PERIYAR UNIVERSITY
SALEM – 636 011

M.Sc., DEGREE

[Choice Based Credit System (CBCS)]

Branch IV (A) CHEMISTRY

(Specializations in Organic, Inorganic and Physical Chemistry)

REGULATIONS AND SYLLABUS

[For the Candidates admitted from the academic year 2009– 2010 and onwards]

CONTENTS

I. Objectives of the Course

Life has changed more in the past two centuries than in all the previously recorded span of human history. In one-way or another, all the changes involve CHEMISTRY. Chemistry is central to the current revolutions in Science. No educated person today can understand the modern world without a basic knowledge of chemistry. The existence of a large number of chemical factories, mines and related industries in the catchments of University necessitates chemistry education. Hence our goal in introducing the M.Sc programme in Chemistry with three specializations has been to educate the undergraduate students in the fascinating fields of chemistry in an effective manner. Rigorous and comprehensive in approach, this syllabus presents essential contents in a detailed, clear and direct way.

M.Sc. Chemistry with specializations in Organic Chemistry, Inorganic Chemistry and Physical Chemistry is a unique kind of course dealing with all aspects of chemistry such as preparation, properties, structure elucidation, kinetics and mechanism of the reaction, techniques of analysis for different kinds of materials, which are very essential for the human society. The major objectives of M.Sc. Chemistry course are:

- To impart knowledge in fundamental aspects of all branches of chemistry (Organic chemistry, Inorganic Chemistry and Physical Chemistry).
- To acquire deep knowledge in the study of physical, chemical, electrochemical and magnetic properties, structure elucidation using various techniques and applications of various organic and inorganic materials and
- To acquire basic knowledge in the specialized areas like Polymer chemistry, Environmental Chemistry, Dye Chemistry, Pharmaceutical Chemistry etc.

This programme is offered under Choice Based Credit System (CBCS). The CBCS enables the students to select variety subjects as per his interest and requirement. Acquiring knowledge in the related fields is advantageous to the students. Fast learners can earn more credits than the stipulated minimum of 72 credits. The programme is structured in such a way to impart more knowledge in science, in particular in Chemistry.

II. Eligibility for Admission

A candidate who has passed B.Sc., Degree Examination with Branch IV Chemistry as main subject of study of this university or any of the B.Sc., degree examination with specialization such as Industrial chemistry, Polymer Chemistry, Applied Chemistry, Pharmaceutical Chemistry or any other specialization in Chemistry of some other university accepted by the syndicate as equivalent thereto, subject to such condition as may be prescribed therefore shall be permitted to appear and qualify for the M.Sc. degree in Chemistry with specializations in Organic, Inorganic and Physical Chemistry of this University after a course of study of two academic years.

III. Duration of the Course

The course for the degree of Master of Science in Chemistry with specializations in Organic, Inorganic and Physical Chemistry shall consist of two academic years divided in to four semesters. Each Semester consist of 90 working days.

IV. Course of Study

M.Sc. Chemistry (Organic Chemistry Specialization)

CBCS - Structure of the Course

S.No	Paper code	Title of the Paper	Hours	L	T	P	C
Core Courses							
1.	09CHE C01	Organic Chemistry - Reaction Mechanism	72	4	0	0	4
2.	09CHE C02	Organic Photochemistry and Pericyclic Reactions	72	4	0	0	4
3.	09CHE C03	Cluster Compounds and Nuclear Chemistry	72	4	0	0	4
4.	09CHE C04	Coordination Chemistry	72	4	0	0	4
5.	09CHE C05	Quantum Chemistry and Surface Phenomena	72	4	0	0	4
6.	09CHE C06	Thermodynamics and Electro Chemistry	72	4	0	0	4
7.	09CHE C07	Advanced Organic Chemistry – Organic Synthesis	72	4	0	0	4
8.	09CHE C08	Advanced Topics in Organic Chemistry	72	4	0	0	4
9.	09CHE C09	Spectroscopy	72	4	0	0	4
10.	09CHE C10	Organic Chemistry Practical	108	0	0	6	5
11.	09CHE C11	Inorganic Chemistry Practical	108	0	0	6	5
12.	09CHE C12	Physical Chemistry Practical	108	0	0	6	5
13.	09CHE C13	Advanced Organic Chemistry Practical - I	162	0	0	6	5
14.	09CHE C14	Advanced Organic Chemistry Practical - II	162	0	0	6	5
15.	09CHE C15	Project	324	0	0	18	9
Elective Courses							
16.	09CHE E01	Analytical Chemistry	72	4	0	0	4
17.	09CHE E02	Instrumental Methods of Analysis	72	4	0	0	4
18.	09CHE E03	Environmental Chemistry	72	4	0	0	4
19	09CHE E04	Polymer Chemistry	72	4	0	0	4
20	09CHE E05	Materials Chemistry	72	4	0	0	4
21	09CHE E06	Medicinal Chemistry	72	4	0	0	4
22	09CHE E07	Dye Chemistry	72	4	0	0	4
23	C09HE E08	Chemistry of Water Treatment	72	4	0	0	4
Supportive Courses for other Departments							
24.	09CHE S01	Fundamental Aspects of Electroanalytical Techniques	72	4	0	0	4
25.	09CHE S02	Conducting Polymers	72	4	0	0	4
26.	09CHE S03	Industrial and Agricultural Chemistry	72	4	0	0	4
27.	09CHE S04	Chemistry of Natural Products	72	4	0	0	4
28.	09CHE S05	Chemistry Of Industrial Products	72	4	0	0	4
29.	09CHE S06	Fundamentals of Analytical Chemistry	72	4	0	0	4
30.	09CHE S07	Pharmaceutical Chemistry	72	4	0	0	4
31.	09CHE S08	Applied Catalysis	72	4	0	0	4

Note: 1.Human Rights – Compulsory course for All P.G. students

2. C – Core Courses, E – Elective Courses & S – Supportive Courses; L – Lecture, T – Tutorial, P - Practical

3. Credits for Core Courses 70; Credits for Elective Courses 16
Credits for Supportive Courses 04 ; Total Credits 90

M.Sc. Chemistry (Inorganic Chemistry Specialization)
CBCS - Structure of the Course

