A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (A)

(Accredited by NAAC with 'B' Grade, Cycle 3)

KAKINADA – 533 002, EAST GODAVARI, A.P.

BOARD OF STUDIES OF CHEMISTRY

SYLLABUS & MODEL PAPERS

2022-2023

Convened on 6th September 2022

DEPARTMENT OF CHEMISTRY

A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (A)
KAKINADA, EAST GODAVARI, A.P.

A.S.D GOVT.DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)
KAKINADA
DEPARTMENT OF CHEMISTRY

AGENDA FOR THE BOARD OF STUDIES MEETING 2022-2023

Date: 06.09.2022 **Time: 2.00 PM**

1. To discuss the semester System and Revised Choice Based Credit System (CBCS) being implemented for the past 02 years.

2. To discuss the Up gradation of the syllabus for the odd and even Semesters of I, II and III Years for academic year 2022-23 in accordance with APSCHE/ University guidelines.

3. To discuss the implementation of Community Service Project for I year in the summer vacation at the end of II semester as well as Internship program introduced with effect from 2020 – 21 admitted batch for a total period of 10 months (Two months at the end of Second year and one full semester (V or VI).

4. Panel of paper setters and examiners**.**

5. To discuss the introduction of new continuous internal assessment (CIA) by the CCE for the first time to 2021-2022 batch students.

6. Introduction of New Market Oriented UG Courses.

7. Admission criteria for programmes offered by the Departments.

8. Proposals for Community Services / Extension Activities / Projects for the benefit of the Society.

9. To discuss and implement the newly introduced Skill Enhancement Courses (SEC's) by the University for the fifth semester and select one pair of the courses based on the interests of the majority of the students.

10. To offer Skill Development Certificate Course entitled "Basic Chemistry Molecular Modeling software".

11. Any other matter of academic interest.

A.S.D. GOVT.DEGREE COLLEGE FOR WOMEN (A), KAKINADA

COMPOSITION OF THE BOARD OF STUDIES OF CHEMISTRY

I. Composition:

Head of the Department concerned (Chairman):

1. V. Mallikarjuna Sarma, M.Sc., M. Phil, NET.

The entire faculty of each specialization:

2. Dr. S. Priyadarshini, M.Sc.,NET, Ph.D.
3. Dr. K. Jhansi Lakshmi, M.Sc., Ph.D.
4. Ms. P. Leena, M.Sc., SET,(Ph.D)
5. Ms. M. Subbalakshmi, M.Sc

Two experts in the subject from outside the college to be nominated by the Academic Council:

1. Sri. V. Sanjeeva Kumar, M.Sc, NET, Lecturer in Chemistry, P. R. Govt. College (A), Kakinada, Ph:9849324966, Mail Id: skvudi1972@gmail.com
2. Smt. V. Anantha Lakshmi, M.Sc., M. Phil. Lecturer in Chemistry, Govt. Degree College Pithapuram. Ph:9296655201; Mail Id: lakshmi.gorti78@gmail.com
3. **One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the College Principal:**

   Dr. V. Narayana Rao, M.Sc., Ph.D., Lecturer in Chemistry, Govt. Degree College, K Perumallapuram, East Godavari District. Ph: 8328673942, 9951465669.

4. One representative from industry/ Corporate Sector/ allied area relating to placement.

Ch. S. N. Murthy, Director, Director, Lord Venky Pharma Ltd, Yanam. Ph: 9699335577.

5. **One postgraduate meritorious alumnus to be nominated by the Principal. The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt**

Kum.S. Vijaya Lakshmi, M.Sc. (Organic Chemistry)

6.Two II B. Sc students from the department of Chemistry, A.S.D. Govt. Degree College(W)(A)

i) V. Naga Sravani, II MPC

ii) S. Yamini II CBZ

II. Term:

The term of the nominated members shall be two years.

III. Meeting:

The Principal of the College shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once a year.

IV. Functions:

The Board of Studies of a Department in the College shall:

a) Prepare syllabus and various courses keeping in view the objectives of the interest of the College stakeholders and national requirement for consideration and approval of the Academic Council.
b) Suggest methodologies for innovative teaching and evaluation techniques.
c) Suggest panel of names to the Academic Council for appointment of examiners
d) Coordinate research, Teaching, Extension and other academic activities in the Department/College.

***

Exam Paper Setters

1. **Dr. B. Mallikarjun**
   Lecturer in Chemistry
   Govt. College (A)
   Rajahmundry
   Ph. No. 8985503523

2. **Dr. V. Narayana Rao**
   Lecturer in Chemistry
   GDC, Perumallapuram
   Email: jkyrjyec.perumallapuram@gmail.com
   Ph. No: 9951465669

3. **Mr. B. Venkata Rao**
   Govt. College (A)
   Rajahmundry
   Ph. No: 9948195459

EXAMINERS

1. **Ms. V. Anantha Lakshmi**
   GDC, Pithapuram
   Ph. No: 9296655201

2. **Mr. V. Sanjeev Kumar**
   PR. Govt. College (A)
   Kakinada
   Ph. No: 9849324966

3. **Mr. R. Suryanarayana**
   Ideal Degree College (A)
   Kakinada
   Ph. No: 9247165040.

A. S. D GOVT. DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA

Course Structure and Scheme of Examination Pattern

As per the orders of the Commissioner of Collegiate Education (CCE), Hyderabad, A.S.D. Govt. Degree College for Women (Autonomous), Kakinada has resolved to adopt the "Choice Based Credit System" (CBCS) from the academic year 2020 – 21. This new system i.e. CBCS would be applicable to 2020 – 21 onwards, i.e. come into force from the Academic year 2020 – 21 onwards. The entire B.Sc. Program consists of M.P.C, CBZ, CBMB, CZAqt and CBHT groups. The courses, number of credits and total number of credits have shown in the table form (see table).

The Department of Chemistry has also resolved to implement the Examination pattern in 25:75 (25 marks for Internal assessment and 75 marks for End – Semester Examinations).

A.S.D. GOVT. DEGREE COLLEGE FOR WOMEN (AUTONOMOUS) KAKINADA – 533 002, EAST GODAVARI, A.P.

Signatures of the members who attended the

Board of studies in Chemistry.

1.	Mr. V. Mallikarjuna Sarma	Chairman & Lecturer in Charge
2.	Dr. V. Narayana Rao	University representative Govt. Degree College Perumallapuram
3.	Sri V. Sanjeeva Kumar	Subject Expert Lecturer in Chemistry, PR. Govt. College (A), Kakinada
4.	Sri V. Sanjeeva Kumar	Subject Expert Lecturer in Chemistry, Govt. Degree College, Pithapuram
5.	Mr. Ch. S. N. Murthy,	Director, Lord Venky Pharma ltd., Yanam
6.	Kum.S. Vijaya Lakshmi	Alumnus
7.	Dr. K. Jhansi Lakshmi	Member
8.	Dr. S. Priyadarshini	Member
9.	Ms. P. Leena	Member
10.	Ms. M. Subbalakshmi	Member
11.	V. Naga Sravani, II MPC	Student Member
12.	Y. Yamini II CBZ	Student Member

ACTION PLAN BOS MEETING -CHEMISTRY HELD ON 06-09-2022.

1. Department activities for 2022-2023 academic year. Annexure I (Tentative)

Month	Activity proposed	Faculty member in charge
July-22	Departmental staff meeting to review results and class work allotment	Mr. V. Mallikarjuna Sarma
	Preparation of curricular plans, time-tables etc.,	
July - 22	Remedial coaching classes for II & III year	Ms. P. Leena
Aug-22		
Aug-22	Bridge classes for I year students	Ms. M. Subbalakshmi
Sep-22	Extension activity	Dr. S. Priyadarshini
Sep 22	Ozone Day Celebrations	Ms.P.Leena Ms. M. Subbalakshmi
Oct-22	Invited lecture by Industrial Expert	Dr. K. Jhansi Lakshmi
Nov-22	National Level Seminar – Ministry of Chemicals and Fertilizers	Mr. V. Mallikarjuna Sarma
Dec-22	World AIDS Day	Dr. S. Priyadarshini
Dec-22	National Chemistry Day	Mr. V. Mallikarjuna Sarma, Dr. S. Priyadarshini, Dr. K. Jhansi Lakshmi, Ms. P. Lena, Ms. M. Subbalakshmi
Jan -23	Field Trip	Mr. V. Mallikarjuna Sarma, Dr. S. Priyadarshini, Dr. K. Jhansi Lakshmi, Ms. P. Lena, Ms. M.

