I

Definition and introduction to food adulteration

Types of food adulteration

Common food adulterants

Causes of food adulteration Analysis of food

Unit-II

Effects of food adulteration

Prevention of food adulteration

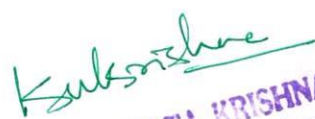
Detection of common food adulterants

Food Adulteration Act-1954

Suggested Readings:

1. Jesse Park Battershall. Food adulteration and its detection. Published by book on demand, Miami, 2015
2. R.B.Sethi's Prevention of food adulteration Act.
3. Dr. Sheela.S. prevention of Food adulteration.


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B.Sc. III yr CHEMISTRY SEMESTER WISE SYLLABUS
SEMESTER IV

Paper-V Chemistry – V

60 hrs

Unit-I (Inorganic Chemistry)

15h (1h/week)

S5-I-1: Coordination Compounds–II

13h

Crystal field theory (CFT)- Postulates of CFT, splitting patterns of d-orbitals in octahedral, tetrahedral, square planer with suitable examples. Crystal field stabilization energies and its calculations for various dn configurations in octahedral complexes. High Spin Low Spin complexes. Colour and Magnetic properties of transition metal complexes. Calculations of magnetic moments spin only formula. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Stability of metal complexes—stepwise and overall stability constant and their relationship and chelate effect determination of composition of complex by Job's method and mole ratio method.

S5-I-2: Hard and soft acids bases (HSAB)

2h

Classification, Pearson's concept of hardness and softness, application of HSAB principles – Stability of compounds / complexes, predicting the feasibility of reaction.

Unit – II (Organic Chemistry)

15h(1hr/week)

S5-O-1: Amines, Cyanides and Isocyanides

7 h

Amines: classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3° Amines, diazotisation. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl)-Sandmeyer and Gatterman reaction, by fluorine (Schiemann's reaction), by iodine, CN, NO₂, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides: Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines.

Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

S5-G--2: Molecular spectroscopy

8 h

Introduction to electromagnetic radiation, interaction of electromagnetic rations with molecules, various types of molecular spectra.

Rotational spectroscopy (Microwave spectroscopy)

Rotational axis, moment of inertia, classification of molecules (based on moment of inertia), rotational energies, selection rules, determination of bond length of rigid diatomic molecules eg. HCl.

Infra-red spectroscopy

Energy levels of simple harmonic oscillator, molecular vibration spectrum, selection rules. Determination of force constant. Qualitative relation of force constant to bond energies. An harmonic motion of real molecules and energy levels. Modes of vibrations in polyatomic molecules. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

Electronic spectroscopy:

Bonding and antibonding molecular orbitals, electronic energy levels of molecules (σ , π , n), types of electronic transitions with suitable examples. Selection rules, Terminology of chromophore, auxochrome, bathochromic and hypsochromic shifts. Absorption characteristics of chromophores: diene, enone and aromatic chromophores. Representation of UV-visible spectra.

Unit-III(Physical Chemistry)

S5-P-1: Chemical Kinetics -I

8 h

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples, order of reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half-life period, graph of 1st order reaction, examples. Decomposition of H_2O_2 and decomposition of oxalic acid.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems.

Second order reaction, derivation of expression for 2nd order rate constant, examples- Saponification of ester, $2\text{O}_3 \rightarrow 3\text{O}_2$, $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$. characteristics of second order reaction, units for rate constants, half-life period and second order plots.

Zero order reaction: derivation of rate expression, examples i) combination of H_2 and Cl_2 to form HCl , ii) thermal decomposition of HI on gold surface characteristics of Zero order reaction units of k , half-life period and graph, problems.

Determination of order of reaction: i) method of integration, ii) half life method, iii) vant-Hoff differential method iv) Ostwald's isolation method. Problems.