S. No.	Paper code	Title of the Paper	Hours	L	T	P	C
Core Courses							
1.	09CHE C01	Organic Reaction Mechanism	72	4	0	0	4
2.	09CHE C02	Organic Photochemistry and Pericyclic Reactions	72	4	0	0	4
3.	09CHE C03	Cluster Compounds and Nuclear Chemistry	72	4	0	0	4
4.	09CHE C04	Coordination Chemistry	72	4	0	0	4
5.	09CHE C05	Quantum Chemistry and Surface Phenomena	72	4	0	0	4
6.	09CHE C06	Thermodynamics and Electro Chemistry	72	4	0	0	4
7.	09CHE C16	Advanced Inorganic Chemistry – Organometallic Chemistry	72	4	0	0	4
8.	09CHE C17	Advanced Inorganic Chemistry – Solid State and Bioinorganics	72	4	0	0	4
9.	09CHE C09	Spectroscopy	72	4	0	0	4
10.	09CHE C10	Organic Chemistry Practical	108	0	0	6	5
11.	09CHE C11	Inorganic Chemistry Practical	108	0	0	6	5
12.	09CHE C12	Physical Chemistry Practical	108	0	0	6	5
13.	09CHE C18	Advanced Inorganic Chemistry Practical - I	162	0	0	6	5
14.	09CHE C19	Advanced Inorganic Chemistry Practical - II	162	0	0	6	5
15.	09CHE C15	Project	324	0	0	18	9
Elective Courses							
16.	09CHE E01	Analytical Chemistry	72	4	0	0	4
17.	09CHE E02	Instrumental Methods of Analysis	72	4	0	0	4
18.	09CHE E03	Environmental Chemistry	72	4	0	0	4
19.	09CHE E04	Polymer Chemistry	72	4	0	0	4
20	09CHE E05	Materials Chemistry	72	4	0	0	4
21	09CHE E06	Medicinal Chemistry	72	4	0	0	4
22	09CHE E07	Dye Chemistry	72	4	0	0	4
23	09CHE E08	Chemistry of Water Treatment	72	4	0	0	4
Supportive Courses for other Departments							
24.	09CHE S01	Fundamental Aspects of Electroanalytical Techniques	72	4	0	0	4
25.	09CHE S02	Conducting Polymers	72	4	0	0	4
26.	09CHE S03	Industrial and Agricultural Chemistry	72	4	0	0	4
27.	09CHE S04	Chemistry of Natural Products	72	4	0	0	4
28.	09CHE S05	Chemistry Of Industrial Products	72	4	0	0	4
29.	09CHE S06	Fundamentals of Analytical Chemistry	72	4	0	0	4
30.	09CHE S07	Pharmaceutical Chemistry	72	4	0	0	4
31.	09CHE S08	Applied Catalysis	72	4	0	0	4

Note: Human Rights – Compulsory course for All P.G. students

2. C – Core Courses, E – Elective Courses & S – Supportive Courses; L – Lecture, T – Tutorial, P – Practical
3. 2. Credits for Core Courses 70; Credits for Elective Courses 16
   Credits for Supportive Courses 04; Total Credits 90

M.Sc. Chemistry (Physical Chemistry Specialization)
CBCS - Structure of the Course

S.No.	Paper code	Title of the Paper	Hours	L	T	P	C
Core Courses							
1.	09CHE C01	Organic Reaction Mechanism	72	4	0	0	4
2.	09CHE C02	Organic Photochemistry and Pericyclic Reactions	72	4	0	0	4
3.	09CHE C03	Cluster Compounds and Nuclear Chemistry	72	4	0	0	4
4.	09CHE C04	Coordination Chemistry	72	4	0	0	4
5.	09CHE C05	Quantum Chemistry and Surface Phenomena	72	4	0	0	4
6.	09CHE C06	Thermodynamics and Electro Chemistry	72	4	0	0	4
7.	09CHE C20	Advanced Kinetics and Photochemistry	72	4	0	0	4
8.	09CHE C21	Advanced Topics in Physical Chemistry & Spectroscopy	72	4	0	0	4
9.	09CHE C09	Spectroscopy	72	4	0	0	4
10.	09CHE C10	Organic Chemistry Practical	108	0	0	6	5
11.	09CHE C11	Inorganic Chemistry Practical	108	0	0	6	5
12.	09CHE C12	Physical Chemistry Practical	108	0	0	6	5
13.	09CHE C22	Advanced Physical Chemistry Practical - I	162	0	0	6	5
14.	09CHE C23	Advanced Physical Chemistry Practical - II	162	0	0	6	5
15.	09CHE C15	Project	324	0	0	18	9
Elective Courses							
16.	09CHE E01	Analytical Chemistry	72	4	0	0	4
17.	09CHE E02	Instrumental Methods of Analysis	72	4	0	0	4
18.	09CHE E03	Environmental Chemistry	72	4	0	0	4
19.	09CHE E04	Polymer Chemistry	72	4	0	0	4
20	09CHE E05	Materials Chemistry	72	4	0	0	4
21	09CHE E06	Medicinal Chemistry	72	4	0	0	4
22	09CHE E07	Dye Chemistry	72	4	0	0	4
23	09CHE E08	Chemistry of Water Treatment	72	4	0	0	4
Supportive Courses for other Departments							
24.	09CHE S01	Fundamental Aspects of Electroanalytical Techniques	72	4	0	0	4
25.	09CHE S02	Conducting Polymers	72	4	0	0	4
26.	09CHE S03	Industrial and Agricultural Chemistry	72	4	0	0	4
27.	09CHE S04	Chemistry of Natural Products	72	4	0	0	4
28.	09CHE S05	Chemistry of Industrial Products	72	4	0	0	4
29.	09CHE S06	Fundamentals of Analytical Chemistry	72	4	0	0	4
30.	09CHE S07	Pharmaceutical Chemistry	72	4	0	0	4
31.	09CHE S08	Applied Catalysis	72	4	0	0	4

Note:

1. Human Rights – Compulsory course for All P.G. students
2. C – Core Courses, E – Elective Courses & S – Supportive Courses; L – Lecture, T – Tutorial, P - Practical
3. Credits for Core Courses 70; Credits for Elective Courses 16
   Credits for Supportive Courses 04; Total Credits 90

V. Teaching Methodologies

The classroom teaching would be through conventional lectures and use of OHP and Power Point presentations. The lecture would be such that the student should participate actively in the discussion. Student seminars would be conducted and scientific discussions would be arranged to improve their communicative skill.

In the laboratory, instruction would be given for the experiments followed by demonstration and finally the students have to do the experiments individually.

Periodic tests would be conducted and for the students of slow learners would be given special attention.

VI. Examinations

The examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examination.

Practical examinations for M.Sc. course in Chemistry with specializations in Organic, Inorganic and Physical Chemistry should be conducted at the end of the even semester.

At the end of fourth semester viva-voce will be conducted on the basis of the Dissertation/Project report submitted by the student. One internal and one external examiner will conduct the viva-voce jointly.