		Subbalakshmi
Jan-23	10 days coaching for PG entrance examinations in chemistry Study tour / Field trips	Mr. V. Mallikarjuna Sarma
Feb -23	National Science Day	Mr. V. Mallikarjuna Sarma, Dr. S. Priyadarshini, Dr. K. Jhansi Lakshmi, Ms. P. Lena, Ms. M. Subbalakshmi
Mar - 23	Work shop	Mr. V. Mallikarjuna Sarma, Dr. S. Priyadarshini, Dr. K. Jhansi Lakshmi, Ms. P. Lena, Ms. M. Subbalakshmi

2. Organizing National/ State level Webinars/Seminars/Workshops/ Conferences/ Training programmes etc., with topics and other details.
(Mandatory for each Department)

i) Awareness on OZONE protection
ii) National Chemistry day
iii) National Science day
iv) Guest lectures
v) National Webinar in Chemistry
vi) Project in Soil analysis
vii) Training in water analysis

Plan for utilization of funds for Autonomous/CPE/other grants available for arranging guest lectures, faculty improvement programmes, study tours, equipping laboratories, reference books& other necessary teaching-learning material with ICT enabled teaching.

I. Study visits to:

1. Dr.Reddy's Laboratories, Yanam.
2. National Institute of Hydrololgy, Kakinada.
3. SAR Chandra Environ Solutions, Kakinada.

4. Soil analysis laboratory, Samalkot.
5. Soap Industries, Kakinada.
6. Venky parenterals, Yanam
7. Manufacturing of pet bottles at Industrial Park, Kakinada

3. Introduction of new programmes–PG/UG/Diploma and certificate courses.

A.S.D. Govt. Degree College for Women (A), Kakinada

Department of Chemistry - BOS Meeting Dt. 06-09.2022

Meeting of Board of Studies in Chemistry is convened on 06-09-2022 at the department of Chemistry at 11.00 AM

Venue: Department of Chemistry Dt: 06-09-2022, Thursday – 11.00 AM

The Principal Dr. V. Anantha Lakshmi, Mr. V. Mallikarjuna Sarma, University Nominee, Dr. V. Narayana Rao, Industrialist Ch.S. N. Murthy, Lord Venky Pharma Ltd, Yanam, Subject Experts Sri. V. Sanjeeva Kumar, P. R. Govt. College (A), Kakinada, Ms. V. Anantha Lakshmi, GDC, Pithapuram, all the faculty members of Chemistry Department and student alumni attended the meeting.

Agenda for the Board of Studies meeting 2022-23

1. To discuss the semester System and Choice Based Credit System (CBCS) being implemented for the past 06 years.
2. To discuss the continuation/Upgradation of the syllabus for the Odd & Even Semesters of II &III Years for 2022-23
3. Teaching learning methodology by offline.
4. Panel of paper setters and examiners.
5. To discuss the weightage to be given to continuous Internal assessment (CIA) & External assessment.
6. Admission Criteria for programmes offered by the departments.
7. Proposals for Community services/Extension activities/Projects for the benefit of the society.
8. To follow B. Sc I & II Year instruction as per APSCHE/University Syllabus.
9. To discuss and resolve the minor modifications/refinement if any,in the cluster electives AI,AII & AIII as majority of the students opting this cluster as their choice.
11. Any other matter of academic interest.

Resolutions:

It is resolved to adopt the following frame work of course papers

1. **I B.Sc. Semesters-I & II**- As the APSCHE/University Syllabus is declared, therefore it is resolved to adopt and follow B. Sc I Year (Sem I & Sem II) as per APSCHE/University Syllabus.
2. **II B.Sc.**

Semester-III - Theory - INORGANIC & ORGANIC CHEMISTRY

Practical paper-3 – LABORATORY COURSE - III

Semester-IV- Theory (Course 4): INORGANIC, ORGANIC & PHYSICAL CHEMISTRY Practical (Course 4L): ORGANIC QUALITATIVE ANALYSIS LAB-4L

Theory (Course 5): INORGANIC & PHYSICAL CHEMISTRY

Practical (Course 5L): CONDUCTOMETRIC & POTENTIOMETRIC TITRIMETRY LAB

3. **III B.Sc.**

Semester-V: As the APSCHE/University Syllabus has introduced Skill Enhancement Courses for the final year students, therefore it is resolved to adopt and follow the same.

Pair-1: Synthetic Organic Chemistry (6A), Synthetic Organic Chemistry (6A Lab) & Analysis of Organic Compounds (7A), Analysis of Organic Compounds (7A Lab).

Pair-2: Analytical Methods in Chemistry-1(6B), Analytical Methods in Chemistry (6 B Lab) & Analytical Methods in Chemistry-2(7B), Analytical Methods in Chemistry-2 (7B Lab).

Pair-3: Industrial Chemistry-1(6C), Industrial Chemistry-1(6C Lab) & Industrial Chemistry-2 (7C), Industrial Chemistry-2 (7C Lab).

Pair–4: Environmental Chemistry (6D), Environmental Chemistry (6D Lab) & Green Chemistry andNanotechnology (7D), Green Chemistry andNanotechnology (7D Lab).

4. The Board has resolved to adopt the following examination pattern.

a). It is resolved to give 75:25 weightage to External and Internal assessment.

b). It is resolved to conduct the odd semester practical exams with internal examiner and even semester with external examiner.

c). For practicals each paper carries 50 marks.

d). The examination pattern is semester wise. It has been decided to conduct two Internal examinations for each theory paper. Award of marks to each theory paper is done by taking average of the marks obtained from the two internal examinations. Internal exam for theory is

conducted for 15 marks, for Assignment 5 marks and for student seminar 5 marks. From 2021-2022 admitted batch, the continual internal assessment pattern has been modified and in addition to the existing system, other activities like clean and green, have been introduced.

Table: Continuous Comprehensive Assessment (2020-2021)

Mode of Internal assessment	**Marks allotted**
Two mid semesters	15
Assignments(Remedial/Critical)	05
Student Seminars	05
Total	**25**

I B.Sc.: Two semesters end examinations (I & II), Four Internal Examinations and two practicals (I &II) and two internal Assignments and Student Seminars.

II B.Sc.: Two semesters end examinations (III & IV), Four Internal Examinations and two practicals (III &IV) and two internal Assignments and Student Seminars.

III B.Sc.: One semesters end examination (V) Four Internal Examinations and Two practicals (V) and four internal Assignments and Student Seminars. For the sixth semester, as per APSCHE guidelines, the students are directed to industries for their internship so as to acquire hands on experience and enhance the employability opportunities.

The duration of the Semester end examination for practicals is three hours.

3. The Board has resolved to adopt the syllabus and model question papers as per the pattern discussed in the meeting for I B.Sc. (Semester I&II), II B.Sc. (Semester III&IV), III B.Sc. (Semester V). The model paper has been divided into two sections viz., Section-A and Section-B. Under Section –A, ten essay questions will be given out of which the student has to attempt any five questions. Each question carries 10 marks (Total 5X10=50 Marks). Under Section-B, the student has to answer five questions out of the given eight questions. Each question carries 05 marks (Total 5x5=25 marks).

4. It is resolved to send the students for internship to industries, during the entire sixth semester.

5. It is resolved to conduct Departmental activities such as Chemistry Day celebrations, Industrial Visits, Seminars, Workshops, and Extension activities etc.

6. It is resolved to offer Skill Enhancement Courses (SEC's) as per APSCHE/ANUR.

7. It is resolved to conduct practical examinations semester wise.

8. It is resolved to organize Guest lectures inviting eminent Scholars.

9. It is resolved to set no minimum pass for Internal Assessment in Choice based Credit System (CBCS).

10. It is resolved to constitute a new Panel of paper setters and examiners.

	Members Present		**Signatures**
1.	Mr. V. Mallikarjuna Sarma	Chair person	
2.	Dr.V. Narayana Rao	University Nominee	
3.	Sri.V. Sanjeeva Kumar	Subject Expert	
4.	Ms. V. Anatha Lakshmi	Subject Expert	
5.	Ch. S. N. Murthy	Industrialist	
6.	Kum. S. Vijayalakshmi	Alumni	
7.	Dr. S. Priyadarshini	Member	
8.	Dr. K. Jhansi Lakshmi	Member	
9.	Ms. P. Leena	Member	
10.	Smt. M. Subbalakshmi	Member	

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

DEPARTMENT OF CHEMISTRY

BOARD OF STUDIES: 2022-23

SEMESTER – I

Course I (Inorganic & Physical Chemistry) 60 hrs. (4h/w)

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of p-block elements.
2. Explain the difference between solid, liquid and gases in terms of intermolecular interactions.
3. Apply the concepts of gas equations, pH and electrolytes while studying other chemistry courses.

INORGANIC

CHEMISTRY **24 h**

UNIT –I

Chemistry of p-block elements **8h**

Group 13: Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilihalides, $\{(PNCl_2)_n$ where n=3,4

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudo halogens, Structures of Interhalogen compounds.

UNIT-II

1. **Chemistry of d- block elements** **6 h**

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

2. **Chemistry of f-block Elements** **6 h**

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides

andactinides.