S5-P-1: Thermodynamics-I

7 h

A brief review of - Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. First law of thermodynamics statement- various forms mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function and path functions. Energy as a state function and exact differential. Work of expansion and heat absorbed as path function.

Expression for work of expansion, sign convention problems on first law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation of $C_p - C_v = R$. Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Problems.

Internal energy of an ideal gas. Joules experiment. Joule-Thompson coefficient. Adiabatic changes in ideal gas, derivation of equation, $PV^\gamma = \text{constant}$. P-V curves for isothermal and adiabatic processes. Heat of a reaction at constant volume and at constant pressure, relation between ΔH and ΔV

Unit - IV(General Chemistry)

15 h (1hr/week)

S5-G-1: Photochemistry 5 h

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthus - Drapper law, Stark - Einsteins Law of photo chemical equivalence. Quantum yield. Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of $\text{H}_2 - \text{Cl}_2$ and $\text{H}_2 - \text{Br}_2$ reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency, Consequences of light absorptions. Singlet and triplet states. Jablonski diagram Explanation of internal conversion, inter- system crossing, Phosphorescence, fluorescence.

Solvent Extraction- Principle, Methods of extraction: Batch extraction, continuous extraction and counter current extraction. Application – Determination of Iron (III).

Chromatography: Classification of chromatographic methods, principles of differential migration, adsorption phenomenon, nature of adsorbents, solvent systems.

Thin layer Chromatography (TLC): Advantages, preparation of plates, development of the chromatogram, Detection of the spots, factors effecting R_f values and applications.

Paper Chromatography: Principle, choice of paper and solvent systems, development of chromatogram – ascending, descending, radial and two-dimensional chromatography and applications.

References

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand Reinhold Company (1977)
3. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006)
5. Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press (1989).
6. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press (1999).
7. Textbook of Inorganic Chemistry by R Gopalan, Universities Press, (2012)

Unit- II

1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Ninth edition (2012)
2. General Organic chemistry by Sachin Kumar Ghosh. New Age Publishers Pvt Ltd (2008)
3. Text book of organic chemistry by Morrison and Boyd. Person (2009)
4. Text book of organic chemistry by Graham Solomons. Wiley (2015)
5. Text book of organic chemistry by Bruice Yuranis Powla. (2012)
6. Text book of organic chemistry by C N pillai CRC Press (2012)
8. Organic Chemistry by L. G. Wade Jr.
9. Organic Chemistry by M. Jones, Jr
10. Organic Chemistry by John McMurry.
11. Organic spectroscopy, William Kemp.
12. Fundamentals of molecular spectroscopy, Banwell & McCash
13. Elements of Organic spectroscopy R Sharma.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th edn. (1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & sons. (2011)
3. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chand and Co. (2017)
4. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
5. Physical Chemistry through problems by S.K. Dogra. (2015)
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan (1966)
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall, London, 1990

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Laboratory Course

Paper V (Organic Synthesis) 45 h (3h/week)

1. Synthesis of Organic compounds:

Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.

Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene and m-dinitro benzene.

Halogenation: Preparation of p-bromo acetanilide, Preparation of 2,4,6-tribromo phenol

Oxidation: Preparation of benzoic acid from benzyl chloride.

Esterification: Preparation of n-butyl acetate from acetic acid.

Methylation: Preparation of - naphthyl methyl ether.

Condensation: Preparation of benzilidene aniline and Benzaldehyde and aniline.

Diazotisation: Azocoupling of β -Naphthol.

2. Qualitative Analysis of Organic Compounds:

Qualitative analysis: Identification of organic compounds through the functional group analysis - ignition test, determination of melting points/boiling points, solubility test, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene.