VII Scheme of Examinations

M.Sc. Chemistry (Organic Chemistry Specialization)

CBCS

Sl. No.	Paper Code	Title of the Paper	Exam Hours	I	E	T	C
Core Courses							
1.	09CHE C01	Organic Reaction Mechanism	3	25	75	100	4
2.	09CHE C02	Organic Photochemistry and Pericyclic Reactions	3	25	75	100	4
3.	09CHE C03	Cluster Compounds and Nuclear Chemistry	3	25	75	100	4
4.	09CHE C04	Coordination Chemistry	3	25	75	100	4
5.	09CHE C05	Quantum Chemistry and Surface Phenomena	3	25	75	100	4
6.	09CHE C06	Thermodynamics and Electro Chemistry	3	25	75	100	4
7.	09CHE C07	Advanced Organic Chemistry – Organic Synthesis	3	25	75	100	4
8.	09CHE C08	Advanced Topics in Organic Chemistry	3	25	75	100	4
9.	09CHE C09	Spectroscopy	3	25	75	100	4
10.	09CHE C10	Organic Chemistry Practical	6	30	50	80	5
11.	09CHE C11	Inorganic Chemistry Practical	6	30	50	80	5
12.	09CHE C12	Physical Chemistry Practical	6	30	50	80	5
13.	09CHE C13	Advanced Organic Chemistry Practical - I	6	30	50	80	5
14.	09CHE C14	Advanced Organic Chemistry Practical - II	6	30	50	80	5
15.	09CHE C15	Project	-	* 50	# 150	200	9
Elective Courses							
16.	09CHE E01	Analytical Chemistry	3	25	75	100	4
17.	09CHE E02	Instrumental Methods of Analysis	3	25	75	100	4
18.	09CHE E03	Environmental Chemistry	3	25	75	100	4
19.	09CHE E04	Polymer Chemistry	3	25	75	100	4
20	09CHE E05	Materials Chemistry	3	25	75	100	4
21	09CHE E06	Medicinal Chemistry	3	25	75	100	4
22	09CHE E07	Dye Chemistry	3	25	75	100	4
23	09CHE E08	Chemistry of Water Treatment	3	25	75	100	4
Supportive Courses for other Departments							
24.	09CHE S01	Fundamental Aspects of Electroanalytical Techniques	3	25	75	100	4
25.	09CHES0 2	Conducting Polymers	3	25	75	100	4
26.	09CHE S03	Industrial and Agricultural Chemistry	3	25	75	100	4
27.	09CHES04	Chemistry of Natural Products	3	25	75	100	4
28.	09CHE S05	Chemistry Of Industrial Products	3	25	75	100	4
29.	09CHE S06	Fundamentals of Analytical Chemistry	3	25	75	100	4
30	09CHE S07	Pharmaceutical Chemistry	3	25	75	100	4
31.	09CHE S08	Applied Catalysis	3	25	75	100	4

*** Periodic Presentation of Learning 50 marks**

 # Concise Dissertation 100 marks + Viva-Voce 50 marks

M.Sc. Chemistry (Inorganic Chemistry Specialization)
CBCS

Sl. No.	Paper Code	Title of the Paper	Exam Hours	I	E	T	C
Core Courses							
1.	09CHE C01	Organic Reaction Mechanism	3	25	75	100	4
2.	09CHE C02	Organic Photochemistry and Pericyclic Reactions	3	25	75	100	4
3.	09CHE C03	Cluster Compounds and Nuclear Chemistry	3	25	75	100	4
4.	09CHE C04	Coordination Chemistry	3	25	75	100	4
5.	09CHE C05	Quantum Chemistry and Surface Phenomena	3	25	75	100	4
6.	09CHE C06	Thermodynamics and Electro Chemistry	3	25	75	100	4
7.	09CHE C16	Advanced Inorganic Chemistry – Organometallic Chemistry	3	25	75	100	4
8.	09CHE C17	Advanced Inorganic Chemistry – Solid State and Bioinorganics	3	25	75	100	4
9.	09CHE C09	Spectroscopy	3	25	75	100	4
10.	09CHE C10	Organic Chemistry Practical	6	30	50	80	5
11.	09CHE C11	Inorganic Chemistry Practical	6	30	50	80	5
12.	09CHE C12	Physical Chemistry Practical	6	30	50	80	5
13.	09CHE C18	Advanced Inorganic Chemistry Practical - I	6	30	50	80	5
14.	09CHE C19	Advanced Inorganic Chemistry Practical - II	6	30	50	80	5
15.	09CHE C15	Project	-	* 50	# 150	200	9
Elective Courses							
16.	09CHE E01	Analytical Chemistry	3	25	75	100	4
17.	09CHE E02	Instrumental Methods of Analysis	3	25	75	100	4
18.	09CHE E03	Environmental Chemistry	3	25	75	100	4
19.	09CHE E04	Polymer Chemistry	3	25	75	100	4
20	09CHE E05	Materials Chemistry	3	25	75	100	4
21	09CHE E06	Medicinal Chemistry	3	25	75	100	4
22	09CHE E07	Dye Chemistry	3	25	75	100	4
23	09CHE E08	Chemistry of Water Treatment	3	25	75	100	4
Supportive Courses for other Departments							
24.	09CHE S01	Fundamental Aspects of Electroanalytical Techniques	3	25	75	100	4
25.	09CHES02	Conducting Polymers	3	25	75	100	4
26.	09CHE S03	Industrial and Agricultural Chemistry	3	25	75	100	4
27.	09CHE S04	Chemistry of Natural Products	3	25	75	100	4
28.	09CHE S05	Chemistry Of Industrial Products	3	25	75	100	4
29.	09CHE S06	Fundamentals of Analytical Chemistry	3	25	75	100	4
30	09CHE S07	Pharmaceutical Chemistry	3	25	75	100	4
31.	09CHE S08	Applied Catalysis	3	25	75	100	4