3. Theories of Bonding in Metals **4 h**

Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

PHYSICAL CHEMISTRY **36h**

UNIT-III

Solid state **10h**

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-IV

Gaseous State **6h**

Van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule- Thomson effect. Inversion temperature.

Liquid state **4h**

Liquid crystals,mesomorphicstate. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

UNIT-V

Solutions, Ionic equilibrium& dilute solutions

1. Solutions **6h**

Azeotropes-HCl-H_2O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation.Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. Ionic Equilibrium **3 h**

Ionic product, common ion effect, solubility and solubility product. Calculations based on

solubility product.

3. Dilute Solutions **7 h**

Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boing point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J.E.Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Atkins,P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress 10thEd(2014).
10. Castellan,G.W.PhysicalChemistry4thEd.Narosa(2004).
11. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).
12. Barrow,G.M.PhysicalChemistry

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

WEIGHTAGE TO THE COURSE CONTENT

First Year Semester - I

INORGANIC AND PHYSICAL CHEMISTRY

S. No	Course Content	Essay	SA
1	UNIT - I	2	2
2	UNIT - II	2	2
3	UNIT - III	2	1
4	UNIT - IV	2	2
5	UNIT - V	2	1
Total		**10**	**8**

N.B: INTERNAL EVALUATION OF THEORY IN EACH SEMESTER: MAX. MARKS: 25

- Average of Two unit tests: 15 M
- Seminar/Quiz 05 M
- Assignment 05 M

Total = 25 M

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning
2. ClassTests,Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions:

   Enhances critical thinkingskills and personality

4. Semester- end Examination: critical indicator of student's learning and teaching methods adopted byteachers throughout the semester.

LABORATORY COURSE -I **30**hrs (2 h / w)

Practical-I Analysis of SALT MIXTURE(At the end of Semester-I)

Qualitative inorganic analysis (Minimum of Six mixtures should be analyzed) 50 M

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of inorganic mixture
2. Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory
3. Apply the concepts of common ion effect, solubility product and concepts related toqualitative analysis

Analysis of SALT MIXTURE **50 M**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

MODEL PAPER

FIRST YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-I

CHEMISTRY Course-I: INORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours Maximum Marks: 60

PART- A 5 X 8= 40 Marks

Answer **ALL** the questions. Each carries **TEN** marks1.

1. (a). Explain Classification, Preparations & uses of Silicones

(or)

(b). (i) What are Pseudo halogens.
(ii) Explain the Structures of any one AX_3& AX_5 type interhalogen compounds.

2. (a). What is Lanthanide Contraction? Explain the Consequences of LanthanideContraction.

(or)

(b). (i) Explain the magnetic properties of d- block elements.
(ii) Explain about Conductors, Semi-Conductors& Insulators using Band Theory.

3.(a). Write an essay on Crystal defects.

(or)

(b). What is Bragg's Law. Explain the determination of structure of a crystal by powder method.

4.(a). Derive the relationship between Critical constants &Vanderwaal constants

(or)

(b).(i) Write the differences between liquid crystals & liquids, solids
(ii) Write the applications of Liquid crystals.

5.(a). Explain Nernst distribution Law. Explain its applications

(or)

(b).What are colligative properties? Write experimental methods for determinationof molar mass of a non-volatile solute by using Elevation in boiling point & depression in freezing point.

PART- B 5 X 4 = 20 Marks

Answer any **FIVE** of the following questions. Each one carries **FIVE** marks

6. Explain the preparation & structures of Phosphonitrilic compounds.
7. Explain in brief, catalytic properties & stability of various oxidation states of d-block elements.
8. Write short note on Bravais lattices and crystal systems.
9. What are Smectic & Nematic liquid Crystals? Explain.
10. Write account on Common ion effect & Solubility product.
11. Describe Andrew's isotherms of carbon dioxide.
12. Explain Actinide Contraction.
13. Explain the structure of Borazine.

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

DEPARTMENT OF CHEMISTRY

BOARD OF STUDIES: 2022-23

SEMESTER – II

Course II – (Organic & General Chemistry) 60 h (4h/w)

UNIT-I

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes) 12h

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane). General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of mono substituted cyclohexane.

UNIT-II

Carbon-Carbon pi Bonds (Alkenes and Alkynes) 12h

General methods of preparation, physical and chemical properties. Mechanism of E1, E2, reactions, Saytzeff and Hoffmann eliminations, Electrophilic Additions, mechanism (Markownikoff / Antimarkownikoff addition) with suitable examples, syn and anti-addition of H_2, HX, X_2. Oxymercuration, Hydroboration-Oxidation, Ozonolysis, Hydroxylation, Diels Alder reaction, 1,2-and 1,4-addition reactions in conjugated dienes. Reactions of alkynes, acidity, electrophilic and nucleophilic additions, Hydration to form carbonyl compounds. Alkylation of terminal alkynes.

UNIT-III

Benzene and its reactivity (12h)

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO2 and Phenolic).Orientation of i)amino, methoxy and methyl groups ii) Carboxy, Nitro, carbonyl and sulphonic acid groups iii) halogens

GENERAL CHEMISTRY (24 h)

UNIT-IV

Surface chemistry and chemical bonding

1. Surface chemistry (6h)

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding (6h)

Valence bond theory, hybridization, VB theory as applied to ClF_3, $Ni(CO)_4$, Molecular orbital theory - LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).

3. HSAB(2h)

Pearson's Concept,HSAB principle and its importance , bonding in hard-hard and soft-soft combinations.

UNIT-V

Stereochemistry of carbon compounds (10h)

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarized light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid.2, 3 – dibromo pentane, D, L, R, S and E, Z- configuration with examples. Definition of recemic mixture-resolution of recemic mixtures.

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

WEIGHTAGE TO THE COURSE CONTENT

First Year Semester - II

ORGANIC AND GENERAL CHEMISTRY

S. No	Course Content	Essay	SA
1	UNIT - I	2	2
2	UNIT - II	2	2
3	UNIT - III	2	1
4	UNIT - IV	2	2
5	UNIT - V	2	1
Total		**10**	**8**

N.B: INTERNAL EVALUATION OF THEORY IN EACH SEMESTER: MAX. MARKS: 25

- Average of Two unit tests: 15 M
- Seminar/Quiz 05 M
- Assignment 05 M

Total = 25 M

MODEL PAPER

FIRST YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-II

CHEMISTRY Course-I: ORGANIC AND GENERAL CHEMISTRY

Time: 3 h **Max Marks: 60 M**

PART-A

Answer **ALL** the questions. Each carries **TEN** marks 5x8 = 40 M

1. (i) Write the preparation of alkanes by Wurtz and Corey-House reaction.

(ii) Explain Halogenation of alkanes with free radical mechanism.

(or)

(b) (i) Explain Baeyer Strain Theory and write its limitations.

2. i) Write any two methods of preparation of alkenes.

(ii) Explain the mechanism of Markownikiff addition of HBr to alkene.

(or)

(b). (i) Explain the mechanism of 1,2 and 1,4 addition reaction of 1, 3-butadiene with HBr.

3. (a). Define Huckel rule of aromatic compounds. What are benzenoid and non-benzenoid aromatic compounds? Give examples.

(or)

(b). Explain the mechanisms of Nitration and Friedel-Craft's alkylation ofBenzene.

4. (a) Derive Langmuir adsorption isotherm.

(or)

(b). Construct the Molecular Orbital diagram for O_2 and NO and explain their bond order.

5. (a). Explain optical isomerism in lactic acid, tartaric acid and alanine.

(or)

(b) (i) Define Optical activity and Specific rotation.

(ii) Write the E- & Z- isomers of 2-butene.

PART-B

Answer any **FIVE** of the following questions. Each carries **FIVE** marks 5x4= 20 M

6. Write different conformations of n-butane. Explain their relative stability.
7. Write Diels Alder Reaction.
8. What are activating and deactivating groups of benzene give example.
9. Explain the mechanism of E1 elimination reaction.
10. Explain the structure of ClF_3 by Valency Bond theory.
11. What are Hard & soft acids .Explain with examples.
12. Draw the conformations of cyclohexane and explain their stability.
13. Define Enantiomers and Diastereomers and give one example for each.

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA
DEPARTMENT OF CHEMISTRY
BOARD OF STUDIES: 2021-22
SECOND YEAR, SEMESTER– III
Paper III (ORGANIC &SPECTROSCOPY) 60 h (4 h / w)

ORGANIC CHEMISTRY 30 h (2h / w)

UNIT –I

Chemistry of Halogenated Hydrocarbons: Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis. Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

1. Alcohols & Phenols

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation Of Diols By Periodic Acid Andlead Tetraacetate,Pinacol- Pinacolone Rearrangement;

Phenols: Preparation And Properties; Acidity And Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism.