Scheme of valuation

B.Sc. chemistry practical paper-v

1. Principle writing: (Chemical equation and mechanism for the synthesis of an organic molecule)	8marks
2. Preparation and submission of crude compound-	10 marks
3. Identification of organic compound	} 22 marks
f) ignition test— 2marks	
g) physical constants:2marks	
h) solubility: 04marks	
i) function group tests(minimum 2 tests 2x5=10)	
j) derivative-04marks	} 10marks
4) Viva & record-	

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**B.Sc. Chemistry III Year
Semester-VI, Paper-VI
Elective-A (3 Credits)
Medicinal Chemistry**

60 Hrs

S6-E-A-I: Unit- I: Introduction and Terminology

15Hrs

Diseases: Common diseases, infective diseases—insect borne, air-borne, water-borne and hereditary diseases.

Terminology in Medicinal Chemistry: Drug, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics, metabolites, anti metabolites and therapeutic index.

Drugs: Nomenclature: Chemical name, Generic name and Trade names with examples; Classification: Classification based on structures and therapeutic activity with examples. **ADME:** a) Absorption: Definition, absorption of drugs across the membrane – active and passive absorption, routes of administration of drugs. b) Distribution: definition and effect of plasma protein binding. c) Metabolism: definition, phase I and phase II reactions.

d) Elimination: definition and renal elimination.

S6-E-A-II: Unit-II: Enzymes and Receptors 15Hrs

Enzymes: Introduction. Mechanism and factors affecting enzyme action, Specificity of enzyme action (including stereo specificity), Enzyme inhibitors and their importance. Types of inhibition - reversible, irreversible and their subtypes with examples.

Receptors: Introduction, Drug action-receptor theory, Mechanism of drug action, concept of agonists and antagonists with examples. Drug receptor interactions involved in drug receptor complex. binding role of – OH group, -NH₂ group, quaternary ammonium salts and double bond.

Structure – activity relationships of drug molecules, explanation with sulfonamides.

S6-E-A-III: Unit- III: Synthesis and Therapeutic Activity of Drugs

15Hrs

Introduction, synthesis and therapeutic activity of :

Chemotherapeutics: Sulphanilamide, dapsone, Penicillin-G (semi synthesis), Chloroquine, Isoniazid, Cisplatin and AZT.

Drugs to treat metabolic disorders: Anti diabetic - Tolbutamide; Anti-inflammatory—Ibuprofen; Cardiovascular- Glyceryl trinitrate; Antipyretic (paracetamol, aspirin) and Antacid- Omeprazole.

Drugs acting on nervous system: Anesthetics-definition, Classification-local and general. Volatile- Nitrous oxide, chloroform uses and disadvantages. Local anesthetics – benzocaine.

S6-E-A-IV: Unit- IV: Molecular Messengers and Health Promoting Drugs 15Hrs

Molecular Messengers: Introduction to hormones and neurotransmitters, Thyroid hormones, Antithyroid drug-Carbimazol. Adrenaline: Adrenergic drugs- salbutamol, atenelol. Serotonin: SSRIs- fluoxetine. Dopamine: Antiparkinson drug- Levodopa .

Health promoting drugs: Introduction, sources, Deficiency disorders and remedy of Vitamins A, B, C, D, E K and micronutrients – Na, K, Ca, Cu, Zn and I .

Reference books

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, New York. 2013.
2. Thomas Nogrady, Medicinal Chemistry, Oxford Univ. Press, New York. 2005
3. David William and Thomas Lemke, Foye's Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, 2008.
4. Ashutosh Kar Medicinal Chemistry, New Age International, 2005.
5. O.D. Tyagi & M. Yadav Synthetic Drugs by, Anmol Publications, 1998.
6. Medicinal Chemistry by Alka L. Gupta, Pragati Prakashan.
7. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K. L. N. Reddy, C. Sudhakar, Drugs, Universities Press (India) Ltd. 2012.

Laboratory course

Experiments in Physical Chemistry-45hrs (3h/w)

1. Electrochemistry

- Determination of cell constant of conductivity cell.
- Determination Of dissociation constant (K_a)Of acetic acid by conductivity measurements.