*** Periodic Presentation of Learning 50 marks**
 # Concise Dissertation 100 marks + Viva-Voce 50 marks

M.Sc. Chemistry (Physical Chemistry Specialization)
CBCS

Sl. No.	Paper Code	Title of the Paper	Exam Hours	I	E	T	C
Core Courses							
1.	09CHE C01	Organic Reaction Mechanism	3	25	75	100	4
2.	09CHE C02	Organic Photochemistry and Pericyclic Reactions	3	25	75	100	4
3.	09CHE C03	Cluster Compounds and Nuclear Chemistry	3	25	75	100	4
4.	09CHE C04	Coordination Chemistry	3	25	75	100	4
5.	09CHE C05	Quantum Chemistry and Surface Phenomena	3	25	75	100	4
6.	09CHE C06	Thermodynamics and Electro Chemistry	3	25	75	100	4
7.	09CHE C20	Advanced Kinetics and Photochemistry	3	25	75	100	4
8.	09CHE C21	Advanced Topics in Physical Chemistry & Spectroscopy	3	25	75	100	4
9.	09CHE C09	Spectroscopy	3	25	75	100	4
10.	09CHE C10	Organic Chemistry Practical	6	30	50	80	5
11.	09CHE C11	Inorganic Chemistry Practical	6	30	50	80	5
12.	09CHE C12	Physical Chemistry Practical	6	30	50	80	5
13.	09CHE C22	Advanced Physical Chemistry Practical - I	6	30	50	80	5
14.	09CHE C23	Advanced Physical Chemistry Practical - II	6	30	50	80	5
15.	09CHE C15	Project	-	* 50	# 150	200	9
Elective Courses							
16.	09CHE E01	Analytical Chemistry	3	25	75	100	4
17.	09CHE E02	Instrumental Methods of Analysis	3	25	75	100	4
18.	09CHE E03	Environmental Chemistry	3	25	75	100	4
19.	09CHE E04	Polymer Chemistry	3	25	75	100	4
20	09CHE E05	Materials Chemistry	3	25	75	100	4
21	09CHE E06	Medicinal Chemistry	3	25	75	100	4
22	09CHE E07	Dye Chemistry	3	25	75	100	4
23	09CHE E08	Chemistry of Water Treatment	3	25	75	100	4
Supportive Courses for other Departments							
24.	09CHE S01	Fundamental Aspects of Electroanalytical Techniques	3	25	75	100	4
25.	09CHES02	Conducting Polymers	3	25	75	100	4
26.	09CHES03	Industrial and Agricultural Chemistry	3	25	75	100	4
27.	09CHE S04	Chemistry of Natural Products	3	25	75	100	4
28.	09CHE S 5	Chemistry Of Industrial Products	3	25	75	100	4
29.	09CHE S06	Fundamentals of Analytical Chemistry	3	25	75	100	4
30	09CHE S07	Pharmaceutical Chemistry	3	25	75	100	4
31.	09CHE S08	Applied Catalysis	3	25	75	100	4

*** Periodic Presentation of Learning 50 marks**
 # Concise Dissertation 100 marks + Viva-Voce 50 marks

VIII. Question Paper Pattern

Time: 3 Hours Max. Marks - 75

PART-A: 5x3=15

(Answer all questions)
(One question from each unit with internal choice)
(No Sub-Division)

1. a) or b)
2. a) or b)
3. a) or b)
4. a) or b)
5. a) or b)

PAPER-B: 5x12=60

(Answer all questions)
(One question from each unit with internal choice)
(Maximum two Sub-Divisions only)

6. a) or b)
7. a) or b)
8. a) or b)
9. a) or b)
10. a) or b)

IX . Distribution of marks for practical examinations

(Internal marks 30 + External Marks 50 marks)

Organic Chemistry Practical	
Qualitative analysis	30 marks
Preparation	10 marks
Viva – Voce in practical	5 marks
Record	5 marks
Total	50 marks

Inorganic Chemistry Practical	
Qualitative analysis	30 marks
Preparation	10 marks
Viva-voce in practical	5 marks
Record	5 marks
Total	50 marks

Physical Chemistry Practical	
Experiment	40 marks
Viva-voce in practical	5 marks
Record	5 marks
Total	50 marks

Organic Chemistry Specialization

(Internal marks 30 + External Marks 50 marks)

Advanced Organic Chemistry Practical – I	
Quantitative analysis	30 marks
Preparation	10 marks
Viva – Voce in practical	05 marks
Record	05 marks
Total	50 marks

Advanced Organic Chemistry Practical II	
Quantitative analysis	30 marks
Preparation	10 marks
Viva – Voce in practical	05 marks
Record	05 marks
Total	50 marks

Inorganic Chemistry Specialization

(Internal marks 30 + External Marks 50 marks)

Advanced Inorganic Chemistry Practical –I	
Complex metrictitration	30 marks
Spectroscopic Experiment	10 marks
Viva-voce in practical	05 marks
Record	05 marks
Total	50 marks

Advanced Inorganic Chemistry Practical II	
Quantitative analysis	30 marks
Preparation	10 marks
Viva-voce in practical	05 marks
Record	05 marks
Total	50 marks

Physical Chemistry Specialization

(Internal marks 30 + External Marks 50 marks)

Advanced Physical Chemistry Practical I	
Experiment	40 marks
Viva-voce in practical	05 marks
Record	05 marks
Total	50 marks

Advanced Physical Chemistry Practical –II	
Experiment	40 marks
Viva-voce in practical	05 marks
Record	05 marks
Total	50 marks

X. Dissertation / Project Work

Dissertation / Project Work: 200 marks

Periodic Presentation of Learning	50 marks
Concise Dissertation	100 marks
Viva-Voce	50 marks
Total	200 marks

(a) Topic:

The topic of the dissertation shall be assigned to the candidate before the end of first semester and a copy of the same should be submitted to the University for Approval.

(b) **Advisory Committee**:

Each guide shall have a maximum of five students.

There will be an advisory committee consisting of the guide as chairman and one member from the same department or allied departments of the University.

(c) **Plan of Work:**

The student should prepare plan of work for the dissertation, get the approval of the advisory committee and should be submitted to the university during the second semester of their study. In case the student want to avail the facility from other University/laboratory, they will undertake the work with the permission of the guide and

acknowledge the alien facilities utilized by them.

The duration of the dissertation research shall be a minimum of three months in the fourth semester.

(d) Dissertation Work out side the Department:

In case the student stays away for work from the Department for more than one month, specific approval of the university should be obtained.

(e) No.of copies/distribution of dissertation:

The students should prepare three copies of dissertation and submit the same for the evaluation by Examiners. After evaluation one copy is to be retained in the Department library and one copy is to be submitted to the University (Registrar) and one copy can be held by the student.

(f) Format to be followed:

The format/certificate for dissertation to be submitted by the students are given below:

Format for the preparation of project work:

(a) Title page

(b) Bonafide Certificate

(c) Acknowledgement

(d) Table of contents

CONTENTS

Format of the Title Page:

TITLE OF THE DISSERTATION

Dissertation Submitted in part fulfillment of the requirement for the Degree of Master of Science in Chemistry with specialization in

_____

to the Periyar University, Salem-636 011.

By

Students Name:

Register Number:

Department of Chemistry

Year:

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ---------- submitted in part fulfillment of the requirement of the degree of Master of Science in Chemistry with specialization in ---------- to the Periyar University, Salem is a record of bonafide research work carried out by ----------under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

Date:

Chairman, Advisory Committee,

Place:

Approved by

Chairman:

Members:

1.

2.