UNIT II:

Carbonyl Compounds: Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction And Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, wolf –kishner, with LiAlH4 &NaBH4). Addition Reactions Of α, β-unsaturated carbonyl compounds: Michael Addition. Active Methylene Compounds: Keto-enol tautomerism. Preparation and Synthetic Applications Diethyl malonate and ethyl acetoacetate.

UNIT III:

Carboxylic Acids and their Derivatives : General methods of preparation, physical properties and reactions of monocarboxylic acids, effect ofsubstituent acidic strength. Typical reactions of carboxylic acids, hydroxy acids and unsaturated acids. Preparation And Reactions Of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

SPECTROSCOPY 30 h (2h / w)

UNIT –IV

Molecular Spectroscopy:
Interactionofelectromagneticradiationwithmoleculesandvarioustypesof spectra;

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational Spectroscopy: Classical Equation Of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental Frequencies, overtones and hot bands.

Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT-V

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating λmax of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

REFERENCE BOOKS:

1. A TextBook of Organic Chemistry by Bahl and Arunbahl
2. A Textbook of Organic chemistry by I L FinarVol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
11. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry,5th Ed. Pearson (2012)
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis,

LABORATORY COURSE -III **30hrs (2 h / w)**

Practical Paper-III (At the end of Semester-III)

Organic Preparations and IR Spectral Analysis Lab : 50 Marks

Course Outcomes

1. How to use glassware, equipment and chemicals and follow experimental procedures in the laboratory

2. how to calculate limiting reagent, theoretical yield, and percent yield

3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately

4. how to dispose of chemicals in a safe and responsible manner

5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.

6. how to create and carry out work up and separation procedures

7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

Organic preparations: 40M

i. Acetylation of one of the following compounds:

amines (aniline, o-, m-, p- toluidine and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzoylation of one of the following amines

(aniline, o-, m-, p- toluidine and o-, m-, p-anisidine)

a. Nitration of any one of the following:Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

IR Spectral Analysis: 10M

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups

b) Carbonyl groups

c) Amino groups

d) Aromatic groups

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)
KAKINADA
CHEMISTRY II YEAR SEMESTER – III MODEL PAPER (2022-23)
ORGANIC AND SPECTROSCOPY

Time: 3 Hrs. **Max. Marks: 75**

SECTION – A (Essay Questions)

Answer **ALL** the questions. Each carries **TEN** marks **5 X 10 = 50 M**

1. (a). Give the mechanism & stereochemistry of SN1 & SN2 reactions of alkyl halides with suitable example.

(OR)

(b). Explain the following reactions with mechanism.

(i) Reimer-Tiemann reaction (ii) Fries rearrangement.

2. (a). Discuss the mechanism for following reactions.

(i) Perkin reaction. (ii) Cannizaro reaction

(OR)

(b). Write the preparation and any three synthetic applications of diethyl malonate.

3..(a). Explain acid and base hydrolysis reaction of esters with mechanism.

(OR)

(b). Explain the mechanisms of Curtius rearrangement & Reformatsky reactions.

4. (a). (i) Write a note on vibrational degrees of freedom for polyatomic molecules.

(ii) Explain different modes of vibrations & selection rules in IR spectroscopy.

(OR)

(b).(i) Define Bathochromic shift. Explain the effect of conjugation in U.V. spectroscopy.

(ii) Discuss the principle of NMR spectroscopy.

5.(a). Write Woodward-Fieser rules for calculating λmax for conjugated dienes and α,β – unsaturated carbonyl compounds , and apply them for one example each.

(OR)

(b).(i) What is Fingerprint region? Explain its significance with an example.

(ii) Write IR spectral data for any one alcohol, aldehyde and ketone

SECTION – B (Short Answer Questions)

Answer any **FIVE** from the following questions: (5x5 = 25M)

6. Discuss two methods for preparation of aryl halides.
7. Explain the mechanism for Pinacol-Pinacolone rearrangement
8. Discuss the mechanism for Baeyer-villiger oxidation reaction.
9. Explain the effect of substituents on acidic strength of mono-carboxylic acids.
10. Write the mechanism for Claisen Condensation reaction.
11. Write the selection rules in rotational spectroscopy.
12. Explain Spin – Spin coupling and Coupling Constant.
13. Explain types of electronic transitions in UV spectroscopy.

WEIGHTAGE TO THE COURSE CONTENT

Second Year Semester - III

ORGANIC AND SPECTROSCOPY - III

Sl. No.	COURSE CONTENT	ESSAY	SA
1	UNIT - I	2	1
2	UNIT - II	2	1
3	UNIT - III	2	2
4	UNIT - IV	2	2
5	UNIT - V	2	2
	Total	**10**	**8**

***

N.B:INTERNAL EVALUATIONOF THEORY IN EACH SEMESTER: MAX. MARKS: 25

- **Average of Two-unit tests: 15 M**
- **Seminar/Quiz 05 M**
- **Assignment 05 M**

Total = 25 M

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA
DEPARTMENT OF CHEMISTRY
BOARD OF STUDIES: 2022-23
SECOND YEAR, SEMESTER– IV
Paper IV(Course 4) INORGANIC, ORGANIC & PHYSICAL CHEMISTRY
60 h (4 h / w)

Course Outcomes:

1. To understand the concept of heptacity and classification of organometallic compounds.
2. To learn constitution, configuration, ring structures, inter conversions of monosaccharaides
3. To learn classification and preparation of aminoacids and understand concept of isoelectric point and zwitter ion.
4. To understand the aromatic character of 5 and 6 membered heterocyclic compounds
5. To learn concept of tautomerism and mechanisms of various named reactions in nitrogen containing compounds
6. To understand the three laws of thermodynamics and concept entropy, entholopy and Gibbs free energy functions
7. To learn about the laws of absorption of light energy by molecules and subsequent photochemical reactions.
8. To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

UNIT I:

Organometallic Compounds: Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls: 18electronrule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT II:

Carbohydrates: Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection And Conformational Structures ;Interconversions of aldoses and ketoses; Kiliani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary Treatment Of Maltose, lactose and sucrose. Polysaccharides–Elementary Treatment Of starch.

UNIT III:

Amino acids and proteins: Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma 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 leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: 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.

Heterocyclic Compounds: Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT IV:

Nitrogen Containing Functional Groups: Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

1. Nitro hydrocarbons

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines:

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties: Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's Method And Nitrous Acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide

Reaction,Carbylamine Reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination.

Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, amino and nitro compounds. Coupling Reactions Of Diazonium Salts (preparation of azo dyes).

UNIT V:

Photochemistry: Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics: The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments Group Discussions: Enhances Critical Thinking Skills And personality

REFERENCE BOOKS:

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl
9. A Text Book of Organic chemistry by I L FinarVol I
10. A Text Book of Organic chemistry by I L FinarVol II
11. Advanced physical chemistry by Gurudeep Raj

LABORATORY COURSE -IV **30hrs (2 h / w)**

Practical Paper-IV (At the end of Semester-IV)

(Course-4L) Organic Qualitative analysis Lab: 50 Marks

Course Outcomes:

1.Use glassware, equipment and chemicals and follow experimental procedures in the laboratory

2. Determine melting and boiling points of organic compounds

3. Understand Application of concepts of different organic reactions studied in theory part of organic chemistry

Organic Qualitative analysis 50 M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)
KAKINADA
CHEMISTRY II YEAR SEMESTER – IV MODEL PAPER (2022-23)
INORGANIC, ORGANIC &PHYSICAL CHEMISTRY

Time: 3 Hrs. **Max. Marks: 75**

SECTION – A (Essay Questions)

Answer **Any Five of** the following questions (5x10 = 50M)

1. (a) What are organometallic compounds? Discuss their Classification on the basis of type of bonds with examples.

(OR)

(b).Discuss the general methods of preparations of mono & bi-nuclear carbonyls of 3d series.

2. (a). Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose.

(OR)

(b). (i) Explain Ruff's degradation. (ii) Explain Kiliani- Fischer synthesis.

3.(a). What are amino acids? Write any three general methods of preparation of amino acids.

(OR)

(b). Discuss the aromatic character of Furan, Thiophene and Pyrrole.

4 (a). Write the mechanism for the following.

(i) Hoffmann Bromanide reaction (ii) Mannich reaction

(OR)

(b). Explain Hinsberg separation of amines.

(ii) Discuss any three synthetic applications of diazonium salts.

5. (a). What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine.

(OR)

(b). Define entropy. Describe entropy changes in the reversible and irreversible

SECTION – B (Short Answer Questions)

Answer any **FIVE** from the following questions: (5x5 = 25M)

6.Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples.