2. Colorimetry

Verification of Beer's law using $KMnO_4$ and determination of the concentration of the given solution.

3. Kinetics

Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by Hydrogen ion at room temperature.

4. Potentiometry

Determination of redox potential of Fe^{2+}/Fe^{3+} by potentiometric titration of ferrous ammonium Sulphate vs. potassium dichromate.

5. pHmetry:

pH metric titration of strong acid (HCl) vs. strong base- Determination of the concentration of the given strong acid.

6. Conductometry:

Determination of overall order: Saponification of ethyl acetate with NaOH by conductance measurements.

Scheme of Valuation: Chemistry paper-VI practical (50 marks)

- | | |
|---|-------------|
| 1. Principle Writing: (Brief principle with necessary equations, model graph) | -- 10 marks |
| 2. Experiment performance with tabulation: ---- | -- 20marks |
| 3. Graph | -- 05 Marks |
| 4. Calculations & Results | -- 05 Marks |
| 5. Record and viva | --10 marks |

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**B.Sc. III yr CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER VI**

Advanced Chemistry – VII

Unit-I (Inorganic Chemistry)

15h (1h/week)

S6A-I-1: Coordination compounds- III

10 h

Labile and inert complexes, Thermodynamic and kinetic stability based on VBT & CFT: ligand substitution reactions – S_N1 and S_N2 in Octahedral complexes; substitution reactions of square planar complexes – Trans effect and applications of trans effect.

Applications of coordination compounds: Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization – Ziegler Natta catalyst d) water softening.

S6A-I-2: Bioinorganic Chemistry

5h

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl⁻). Toxic metal ions As, Hg & Pb. Oxygen transport and storage – structure of hemoglobin, binding and transport of oxygen. Fixation of CO₂ in photosynthesis- overview of light and dark reactions in photosynthesis. Structure of chlorophyll and coordination of magnesium. Electron transport in light reactions from water to NADP⁺ (Z –scheme).

UNIT - II (Organic Chemistry)

15 h

S6A-O-1: Carbohydrates

8 h

Introduction: Classification and nomenclature – classification into mono, oligo and poly sacchrides, into pentoses, hexoses *etc.*, into aldoses and ketoses.

Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n- hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acids). Number of optically active, isomers possible for the structure, configuration of glucose based on D-glyceraldehyde as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehyde tests and mutarotation). Cyclic structure of glucose: Proposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure (formation of penta acetate, formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n-hexane) Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: Aldopentose to aldo hexose – eg: Arabinose to D-glucose, D-mannose (kiliani – Fischer method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. Aldohexose – Aldopentose eg: D-glucose to D-arabinose by Ruff's degradation.

Aldohexose(+) (glucose) to ketohexose

(-)(fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

S6A-O-2 Amino acids and proteins

7h

Introduction: Definition of Amino Acids, classification of Amino acids into alpha, beta and gama amino acids. Natural and essential amino acids – definition and examples, Classification of alpha amino acids into acidic, basic and neutral amino acids with examples.

Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and Leucene) by following methods: a) From halogenated Carboxylic acid b) Malonic ester synthesis c) strecker's synthesis.

Physical properties: Optical activity of naturally occurring amino acids: L – configuration, irrespective of sign of rotation. Zwitter ion structure – salt like character, solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups – Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins, peptide synthesis.

Unit-III (Physical Chemistry)

S6A-P-1: Polymers

7h

Definition of polymers — natural polymers and synthetic polymers examples classification as plastics, fibers, elastomers. Thermosetting, thermoplastic polymers. Branched, cross-linked and copolymers. Definition of polymerization-addition and condensation polymerization with examples. Explanation :chain polymerization, step polymerization, co-polymerization and co-ordination polymerization. Kinetics of free radical polymerization. Tacticity, atacticity, stereo specific synthesis- Zeigler- Natta catalyst. Molecular weight definitions- number average, weight average molecular weight.