External Examiner

Guidelines for approval of M.Sc. Chemistry guides for guiding students in their research

for submitting dissertation:

1. M.Sc. Chemistry (Part fulfillment) Guide:

   (i) The person seeking for recognition, as guide should have:

   (a) A Ph.D. Degree in Chemistry or specializations in various branches of Chemistry (or)

   (b) M.Phill / M.Sc. degree in Chemistry with first class/second class

   (c) Should have 3 years of active teaching/research experience

   (ii) They should have published at least one research paper in a National Journal authored solely or jointly.

2. Procedure for submitting application for approval as guides:

   (i) The University will on request give prescribed application form.

   (ii) The filled in applications should be submitted before the close of said date by the University.

   (iii) All such applications should be routed through the HOD with specific recommendations.

   (iv) All relevant proofs should be submitted along with the applications.

3. Approval:

The committee constituted for the purpose will scrutinize the applications and recommend for approval/rejection.

Orders will then be passed by the authority of the University and communicated to each member individually through the Principal.

XI. Rural Development Course (RDC)

The four districts in the jurisdiction of Periyar University are very backward districts, where a majority of the people lives in poverty. The rural mass is economically and educationally backward. Thus the aim of the introduction of this Rural Development Course (RDC) is to extend outreach programs in environmental awareness, hygiene and health to the rural masses of this region.

The students in their Third semester have to visit any one of the villages within the jurisdiction of Periyar University and can arrange various programmes to educate the rural masses in the following areas for three days. A minimum of two faculty members can accompany the students and guide them.

1. Environmental awareness

2. Hygiene and health

This course is a compulsory course for all the M.Sc Chemistry students of the Department of Chemistry, Periyar University. Students will be awarded TWO credits apart from the minimum credits 90 to be earned for the M.Sc. programme.

XII. Passing Minimum

The candidate shall be declared to have passed the examination if the candidate secures a minimum of 50 % (Each in Internal and External) in the University examination.

For a pass in the Practical paper, a candidate has to secure a minimum of 50% marks in the University examination. There is no passing minimum for the record notebook. However submission of a record notebook is a must.

For the project work and viva-voce a candidate should secure 50% of the marks for pass. The candidate should compulsorily attend viva-voce examination to secure pass in that paper.

Candidates who do not obtain the required minimum marks for a pass in a paper/Project Report shall be required to appear and pass the same at a subsequent appearance.

XIII. Classification of Successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in First Class.

All other successful candidates shall be declared to have passed in the Second Class.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in First Class with Distinction provided they pass all the examinations prescribed for the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period two academic years from the year of admission to the course only are eligible for University Ranking.

A candidate is deemed to have secured first rank provided he/she

(i) should have passed all the papers in first attempt itself

(ii) should have secured the highest over all grade point average (OGPA)

XIV. Maximum Duration for the Completion of the Course

The maximum duration for completion of M.Sc. Degree in Chemistry with specialization Organic/Inorganic/Physical Chemistry Programme shall not exceed eight semesters.

XV. Commencement of this Regulation

These regulations shall take effect from the academic year 2009-10.i.e., for students who are to be admitted to the first year of the course during the academic year 2009-10 and thereafter.

XVI. Transitory Provision

Candidates who were admitted to the M.Sc. Degree in Chemistry with specialization Organic/Inorganic/Physical Chemistry course of study before 2009-2010 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., up to and inclusive of the examination of April/May 2012. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

XVII. Syllabus

Core Courses

09CHE C01 ORGANIC CHEMISTRY – REACTION MECHANISM

Hours	L	T	P	C
72	4	0	0	4

UNIT – I Basic Concepts

Formation, stability and reactions of carbenes and nitrenes. Non-classical carbonium ions.

Kinetic and thermodynamic control of chemical reactions; Methods of determining reaction mechanism - kinetic methods – Primary and secondary kinetic isotopic effects; Non-kinetic methods – Study of intermediates, product analysis, isotope labeling, Stereochemical studies and cross over experiments; Principle of microscopic reversibility; Hammond postulate.

Linear free energy relationship; Hammett equation – Significance of reaction and substituent constants (□ and □); Taft equation.

UNIT II Substitution Reactions

Mechanism of aliphatic nucleophilic substitution - S_N1, S_N2, S_N1CB and S_Ni mechanisms, Ambient nucleophiles, Neighbouring group participation, Nucleophilic substitution at allylic and vinylic carbon. Mechanism of aliphatic electrophilic substitution S_E1, S_E2 mechanisms – Simple examples.

Concept of aromaticity; Nonaromatic and antiaromatic systems; Craig's rule; Alternant and non-alternant hydrocarbons; Chemistry of fullerenes, annulenes and heteroannulenes.

Mechanism of aromatic electrophonic substitution - □ and □ complexes, nitration, halogenation, sulphonation, Friedel–Crafts alkylation and acylation, Reimer-Tiemann reaction and Gattermann – Koch formylation; Orientation and reactivity.

Mechanism of aromatic nucleophilic substitution - benzyne mechanisms.

UNIT III Elimination Reactions

E_1, E_2, E_1cB and E_2C mechanisms; Stereochemistry of elimination – Hofmann and Zaitsev rules; Competition between elimination and substitution; pyrolytic *cis* elimination – Chugaev reaction; Bredt's rule; Hofmann degradation and Cope elimination.

UNIT IV Addition Reactions

Electrophilic, Nucleophilic and Free radical additions – Additions of halogen and halogen acids to C–C multiple bonds; Markovnikov and Anti Markovnikov addition; Stereochemistry of additions; Hydroboration and Diels – Alder reactions.

Reactions of carbonyl group – Mechanisms of Aldol, Perkin, Stobbe and Dieckmann condensations; Conjugate additions to □, □ – Unsaturated carbonyl and nitrile systems – Michael addition.

UNIT V Alkaloids and Terpenoids

General methods of structure elucidation of alkaloids; Structure, synthesis and stereochemistry of the following alkaloids – Quinine, papaverin, lysergic acid, atropine and reserpine; Biosynthesis of alkaloids.

Structure, Stereochemistry and synthesis of zingiberene, cadinene and abietic acid; Biosynthesis of terpenoids.

Text Books

1. Jerry March, **Advanced Organic Chemistry** – **Reactions, Mechanisms and Structure,** IV Edn., John Wiley & Sons, 1992.
2. P.Sykes, **A Guide Book to Mechanisms in Organic Chemistry**, VI Edn., Longmans Scientifics and Technical, Essex 1986.
3. S.M. Mukherji and S.P.Singh, **Reaction Mechanism in Organic Chemistry**, III Edn., MacMillan, 1984.
4. I.L. Finar**, Organic Chemistry, Vol. II**, V Edn. First Indian reprint, Pearson Education Asia Pvt. Ltd. 2000.