7. What are epimers and anomers. Give examples.

8. Discuss about iso electric point and zwitter ion.

9. Discuss the Paul-Knorr synthesis of five membered heterocyclic compounds.

10. Explain Tautomerism shown by nitro alkanes

11. Discuss the basic nature of amines.

12. Write the differences between thermal and photochemical reactions.

13. Derive heat capacities and derive Cp – Cv = R

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA
DEPARTMENT OF CHEMISTRY
BOARD OF STUDIES: 2022-23
SECOND YEAR, SEMESTER– IV
Paper IV (Course 5) (INORGANIC&PHYSICAL CHEMISTRY) 60 h (4 h / w)

INORGANIC CHEMISTRY

UNIT I:

Coordinator Chemistry: IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

UNIT II:

1. Inorganic Reaction Mechanism:

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -SN1 and SN2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

2. Stability of metal complexes:

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium / K - pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

PHYSICAL CHEMISTRY

UNIT-III:

1 .Phase rule: Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT IV:

Electrochemistry: Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conduct metric titrations.Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications

UNIT V:

Chemical Kinetics:

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity,factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels-Menten equation- derivation, significance of Michaelis-Menten constant.

REFERENCE BOOKS:

1. Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P.W. & Paula, J.de Atkin's Physical Chemistry Ed., Oxford UniversityPress 10thEd(2014)
11. Castellan, G.W.PhysicalChemistry, 4thEd.Narosa(2004)
12. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).

LABORATORY COURSE -IV 30hrs (2 h / w)

Practical Paper-IV (At the end of Semester-IV)

(Course-5L) Conductometric and Potentiometric Titrimetry Lab : 50 Marks

Course Outcomes:

1.Use glassware, equipment and chemicals and follow experimental procedures in the laboratory

2. Apply concepts of electrochemistry in experiments

3. Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

Conductometric and Potentiometric Titrimetry 50 M

1. **Conductometric titration**- Determination of concentration of HCl solution using standard NaOH solution.

2. **Conductometric titration**- Determination of concentration of CH_3COOH Solution using standard NaOH solution.

3. **Conductometric titration**- Determination of concentration of CH_3COOH and HCl in a mixture using standard NaOH solution.

4. **Potentiometric titration**- Determination of Fe (II) using standard $K_2Cr_2O_7$ solution.

5. Determination of rate constant for acid catalyzed ester hydrolysis.

A.S.D.GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)
KAKINADA
CHEMISTRY II YEAR SEMESTER – IV MODEL PAPER (2022-23)
(Course-5) INORGANIC&PHYSICAL CHEMISTRY

Time: 3 hrs. **Max. Marks: 75**

SECTION – A (Essay Questions)

Answer **Any Five of** the following questions (5x10 = 50M)

1.(a).Explain Valence Bond theory with Inner and Outer orbital complexes. Write limitations of VBT.

(OR)

(b).Define CFSE. Explain the factors affecting the magnitude of crystal field splitting energy.

2. (a). Explain Trans effect. Explain the theories of trans effect and write any two applications of trans effect.

(OR)

(b). (i) Write the biological functions of Haemoglobin and Myoglobin.

(ii) Write a note on the use of chelating agents in medicines.

3. (a). Define Phase rule and terms involved in it. Explain phase diagram of Pb-Ag system.

(OR)

(b). (i) Explain phase diagram for NaCl-water system.

(ii) Explain briefly about Freezing mixtures.

4. (a). Define Transport number. Write an experimental method for the determination of transport number by Hittorf method.

(OR)

(b).(i) Define single electrode potential.

(ii) Explain four types of electrodes with examples.

5. (a). Explain general methods for determination of order of a reaction.

(OR)

(b).Explain Collision theory and Activated complex theory of bimolecular reactions.

SECTION – B (Short Answer Questions)

Answer any **FIVE** from the following questions: (5x5 = 25M)

6. Write note on Jahn-Teller distortion
7. Explain Labile & inert complexes.
8. Explain Job's method for determination of composition of complex.
9. Explain Thermodynamic derivation of Gibb's phase rule.
10. Explain any two conductometric titrations.
11. Write note on Fuel Cells with examples and applications.
12. What is enzyme catalysis? Write any three factors effecting enzyme catalysis.
13. Derive Michaels- Menten equation.

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA

DEPARTMENT OF CHEMISTRY

BOARD OF STUDIES: 2022-23

SEMESTER – V

Structure of SECs for Semester–V

(To choose One pair from the Five alternate pairs of SECs)

Course NO. 6&7	Name of Course	Th. Hrs./ Week	IE Mar-ks	EE Mar-ks		Mar-ks	
6A	Synthetic Organic Chemistry	3	25	75		50	
7A	Analysis of Organic Compounds	3	25	75		50	
	OR						
6B	Analytical Methods in Chemistry-1	3				50	
7B	Analytical Methods in Chemistry-1	3				50	
	OR						
6C	Industrial Chemistry-1	3				50	
7C	Industrial Chemistry-2	3				50	
	OR						
6D	Environmental Chemistry	3					2
7D	Green Chemistry and	3					2

	Nanotechnology							

OR

6E	Analytical Methods in Chemistry							2
7E	Cosmetics and Pharmaceutical Chemistry							2

Note-1: For Semester–V, for the domain subject Chemistry, any one of the five pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A&7A or 6B&7B or 6C&7C or 6D&7D or 6E&7E.The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note-2: *One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate skillsrelated to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the skills embedded in syllabus citing related real field situations.*

Max Marks: 100+50

Course 6-A: **Synthetic Organic Chemistry**

(Skill Enhancement Course (Elective), Credits: 05)

1. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of reagents used in the synthesis of organic compounds.
2. Acquire knowledge on basic concepts indifferent types of pericyclic reactions.
3. Understand the importance of retro synthesis in organic chemistry.
4. Comprehend the applications of different reactions in synthetic organic chemistry.

I. Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Pericyclic reactions **12 hours**

1. A brief introduction to synthetic organic chemistry
2. Features and classification of per cyclic reactions: Phases, nodes and symmetry properties of molecular orbital's in ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, alkylation and ally radical. Thermal and photochemical reactions.
3. Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward- Hoffmann selection rules.(Correlation diagrams are not required)
4. Cyclo addition reactions: Definition and examples, definitions of supra facial and an tar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)

Unit-2: Organic photochemistry **8hours**

1. Jablonski diagram-singlet and triplettates
2. PhotochemistryofCarbonylcompounds-$n-\pi$and$\pi-\pi^*$transitions,Norrishtype-1and type-2 reactions
3. Paterno – Buchi reaction.

Unit-3: Retro synthesis **12 hours**

1. Important terms in Retro synthesis with examples-Disconnection, Target molecule, FGI, Synthon, Retro synthetic analysis, chemo selectivity, region selectivity
2. Importance of Order of events in organic synthesis
3. Retro synthetic analysis of the compounds: a. cyclohexene, b.4-Nitro toluene, c. Paracetamol.

Unit-4: Synthetic Reactions

8hours

Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using1, 3-Dithiane.

Unit-5: Reagents in Organic Chemistry

10 hours

Oxidizing agents: PCC, PDC, SeO_2 (Riley oxidation), NBS.
Reducing agents: $LiAlH_4$ (with mechanism), LTBA, Metal-solvent reduction(Birch reduction), Catalytic reduction.

1. References

1. Peri cyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Peri cyclic Reactions-A Text book: Reactions, Applications and Theory by S. Sankararaman, WILEY-VCH.
3. Reaction Mechanismin Organic Chemistry by S.M. Mukherji and S.P.Singh, Revised edition, Trinity Press.
4. Pericyclic reactions-AMechanistic study by S.M.Mukherji, Macmill an India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.

Course6-A: Synthetic Organic Chemistry-PRACTICAL SYLLABUS

I. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the organic qualitative analysis for the detection of N, S and halogens using thegreen procedure.
2. Learn the procedure for the separation of mixture famine acids using paperChromatography.
3. Prepare the TLC plates for TLC chromatography.
4. Acquire skills in conducting column chromatography for the separation of dyes in thegiven mixture.

II. Practical (Laboratory) Syllabus :(**30hrs**)

(Max.50 Marks)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascendingpaper chromatography.
3. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (usingalumina as adsorbent).
4. Separation of mixture of methyl range and methyl enable by column chromatography
5. Separation of food dyes using Column Chromatography
6. Separation of triglycerides using TLC

III. Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, Universitypress.
4. Mann F. G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

IV. Co-Curricular Activities

a) Mandatory:*(Lab/field training of students by teacher:(lab: 10+field:05*):

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of N, Sand halogens using the green procedure, preparation of TLC plates, detection of organic compounds using Rf values in TLC/ paper chromatography, loading of column, selection of solvent system for column chromatography, separation of amino acids and dyemixtureusing chroma tographic techniques.

2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher.

3. Max marks for Fieldwork/project work Report: 05.

Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

4. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos andmaterial.
3. Visits of abilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

V. Suggested Question Paper Pattern:

Max. Marks: 75 Time: 3 hrs

SECTION – A

(Total: 10 M)

Very Short Answer Questions 5x2 = 10 M

SECTION - B (Total: 20 M)

Answer any four questions. Each answer carries 5 marks

(At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

SECTION - C (Total: 4x10 =40 M)

(Answer any four questions. Each answer carries 10 marks(At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

Max Marks: 100+50

Course 7-A: **Analysis of Organic Compounds**

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of mass spectrometry in the structural elucidation of organiccompounds.
2. Acquire the knowledge eon structural elucidation of organic compounds.
3. Understand various chromatography methods in the separation andidentification of organic compounds.
4. Demonstrate the knowledge gained in solvent extraction for the separate the organiccompounds.