Determination of molecular weight of polymers using viscosity method, Osmometric method. Problems. Preparation and industrial applications of polyethylene, poly vinyl chloride (PVC), nylon —66, teflon, polyacrylonitrile and terelene.

Introduction to biodegradability and examples of biodegradable polymers.

S6A-P-2: Thermodynamics-II

8 h

Statement of second law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine. Problems. Thermodynamic scale of temperature.

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non-spontaneous processes & equilibrium processes. Entropy changes in i). Reversible isothermal process, ii). Reversible adiabatic process, iii). Phase change, iv). Reversible change of state of an ideal gas. Problems.

Entropy of mixing of ideal gases. Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of maximum work and maximum ΔG as Criteria for spontaneity. Derivation of equation $\Delta G = \Delta H - T\Delta S$. Significance of the equation. Gibbs equations and Maxwell relations. Variation of G with P, V and T.

Unit – IV (General Chemistry)

15 h (1hr/week)

S6A-G-1: Proton Magnetic Resonance Spectroscopy

4h

Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals – spin-spin coupling, representation of proton NMR spectrum – Integrations. ^1H NMR spectrum of – ethyl bromide, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate and acetophenone.

S6A-G-2: Mass Spectrometry

4 h

Electron Impact Mass: Basic principles, Nitrogen rule, types of ions: Molecular ion, fragment ion and isotopic ions, representation of mass spectrum, types of peaks (molecular ion, fragment and isotopic ion peaks). Determination of molecular weight Mass spectrum of ethyl chloride, ethyl bromide and acetophenone.

S6A-G-3: Separation techniques II

7 Hrs

Chromatography: Column Chromatography- Principle, Types of stationary phases, Column packing – Wet packing technique, Dry packing technique. Selection criteria of mobile phase solvents for eluting polar, non-polar compounds and its applications.

Ion exchange chromatography: Principle, cation and anion exchange resins, its application in separation of ions.

Gas Chromatography: Theory and instrumentation (Block Diagram), Types of stationary phases and carrier gases (mobile phase).

High performance liquid chromatography: Theory and instrumentation, stationary phases and mobile phases. Analysis of paracetamol.

References :

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem.
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A.
5. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press
7. 1989.
8. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.

Unit- II

1. Text book of organic chemistry by Soni.
2. General Organic chemistry by Sachin Kumar Ghosh.
3. Text book of organic chemistry by Morrison and Boyd.
4. Text book of organic chemistry by Graham Solomons.
5. Text book of organic chemistry by Bruice Yuranis Powla.

Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri, Sharma and Pattania.
4. Physical Chemistry by Atkins & De Paula, 8th Edition
5. Text Book of Physical Chemistry by K. L. Kapoor.
6. Physical Chemistry through problems by S.K. Dogra.
7. Text Book of Physical Chemistry by R.P. Verma.
8. Elements of Physical Chemistry by Lewis Glasstone.
9. Basics of Chemical Kinetics by G.L. Agarwal
10. Kinetics and mechanism of chemical transformations by Rajaram & Kuriacose

Unit IV

1. Organic spectroscopy, William Kemp.
2. Fundamentals of molecular spectroscopy, Banwell & McCash
3. Elements of Organic spectroscopy R Sharma.
4. Analytical Chemistry by David Krupadanam, Universities Press (India) Limited.
5. D.A. Skoog, F.J. Holler, T.A. Nieman, Principles of Instrumental Analysis, Engage earning India Ed.
6. D. A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort worth (1992).
7. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
8. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.2007.
9. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
10. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
11. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y. USA, 1982.
12. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16, 1977.
13. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
14. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
15. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc, New York (1995).
16. Analytical Chemistry 7th edition by Gary D. Christian (2004).
17. B. K. Sharma, Industrial Chemistry (including Chemical Engineering). Edn. (1997).

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