Reference Books

1. F.A.Carey and Sundberg, **Advanced Organic Chemistry, Part A & B**, III Edn. Plenum Press, 1990.
2. S.H.Pine, J.B. Hendrickson, D.J.Cram and G.S.Hammond, **Organic Chemistry,** IV Edn. McGraw-Hill Company 1980.
3. T.H. Lowry and K.S. Richardson, **Mechanism and Theory in Organic Chemistry,** Harper and Row, NY 1976.
4. P.S.Kalsi, **Organic Reactions and Mechanisms**, II Edn. New Age International Publishers, 2000.
5. J.M.Harris and C.C. Wamser, **Fundamentals of Organic Reaction Mechanisms,** John Wiley & Sons, Inc. 1976.
6. R.K. Bansel, **Organic Reaction Mechanisms,** Tata McGraw Hill, 1975.
7. S.W. Pelletier, **Chemistry of Alkaloids,** Van Nostrand Reinhold, 1970.
8. A.A.Newman (Ed.), **Chemistry of Terpenes and Terpenoids**, Academic Press, London, 1972.
9. P.Mehta and M.Mehta, **Organic Chemistry,** Prentice Hall India, New Delhi, 2005.

09CHE C02 ORGANIC PHOTOCHEMISTRY AND PERICYCLIC REACTIONS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Stereochemistry and Conformational Analysis

Newman, Sawhorse and Fisher projection formulae and interconversions; Concept of Chirality; R,S nomenclature; Enantiotropic and diastereotopic atoms and groups; Enantio and Diastereo selective synthesis; Newer methods of asymmetric synthesis including enzymatic and catalytic nexus. E – Z isomerism; Determination of configuration of geometrical isomers.

Configuration and conformation; Conformational analysis of cyclohexane systems; Stability and reactivity of conformers in mono and disubstituted cyclohexanes. Geometrical isomerism in decalins.

UNIT II Photochemistry

Introductory theory-Jablanski diagram, Norrish type I and II reactions, study of photochemical reactions of carbonyl compounds, photooxidations, photoreductions, photocycloadditions and photorearrangements - di-pi-methane rearrangement.

Study of following reactions: Paterno-Buchi, Favorski, Fries, Barton

UNIT III Pericyclic Reactions

Selection rules and stereochemistry of electrocyclic reactions, cycloadditions and Sigmatropic shifts – applications of Frontier Molecular Orbital approach, Correlation diagram approach, Huckel-Mobius approach and perturbation molecular orbital approach; Sommelet-Hauser, Cope and Claisen rearrangements.

UNIT IV Molecular Rearrangements

Favorskii, Stork enamine, Mannich, Barton, Hofmann-Loffler-Freytag, Sharpio, Baeyer-Villiger, Chichibabin and ene reactions; Sharpless asymmetric epoxidation.

Hofmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangements; Reformatsky, Grignard and Wittig reactions; Robinson annulation.

UNIT V Carbohydrates, Peptides, Proteins and Nucleic Acids

Pyranose and furanose forms of aldohexoses and ketohexoses; Structure and synthesis of maltose, lactose and sucrose.

Sequence analysis of peptides by chemical, enzymatic and mass spectrometric methods; Peptidisation methods like activated ester method, mixed anhydride method using reagents like DCC and Woodward reagent.

Classification of proteins; Primary, secondary and tertiary structures of proteins and their functions.

Nucleic acids – nucleosides and nucleotides, their chemistry including synthesis; RNA and DNA; Functions of nucleic acids.

Text Books

1. Ernest L. Eliel, **Stereochemistry of carbon compounds**, T.M.H. Edn., Tata McGraw-Hill Publishing Company, 1962.
2. P.S.Kalsi, **Stereochemistry – Conformation and Mechanism**, New Age International (P) Ltd. VI Edn., 2005.
3. J.M.Coxon and B. Halton, **Organic Photochemistry**, Cambridge University Press 1974.
4. Jerry March, **Advanced Organic Chemistry – Reactions, Mechanisms and Structure,** IV Edn., John Wiley & Sons, 1992.
5. Paul de Mayo, **Molecular Rearrangements, Vol.I, Vol. II**, Interscience, NY, 1963.
6. I.L. Finar**, Organic Chemistry, Vol.II**, V Edn., First Indian reprint, Pearson Education Asia Pvt.Ltd., 2000.

Reference Books

1. D.Nasipuri, **Stereochemistry of Organic Compounds**, New Age International Publishers, 1994.
2. V.M. Potapov, **Stereochemistry**, MIR Publishers, Moscow 1979.
3. E.L.Eliel, N.C. Alliger, S.J.Angyal and G.A.Morrison, **Conformational Analysis,** Interscience, NY 1965.
4. P.S. Kalsi, **Stereochemistry and Mechanism through solved problems**, Second

Edition, New Age International Publishers, 1994.

5. Charles A. Depuy and Orville L. Chapman, **Molecular reactions and Photochemistry,** Prentice Hall of India Pvt. Ltd, 1972.
6. N.J.Turro, **Modern Molecular Photochemistry**, Benjamin/ Cummings, Menlo Park, California, 1978
7. R.T. Morrison and R.N. Boyd, **Organic Chemistry,** Allyn and Bacon Inc., 1983.
8. S.H.Pine, J.B. Hendrickson, D.J.Cram and G.S.Hammond, **Organic Chemistry,** IV Edn., McGraw-Hill Company 1980.
9. P.S.Kalsi, **Organic Reactions and Mechanisms**, II Edn. New Age International Publishers, 2000.
10. J.M.Harris and C.C. Wamser, **Fundamentals of Organic Reaction Mechanisms,** John Wiley & Sons, Inc. 1976.

09CHE C03 CLUSTER COMPOUNDS AND NUCLEAR CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Structure and Bonding

Van der Waals bonding, Hydrogen bonding; HSAB concept; polyacids - Isopolyacids of V, Cr, Mo and W; Heteropolyacids of Mo and W (only structural aspects). Inorganic polymers - silicates - structure, properties, correlation and application; Molecular sieves; polysulphur nitrogen compounds and polyorganophosphazenes.

UNIT II Boron Compounds and Clusters

Boron hydrides, polyhedral boranes, hydroborate ions- a general study of preparation, properties and structure; Carboranes - types such as closo and nido, preparation, properties and structure; Metallo carboranes - a general study; Metal clusters-chemistry of low molecularity metal clusters only, multiple metal-metal bonds.

UNIT III \Nuclear Chemistry I

Nuclear structure - stability of nuclei, packing fraction, even-odd nature of nucleons, n/p ratio, nuclear potential, binding energy and exchange forces; shell model and liquid drop model; Decay of radio nuclei - rate of decay; determination of half-life period; Modes of decay - alpha, beta, gamma and orbital electron capture; nuclear isomerism; internal conversions; Q value; nuclear cross section; threshold energy and excitation functions.