II.*Syllabus :(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Mass Spectrometry

10 hours

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impact ionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, But aldehyde, Propionic acid.

Unit-2: Structural elucidation of organic compounds using IR, NMR, mass spectraldata- 8hours

2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Prop ionic acid and methyl propionate.

Unit-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data

8 hours

Phenyl acetylene, ace to phenomenon amici acid and p-nitro aniline.

Unit-4: Separation techniques-1

12 hours

1. Solvent extraction-Principle and theory, Batch extraction technique, application of batchextraction in the separation of organic compounds from mixture- acid & neutral, base &neutral.
2. Chromatography- Principle and theory, classification, types of adsorbents, eluents, Rfvalues and factors affecting Rfvalues.
3. Thin layer chromatography-principle, experimental procedure, advantages and applications.

Unit-5: Separation techniques-2 **12 hours**

1. Paper chromatography- Principle, experimental procedure, ascending, descending, radialand two dimensional, applications.
2. Column chromatography-Principle, classification, experimental procedure, applications.
3. HPLC-Principle, Instrumentation-block diagram and applications.

III. References

1. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
2. Introduction to Spectroscopy by Pavia, Lamp man, Kriza and Vyvyan, Fifth edition,Cen gage.
3. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition,Alpha Science.
4. Spectroscopy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age International.
5. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
6. Fundamentals of Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald, M. Westand Douglas A. Skoog, Ninth edition, Cen gage.
7. Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
8. Quantitative analysis by R. A. Day Jr. and A. L. Underwood, Sixth edition, Pearson.
9. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

***Course7-A*: Analysis of Organic Compounds - PRACTICAL SYLLABUS**

IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of anazodye.
3. Acquire skills in the separation of organic compounds in the given mixture using solventextraction

V. Practical (Laboratory) Syllabus:(**30hrs**) (Max.50 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylating of 1^0 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
8. Separation of organic compounds in a mixture (acidic compound + neutral compound) using solventextraction.
9. Separation of organic compounds in a mixture (basic compound +neutral compound) using solventextraction.

VI. Lab References:

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, Universitypress.
4. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

IV. Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):*

5. **For Teacher**: Training of students by teacher in laboratory and field for not less than15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
6. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a handwritten fieldwork/project work report not exceeding10 pages in the given format to the teacher.
7. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

5. Unit tests (IE).

b) **Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and othermaterial.
3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

VIII. Suggested Question Paper Pattern:

Max. Marks: 75 Time: 3 hrs

SECTION - A (Total: 10 M)

Very Short Answer Questions (5x2 =10M)

SECTION - B (Total: 4x5=20M)

(Answer any four questions. Each answer carries 5 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

SECTION - C (Total: 4x10 =40 M)

(Answer any four questions. Each answer carries 10 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

***Course6-B*: Analytical Methods in Chemistry-1** Max Marks: 100+50

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and their minimization methods.

II. Syllabus:

(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

Unit-1: Quantitative analysis-1 8 hours

1. A brief introduction to analytical methods in chemistry
2. Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.
2. Description and use of common laboratory apparatus- volumetric flask, burette, pipette,beakers, measuring cylinders.

Unit-2: Quantitative analysis-2 12hours

1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.
2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, dryingand ignition.

Unit-3: Treatment of analytical data 8hours

Types of errors- Relative and absolute, significant figures and its importance, accuracy -methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence interval.

Unit-4: separation techniques **12 hours**

1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).
2. Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5: Analysis of water **10hours**

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, determination of chloride using Mohr's method.

III. References

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M. Westand Douglas A. Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
3. Quantitative analysis by R. A. Day Jr. And A. L. Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D. D.Mishra, Revised edition, S Chand & Co Ltd.

***Course6-B*: Analytical methods in chemistry-1-PRACTICALSYLLABUS**

IV. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Estimate Iron(II) using standard Potassium dichromate solution
2. Learn the procedure for the estimation of total hardness of water
3. Demonstrate the determination of chloride using Mohr's method
4. Acquire skills in the operation and calibration of pH meter
5. Perform the strong acid vs strong base titration using pH meter

V. Practical (Laboratory)Syllabus:(30hrs) (Max.50 Marks)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Determination of chloride ion by Mohr's method
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and theirmixtures.
5. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride-ammonium hydroxide.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Determination of dissociation constant of a weak acid.

VI. Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

VII. Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):*

8. **For Teacher**: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vsstrongbasetitrationusingpHmeter,determinationofchlorideion,estimationofwater qual ityparametersand estimation of Iron(II).

9. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe various methodsused for the analysis of water. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

10. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

5. Unit tests (IE).

***b)* Suggested Co-Curricular Activities**

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

VIII. Suggested Question Paper Pattern:

Max. Marks: 75 Time: 3 hrs

SECTION-A (Total: 10 M)

Very Short Answer Questions (5x2 = 10 M)

SECTION- B (Total: 4x5=20M)

(Answer any four questions. Each answer carries 5 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

SECTION- C (Total: 4x10 =40 M)

(Answer any four questions. Each answer carries 10 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

***Course7-B*: Analytical Methods in Chemistry-2** Max Marks: 100+50

(Skill Enhancement Course (Elective), Credits: 05)

I. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of chromatography in the separation and identification ofcompounds in a mixture
2. Acquire a critical knowledge on various chromatographic techniques.
3. Demonstrate skills related to analysis of water using different techniques.
4. Understand the principles of spectro chemistry in the determination of metal ions.
5. Comprehend the applications of atomic spectroscopy.

II. Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Chromatography-Introduction and classification 10 hours Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, Rf values, factors affecting Rf values.

UNIT-2: TLC and paper chromatography 12 hours

1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applicationsand advantages.
2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and twodimensional, applications.

UNIT-3: Column chromatography 12 hours

1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.
2. HPLC: Basic principles, instrumentation –block diagram and applications.

UNIT-4: Spectrophotometry 8hours

Principle, Instrumentation: Single beam and double beam spectrometer, Beer- Lambert's law- Derivation and deviations from Beer-Lambert's law, applications of Beer- Lambert's law-Quantitative determination ofFe^{+2}, $Mn^{+2}$and Pb^{+2}.

UNIT-5: Atomic spectroscopy **8hours**

Types, atomizer, atomic absorption and emission and applications.

III. References

1. Fundamental so Analytical Chemistry by F.James Holler, Stanley R Crouch, DonaldM.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug, Seventh edition, Wiley.
3. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/ Pearson.

***Course7-B*: Analytical Methods in Chemistry-2- PRACTICAL SYLLABUS**

V. Learning Outcomes:

On successful completion of this practical course, student shall be able to:

1. Perform the separation of a given dye mixture using TLC
2. Learn the preparation of TLC plates
3. Demonstrate the separation of mixture of amino acids using paper chromatography
4. Acquire skills in using column chromatography for the separation of dye mixture

VI. Practical (Laboratory) Syllabus: (**30hrs**) (Max.50Marks)

1. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (usingalumina as adsorbent).
2. Separation of mixture of methyl orange and methylene blue by column chromatography.
3. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascendingpaper chromatography.
4. Separation of food dyes using Column Chromatography
5. Separation of triglycerides using TLC
6. Verification of Beer lambert's law. (Using potassium permanganate solution) usingcolorimeter /spectrophotometer.

VII. Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

1. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley- Eastern.
3. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, Universitypress.
4. Mann F.Gand Saunders B.C, Practical Organic Chemistry, Pearson Education.

VII. Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher (lab:10+field:05):*

11. **For Teacher**: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture usingchromatographic techniques.

12. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.

13. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*

10. Unit tests (IE).

b) **Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

VIII. Suggested Question Paper Pattern:

Max. Marks: 75 Time: 3 hrs

SECTION – A (Total: 10 M)

Very Short Answer Questions (5x2 = 10 M)

SECTION - B (Total: 4x5=20 M)

(Answer any four questions. Each answer carries 5 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

SECTION - C (Total: 4x10 =40 M)

(Answer any four questions. Each answer carries 10 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

***Course6-C*: Industrial Chemistry-1**

(Skill Enhancement Course (Elective), Credits: 05) Max. Marks : 100+50

I. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of different surface coatings.
2. Acquire a critical knowledge on manufacture of ceramics and cement.
3. Understand various steps in the manufacture of cane sugar.
4. Explain the manufacture of pulp and paper.

***II.*Syllabus :** *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Fertilizers **10 hours**

A brief introduction to industrial chemistry
Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Superphosphate, Compound and mixed fertilizers.

Unit-2: Silicates **10hours**

1. **Ceramics:** Important clays and Felds par. Ceramics-types, uses and manufacture. Hightechnology ceramics and their applications.
2. **Cements:** Classification of cement, ingredients and their role, Manufacture of cement andthe setting process, quick setting cements.

Unit-3: Surface Coatings **12 hours**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, toners and lake pigments, fillers, thinners, enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints.

Unit-4: Sugar Chemistry **08 hours**

Introduction–Manufacture and recovery of cane sugar from molasses, manufacture of sucrosefrom beat root, testing and estimation of sucrose.

Unit-5: Paper Industry **10 hours**

Pulp and Paper-Introduction, Manufacture of pulp, sulphate or Kraft pulp, soda pulp, sulphitepulp, rag pulp, beating, refining, filling, sizing and colouring of pulp, manufacture of paper.

III. References:

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd.UK
2. J.A.Kent: Riegel's *Hand book of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas

Publications,New Delhi.
5. B. K. Sharma: *Engineering Chemistry,* Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., NewDelhi.

***Course6 C*: Industrial Chemistry-1- PRACTICAL SYLLABUS**

IV. Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. Determine free acidity in ammonium sulphate fertilizer.
2. Learn the procedure for the Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Demonstrate skills on Estimation of phosphoric acid in superphosphate fertilizer.
4. Acquire skills in using colorimetry for the estimation of sucrose.

V. Practical(Laboratory)Syllabus:(**30hrs**) (Max.50 Marks)

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Estimation of sucrose by colorimetry.

VI: Lab References

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Text book on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.
3. R.Gopalan, D.Venkappayya, S.Nagarajan: Engineering Chemistry, Vikas Publications.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut

VII. Co-Curricular Activities:

a)* Mandatory:(Lab/field training of students by teacher:(lab:10+field:05):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on field related skills in determination of free acidity, estimation of calcium and phosphoric acid in a fertilizer, use of colorimeter to estimate sucrose.
2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the surface coatings of surfaces used to prevent the corrosion. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work**:** *Title page, student details, indexpage, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

***b)* Suggested Co - Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

VIII. Suggested Question Paper Pattern:

Max. Marks: 75 Time: 3 hrs

SECTION – A (Total: 10 M)

Very Short Answer Questions (5x2 = 10 M)

SECTION – B (Total: 4x5=20 M)

(Answer any four questions. Each answer carries 5 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

SECTION – C (Total: 4x10 =40 M)

(Answer any four questions. Each answer carries 10 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

Course7-C: Industrial Chemistry-2

(Skill Enhancement Course (Elective), Credits: 05)

Max Marks: 100

Learning Outcomes:

Students after successful completion of the course will be able to:

1. Identify the importance of industrial waste management.
2. Acquire a critical knowledge on the preparation and applications of organic polymers.
3. Demonstrate the analysis of water quality parameters.
4. Explain the sources of air pollution.

II. **Syllabus :***(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Organic Polymers-1 **10 hours**

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and In organic polymers, Thermoplastic and Thermo setting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross- Linked polymers.

Unit-2: Organic Polymers-2 **10 hours**

Addition polymers and Condensation polymers, mechanism of polymerization- Free radical, ionic and Zeigler-Natta polymerization. Industrial manufacturing and applications of following polymers, Polystyrene, Poly acrylonitrile, Poly methacrylate, Poly methyl-methacrylate.

Unit-3: Air Pollution **8 hours**

Sources of air pollution, acid rain, photochemical smog, Greenhouse effect, Formation and depletion of ozone, sources and effects of various gaseous pollutants: NOx, SOx, SPM, CO, hydrocarbons, controlling methods of air pollution.

Unit-4: Analysis of water **10hours**

Determination of total hardness of water, Dissolved oxygen, BOD, COD, total dissolved solids, turbidity, alkalinity, determination of chloride using Mohr's method.

Unit-5: Industrial Waste Management **12hours**

Waste water treatment - primary, secondary & tertiary treatment. (All treatment methods in detail). Characteristics of solid wastes, methods of solid waste treatment and disposal,microbiology involved in solid waste disposal, methods of solid waste disposal- composting, sanitary landfilling- economic, aesthetic and environmental problems.

III. **References:**

1. E.Stocchi: *IndustrialChemistry*,Vol-I,EllisHorwoodLtd.UK
2. J.A.Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry*, DhanpatRai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry*, Galgotia Publications Pvt. Ltd.,New Delhi.
7. A.K.De, *Environmental Chemistry*: New Age International Pvt, Ltd, New Delhi.
8. C.k.Varshney: *Water Pollution and Management*, Wiley Eastern Limited, Chennai.
9. S.S. Dara and D.D. Mishra: *Textbook of Environmental Chemistry and Pollution Control*, Revised edition, S.C.Hand &CoLtd.

***Course7-C*: Industrial Chemistry-2-PRACTICAL SYLLABUS**

IV. **Lab work-Skills Outcomes:**

On successful completion of this practical course, student shall be able to:

1. Learn the procedures for the determination of BOD and COD.
2. Demonstrate skills in the determination of chloride in the given water sample.
3. Acquire skills in determining the hardness of water.

V. **Practical (Laboratory) Syllabus**:(**30hrs**) (Max.50 Marks)

1. Determination of Hardness of water by EDTA titration.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Determination of chloride using Mohr's method.

5. Determination of pH, turbidity and total solids in water sample.
6. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
7. Determination of Ph in soil samples using pH metry.

VI. Lab References:

1. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Textbook on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.

VII. Co-Curricular Activities

a) **Mandatory:***(Student training by teacher in field related skills: inlab:15,infield: 05 hours):*

1. **For Teacher**: Training of students by the teacher in laboratory and field for not lesst han15hours on the field related skills in determination of hardness of water, estimationof COD and BOD in water sample, determination chloride ion in water sample.
2. **For Student**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the measurement of water quality parameters. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of place visited, observations, findings, and knowledgements.*
5. Unit tests (IE).

b) **Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invitedlecturesandpresentationsonrelatedtopicsbyfield/industrialexperts.

VIII. Suggested Question Paper Pattern:

Max. Marks: 75 Time: 3 hrs

SECTION – A (Total: 15 M)

Very Short Answer Questions (5x2 = 10 M)

SECTION - B (Total: 4x5=20 M)

(Answer any four questions. Each answer carries 5marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	

6	
7	
8	

SECTION – C (Total: 4x10 =40 M)
(Answer any four questions. Each answer carries 10 marks (At least 1 question should be given from each Unit)

1	
2	
3	
4	
5	
6	
7	
8	

Course6-D: Environmental Chemistry

(Skill Enhancement Course (Elective), Credits -05 Max Marks: 100+50

I. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the environment functions and how it is affected by human activities.
2. Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems services.
3. Engage in simple and advanced analytical tools used to measure the different typesof pollution.
4. Explain the energy crisis and different aspects of sustainability.
5. Analyze key ethical challenges concerning biodiversity and understand the moral principles,goals and virtues important for guiding decisions that affect Earth's plant and animal life.

II Syllabus :*(Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

UNIT-I: Introduction 10 h

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydro logical cycle.

UNIT-II: Air Pollution 10 h

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards- Climate change – Global warming – Pollution from combustion systems- Acid rain – Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster–Instrumental techniques to monitor pollution – Controlling methods of air pollution.

UNIT-III: Water pollution 10 h

Unique physical and chemical properties of water – Water quality standards and parameters –

Turbidity- pH Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity– Hardness of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects –Industrial waste water treatment.

UNIT-IV: Chemical Toxicology **10 h**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium- Solid waste management.

UNIT-V: Ecosystem and biodiversity **10 h**

Ecosystem

Concepts–structure–Functions and types of ecosystem–Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem– Food chains – Food web– Tropic levels–Biogeochemical cycles (carbon, nitrogen and phosphorus)

Biodiversity

Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity–trends-bio geographical classification of India–biodiversity at national, global and regional level.

III. List of Reference books:

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k.Banerji
4. Water pollution, Lalude, MC Graw Hill
5. Environmental Chemistry, Anil Kumar De, Wiley Eastern ltd.
6. Environmental analysis, SM Khopkar (IIT Bombay)
7. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house.
8. Fundamentals of Environmental Chemistry, Manahan, Stanley. E
9. Applications of Environmental Chemistry, Eugene R. Wiener

10. Web related references suggested by teacher.

Course 6-D: Environmental Chemistry – Practical syllabus

IV. Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Chemistry lab.
2. Learn the procedures of preparation of standard solutions.
3. Demonstrate skills in operating instruments.
4. Acquire skills in handling spectrophotometer.
5. Analyse water and soil samples.