UNIT IV Nuclear Chemistry II

Different type of nuclear reactions with natural and accelerated particles-transmutation, stripping and pick-up, spallation, fragmentation, fission; Characteristic of fission reaction, product distribution and theories of fission; fissile and fertile isotopes - U^{235}, U^{238}, Th^{232} and Pu^{239}; atom bomb; nuclear fusion - steller energy; Synthesis of new elements; principles underlying the usage of radioisotopes in analysis – agriculture, industry, medicine, mechanism of chemical reactions; uses of radioisotopes in analytical chemistry; isotopic dilution analysis; neutron activation analysis and dating methods.

UNIT V Experimental Methods

Cloud chamber, nuclear emulsion, bubble chamber, proportional counters, G.M. Counter, Scintillation counters and Cherenkov counters. Particle accelerators - Linear accelerator, Cyclotron, Synchrotron, Betatron and Bevatron.

Text Books

1. H.J. Emelius and Sharpe, **Modern aspects of Inorganic chemistry,** Universal book Stall, New Delhi, 1989.
2. J.E. Huheey, E.A. Keiter and R.L. Keiter, **Inorganic Chemistry- Principles of structure and reactivity**, 4th edition, Pearson-Education, 2002.
3. F.A. Cotton and G. Wilkinson, **Advanced Inorganic Chemistry,** Wiley Eastern, 5th edition, 1988.
4. S. Glasstone, **Source book of atomic Energy**, Van Nonstrand Co., 1969.
5. H.J. Arniker, **Essentials of nuclear chemistry**, 2nd edition Wiley eastern Co.,1987.

Reference Books

1. E.L. Mutteri, **Polyhedral boranes**, Acadamic press, NY, 1975.
2. N.H. Ray, **Inorganic polymers**, Academic press, NY, 1975.
3. K.F. Purcell and J.C. Kotz, **Inorganic Chemistry,** WB Saunders Co. USA 1977.
4. G.S. Manku, **Inorganic Chemistry,** TMH Co., 1984.
5. A.K. Srivatsava and P.C. Jain, **Elements of Nuclear Chemistry,** S. Chand and Co., 1989.
6. G. Friedlander, J.W. Kennedy and J.M. Miller, **Nuclear and Radiochemistry,** Wiley, 1964.

09CHE C04 COORDINATION CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Metal-Ligand Bonding

18 Electron rule; EAN rule, theories of coordination compounds - valence bond theory, crystal field theory - splitting of d-orbitals in different symmetries, crystal field stabilization energy, factors affecting the magnitude of 10 Dq, evidence for crystal field stabilization, spectrochemical series, site selection in spinels, tetragonal distortion from octahedral symmetry, Jahn-Teller distortion; Molecular Orbital Theory - octahedral complexes, tetrahedral and square planar complexes, pi bonding and molecular orbital theory, experimental evidence for pi-bonding.

UNIT II Electronic Spectra and Magnetic Properties

Term states of d^n ions - microstates and their classifications, electronic spectra of coordination compounds - selection rules, band intensities and band widths; energy level diagrams of Orgel and Tanabe - Sugano diagram; spectra of Ti^{3+}, V^{3+}, Ni^{2+}, Cr^{3+}, Co^{2+}, Cr^{2+} and Fe^{2+}; calculation of 10Dq and B for V^{3+} (oct) and Ni^{2+} (oct) complexes.

Magnetic properties of coordination compounds - change in magnetic properties of complexes in terms of spin-orbit coupling; spin only moments of d^n systems; temperature independent paramagnetism; spin cross over phenomena.

UNIT III Structure of Coordination Complexes

Structure of coordination compounds with reference to the existence of various coordination numbers - complexes with coordination number two, complexes with coordination number three, complexes with coordination number four - tetrahedral and square planar complexes, complexes with coordination number five - regular trigonal bipyramidal and square pyramidal; site preference in trigonal bipyramidal complexes, site preference in square planar complexes; coordination number six - distortion from perfect octahedral symmetry, trigonal prism; stereoselectivity and conformation of chelate rings; coordination number seven and eight.

UNIT IV Stability and Stereochemical Aspects

Stability of complexes - thermodynamic aspects of complex formation, factors affecting stability, stability correlations, statistical and chelate effects; Determination of stability constants - polarographic, photometric and potentiometric methods.

Stereochemical aspects - stereoisomerism in inorganic complexes, isomerism arising out of ligand distribution and ligand conformation, chirality.

Macrocyclic ligand types - porphyrins, corrins, Schiff bases, crown ethers, cryptates and catenands. (simple complexes).

UNIT V Reaction Mechanism of transition metal complexes

Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitutions, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reactions. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Text Books

1. J.E. Huheey, E.A. Keiter and R.L. Keiter, **Inorganic Chemistry- Principles of structure and reactivity**, 4th edition, Pearson-Education, 2002.
2. F.A. Cotton and G. Wilkinson, **Advanced Inorganic Chemistry,** Wiley Eastern 1988.
3. S.F.A. Kettle, **Co-ordination compounds**, ELBS, 1973.
4. M.C. Day and J. Selbin, **Theoretical Inorganic Chemistry**, Van Nostrand Co., NY. 1974.
5. K.F. Purcell and J.C. Kotz, **Inorganic Chemistry,** WB. Sanders Co., USA 1977.
6. D. F. Shriver, P. W. Atkins and C.H. Longford, **Inorganic Chemistry,** ELBS, 2nd edition, 1994.
7. R.B. Heslop and K. Jones, **Inorganic Chemistry,** Elsevier, 1976.

Reference Books

1. D. Bannerjea, **Co-ordination Chemistry,** Tata-McGraw Hill, 1993.
2. M.L. Tobe, **Inorganic Reaction Mechanism,** Nelson, 1972.
3. K. Burger, **Coordination Chemistry Experimental Methods,** Butterworths, 1973.
4. B.N. Figgis, **Introduction to Ligand Fields,** Wiley Eastern Ltd, New Delhi, 1976.
5. F. Basolo and R.G. Pearson, **Mechanism of Inorganic Reactions**, Wiley Eastern, 1967.

09CHE C05 QUANTUM CHEMISTRY AND SURFACE PHENOMINA

Hours	L	T	P	C
72	4	0	0	4

UNIT-I Quantum Chemistry-I

Planck's Quantum theory - wave particle duality, Uncertainity principle; Operators and commutation relations- Linear and Hermitian operators. Postulates of quantum mechanics; The Schrodinger equation-Particle in a box (one, two and three dimensional systems).

UNIT-II Quantum chemistry –II

Applications of quantum mechanics - harmonic oscillator, rigid rotator, hydrogen atom; Approximation methods-variation and perturbation methods, application to helium atom.