V. Practical (Laboratory) Syllabus: (**30 h**) (Max.50 M).

1. Identification of various equipment in the laboratory.
2. Determination of carbonate and bicarbonate in water samples by double titration method.
3. Determination of hardness of water using EDTA

a) Permanent hardness b) Temporary hardness

4. Determination of Chlorides in water samples by Mohr's method.
5. Determination of pH, turbidity and total solids in water sample.
6. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
7. Determination of PH in soil samples using pH metry.

VI. List of Reference books:

1. A Text Book of Quantitative Inorganic Analysis (3rd Edition)–A.I.Vogel
2. Water pollution, Lalude, MC Graw Hill
3. Environmental analysis, SM Khopkar (IIT Bombay)
4. Web related references suggested by teacher.

VII. Co-Curricular Activities:

a) Mandatory: (Training of students by teacher on field related skills: 15hrs)

1. For Teacher: Skills training of students by the teacher in classroom, lab and field for not less than15 hours on field related quantitative techniques for the water quality parameters, soil pollution and air pollution.

2. For Student: Individual visit to any one of the local field agencies/research laboratories in universities/research organizations/private sector culminating writing and submission of ahand-written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: *Title page, student details, index page, details of places visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of spectrophotometry.

VIII. Suggested Question Paper Pattern and Model (Theory):

Max.Marks:75 Time:3 hrs

SECTION – A

Very Short Answer Questions

Answer any five of the following questions. 5x2 = 10M

1. Explain the terms with examples

a) Pollutant b)Contaminant

2. Write the reaction of atmospheric oxygen
3. Explain Greenhouse effect.
4. Brief note on Bhopal gas disaster.
5. Discuss what is Eutrophication and the effects of Eutrophication
6. Write the toxic effect of Lead and Mercury.

7. What are the biochemical effects of pesticides?
8. Explain food chain.
9. Define BOD & COD.
10. Write about the functions of Ecosystem.

SECTION – B

Answer any five of the following questions. 5x5=25 M

(At least 1 question should be given from each Unit)

1. Explain the scope and importance of environment in now-a-days.
2. Write about Hydrological cycle.
3. What are Acid rains?
4. Write a brief note on Global warming.
5. Explain the reasons for the Hardness of water.
6. Brief about Solid waste management.
7. Describe Biodiversity at regional level.
8. Discuss briefly about Carbon cycle.

SECTION - C

Answer any four of the following questions (4x10 = 40 M)

(At least1question should be given from each Unit)

1. Explain the formation and depletion of the Ozone layer.
2. Discuss about the renewable energy resources.
3. What are the toxic effects of cyanide on the environment?
4. Describe the methods to convert permanent hard water to soft water.
5. Outline the functions and types of ecosystem.
6. Give a detailed account on biodiversity

Course7- D: Green Chemistry and Nanotechnology

(Skill Enhancement Course , Elective, Credits – 05) Max Marks: 100+50

1. Learning Outcomes:

Students after successful completion of the course will be able to:

1. Understand the importance of Green chemistry and Green synthesis.
2. Engage in Microwave assisted organic synthesis.
3. Demonstrate skills using the alternative green solvents in synthesis.
4. Demonstrate and explain enzymatic catalysis.
5. Analyse alternative sources of energy and carry out green synthesis.
6. Carry out the chemical method of nanomaterial synthesis.

VI. Syllabus: *Total Hours: 90, including Teaching, Lab, Field Training, Unit tests etc.)*

UNIT-I Green Chemistry: Part- I 10 h

Introduction-Definition of green Chemistry, Need for green chemistry, Goals of Green chemistry Basic principles of green chemistry. Green synthesis- Evaluation of the type of the reaction

i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic). Organic reactions by Sonication method: apparatus required and examples of sonochemical reactions (Heck, Hunds dicker and Wittig reactions).

UNIT- II Green Chemistry: Part- II 10 h

A) Selection of solvent:

i) Aqueous phase reactions

ii) Reactions in ionic liquids, Heck reaction, Suzuki reactions, epoxidation. Iii) Solid supported synthesis

B) Supercritical CO2: Preparation, properties and applications, (decaffeination, drycleaning)

C) Green energy and sustainability.

UNIT-III Microwave and Ultrasound assisted green synthesis: 10 h

Apparatus required, examples of MAOS (synthesis of fused anthroquinones, Leukart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldolcondensation –Cannizzaro reaction- Diels-Alder reactions-Strecker's synthesis

UNIT-IV Green catalysis and Green synthesis 10 hrs.

Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis - bio catalysis:Enzymes, microbes Phase transfer catalysis (micellar /surfactant)

1. Green synthesis of the following compounds: adipic acid, catechol, disodium menudo acetate (alternative Strecker's synthesis)

2. Microwave assisted reaction in water –Hoffmann elimination – methyl benzoate to benzoic acid – oxidation of toluene and alcohols–microwave assisted reactions in organic solvents. Diels-Alder reactions and decarboxylation reaction.
3. Ultrasound assisted reactions–sonochemical Simmons–Smith reaction (ultrasonic alternative to iodine)

UNIT – V Nanotechnology in Green chemistry 10 h

Basic concepts of Nano science and Nanotechnology – Bottom-up approach and Top down approaches with examples – Synthesis of Nano materials – Classification of Nanomaterial – Properties and Application of Nanomaterial. Chemical and Physical properties of Nanoparticles – Physical synthesis of nanoparticles – Inert gas condensation - aerosol method - Chemical Synthesis of nanoparticles – precipitation and co-precipitation method, sol-gel method.

III. Lab work - Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in the laboratory.
2. Learn the procedures of green synthesis.
3. Demonstrate skills in the preparation of Nanomaterials.
4. Acquire skills in Microwave assisted organic synthesis.
5. Perform some applications of Nanomaterials.

IV. Practical (Laboratory) Syllabus: (30 hrs.) (Max.50 Marks).

1. Identification of various equipment in the laboratory.
2. Acetylation of 1^0 amine by green method: Preparation of acetanilide

3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipicacid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Preparation and characterization of Nanoparticles of gold using tea leaves.
8. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
9. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.

V. Reference books:

1. Green Chemistry Theory and Practical. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Principles and practice of heterogeneous catalysis, Thomas J.M.,Thomas M.J., John Wiley
6. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava, Narosa Publications
7. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press (2008).
8. Green Processes for Nanotechnology: From Inorganic to Bioinspired Nanomaterials, Vladimir A. Basiuk, Elena V. Basiuk Springer (2015)
9. Web related references suggested by teacher.

VI. Co-Curricular Activities:

a) Mandatory: (*Training of students by teacher on field related skills: 15 hours*)

1.For Teacher: Training of students by the teacher in the classroom or in the laboratory for not less than 15 hours on field related quantitative techniques for Enzymatic catalysis, Microwave assisted organic synthesis, Biodiesel preparation etc.

2. For Student: Individual visit to any one of the local field agencies, research laboratories in universities/research organizations/private sector culminating writing and submission of a hand- written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for fieldwork/project work Report: 05.

4. Suggested Format for fieldwork/project work: *Title page, student details, index page, details ofplaces visited, observations, findings and acknowledgements.*

5. Unit tests (IE).

b) Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Visits to research organizations and laboratories.
3. Invited lectures and presentations on related topics by field / industrial experts.
4. Assignments.
5. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
6. Preparation of videos on tools, techniques and applications of Green chemistry and Nanosynthesis.

VII. Suggested Question Paper Pattern/ Model (Theory):

Max. Marks: 75

SECTION -A (Total: 10 M)

Very Short Answer Questions (Answer any five of the following questions. Each answer carries 2 marks) (5 x2=10 Marks)

1. What are the goals of Green chemistry
2. Explain green synthesis.
3. Discuss epoxidation.
4. Write a brief note on decaffeination
5. Describe the advantages of MAOS.
6. Explain Cannizaro reaction.
7. What are the uses of zeolites?
8. Define bio catalysis.
9. Discuss in

brief aerosol method.

10. What is chemical vapour synthesis?

SECTION - B (Total: 25 Marks) (Answer any five of the following questions. Each answer carries 5marks) (5x5=25 Marks)

(At least 1 question should be given from each Unit

1. What is the need of green chemistry?
2. Discuss atom economy reactions.
3. Write short notes on Heck reaction.
4. Explain solid supported synthesis.
5. Describe the green synthetic procedure for the Diels-alder reaction
6. Brief about Bio catalysis.
7. How do you perform Strecker's synthesis by green synthesis method?
8. Discuss about Ultrasound assisted reactions.

SECTION – C (Total: 40 Marks) (Answer any four of the following questions. Each answer carries 10 marks) (4x10 = 40 Marks) (At least 1 question should be given from each Unit)

1. Explain the basic principles of green chemistry
2. Illustrate the sonication method with any two reactions
3. Describe the preparation and properties of super critical carbon dioxide.
4. Explain the synthesis of fused anthro quinines by microwave assisted organic synthesis
5. How are adipic acid and catechol prepared by Green synthesis?
6. Discuss the classification and applications of Nanomaterials.