UNIT-III Quantum Chemistry-III

Born-Oppenheimer approximation- VB and MO treatments of hydrogen molecule; MO for polyatomic molecules; Concept of hybridization-sp, sp^2 and sp^3; Huckel pi- electron theory and its applications to ethylene, butadiene and benzene; Idea of self consistent fields.

UNIT-IV Surface Chemistry

Surface tension; solid-liquid interfaces; contact angle and wetting; Solid-gas interface; Adsorption of gases on solids-Freundlich, Gibbs, Langmuir, Temkin and BET adsorption isotherm; Surface area determination; electrical phenomena at interfaces; micelles and reverse micelles - solublization and microemulsion.

UNIT-V Chemical Kinetics

Methods of determining rate laws; Theories of reaction rates - simple collision theory, ARR theory; treatment of unimolecular reactions (Lindemann-Hinselwood and Rice-Ramsperger-Kassel-Marcus[RRKM] theories); termolecular reactions; chain reactions; explosive reactions; Arrhenius and Eyring equations; Reaction rates in solution; salt effect and solvent dielectric constant; Homogeneous and heterogeneous catalysis; Enzyme catalysis- Michaelis-

Menton kinetics; Fast reactions- study of kinetics by stopped flow technique, relaxation method, flash photolysis and magnetic resonance method.

Text Books

1. D.A. McQuarrie, **Quantum Chemistry**, University Science Books, Mill Valley, California, 1983.
2. J. Rajaram and J.C. Kuriacose, **Kinetics and Mechanism of Chemical Transformations**, MacMillan India Ltd. 1993.
3. P.W.Atkins, **Physical Chemistry,** Oxford University Press, Oxford, 1990.
4. D.A. McQuarrie, **Text Book of Physical Chemistry**, University Science Books, Mill Valley, California, 1983.
5. R.A. Alberty and R.J.Silbey, **Physical Chemistry**, John Wiley and Sons, New York, 1992
6. A.W.Adamson, **Physical Chemistry of surfaces**, 4^{th} edn., Wiley - Interscience, Newyork, 1982.

Reference Books

1. P.W. Atkins, **Molecular Quantum Mechanics**, Oxford University Press, Oxford, 1983
2. M.W.Hanna, **Quantum Mechanics in Chemistry**, W.A.Benjamin Inc. London 1965
3. S. Glasstone, **Thermodynamics for Chemists**, Affiliated East West Press, New Delhi 1960.
4. K.J.Laidler, **Chemical Kinetics**, Harper and Row, New York,1987.
5. R.G. Frost and Pearson, **Kinetics and Mechanism**, Wiley New York, 1961
6. R.K.Prasad, **Quantum Chemistry**, Wiley Eastern, New Delhi,1992.
7. A.W.Anderson, **Physical Chemistry of Surfaces**, Wiley - Interscience, Newyork, 1990.

09CHE C06 THERMODYNAMICS AND ELECTROCHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT- I Group theory-I

Symmetry elements; symmetry operations; point groups - identification and determination; comparison of molecular and crystallographic symmetry; reducible and irreducible representations; direct product representation; orthogonality theorem and its consequences; character table. Hybrid orbitals in non-linear molecules – Examples: H_2O, NH_3, BF_3, CH_4 and XeF_4. Determination of representations of vibrational modes in non-linear molecules such as water, ammonia, BF_3, CH_4 and XeF_4.

UNIT-II Thermodynamics

First law of thermodynamics; temperature dependence of enthalpies; Second law of thermodynamics; Gibbs-Helmholtz equation; Third law of thermodynamics. Free energy and entropy of mixing; chemical potential, partial molar volume and partial molar heat content. Variation of chemical potential with temperature and pressure- Gibbs-Duhem equation. Thermodynamics of ideal and real gases-fugacity, activity and activity coefficient.

UNIT- III Statistical thermodynamics

Thermodynamic probability and entropy; Boltzman distribution law; Maxwel-Boltzman, Bose-Einstein and Fermi-Dirac statistics; vibrational, rotational and electronic partition functions; calculation of thermodynamic functions and equilibrium constants; Theories of specific heats of solids; postulates and methodologies of non-equilibrium thermodynamics; linear laws; Gibbs equation;

UNIT-IV Non-equilibrium thermodynamics

Thermodynamic criteria for non-equilibrium states; entropy production and entropy flow; entropy balance equations for different irreversible processes (heat flow, chemical reaction etc.); Non-equilibrium stationary states; microscopic reversibility; Onsager reciprocal theory.

UNIT-V Electrochemistry

Mean ionic activity and activity coefficient of electrolytes in solutions; ideal and non-

ideal solutions; excess functions; Hydration number; Debye-Huckel treatment of dilute electrolyte solutions; Debye-Huckel limiting law; Electrochemical cell reactions - Electrode-electrolyte interface; electrokinetic phenomina; electrode kinetics; Batteries-primary and secondary; fuel cells; corrosion and its prevention.

Text Books

1. V. Ramakrishnan and M.S. Gopinathan, **Group theory in Chemistry**, Vishal Publications,1988.
2. J. Rajaram and J.C. Kuriacose, **Thermodynamics for Students of Chemistry**, Lal Nagin Chand, New Delhi, 1986.
3. M.C. Gupta, **Statistical Thermodynamics**, Wiley Eastern, New Delhi,1990.
4. J. Rajaram and J.C. Kuriacose, **Irreversible Thermodynamics,** Lal Nagin Chand, New Delhi, 1989.
5. S.Glasstone, **Introduction to Electrochemistry**, Affiliated East west Press, New Delhi 1960.

Reference Books

1. F.A. Cotton, **Chemical Application of Group Theory**, John Wiley and Sons Inc. New York,1971.
2. K.V. Raman, **Group theory and its applications to Chemistry**, Tata McGraw-Hill Publishing Company,1990.
3. R.P.H.Gasser and W.G.Richards, **Introduction to Statistical Thermodynamics**, World Scientific, Singapore, 1995.
4. D.R. Crow, **Principles and application of Electrochemistry**, Chapman and Hall, 1991.
5. J.O.M. Bockris and A.K.N. Reddy, **Electrochemistry**, Vols. 1 and 2, Plenum, New York, 1977.
6. P.H.Rieger, **Electrochemistry**, Chapman and Hall, New York, 1994.

09CHE C07 ADVANCED ORGANIC CHEMISTRY – ORGANIC SYNTHESIS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Advanced Conformational Analysis

Conformation and reactivity in steroids; Reactions of enols and enolates – reflex effect and conformational transmission; Stereochemistry of conjugate addition; Allylic strain; Transannular interactions; Concept of internal strain; Conformational rule.

Conformation, stability and reactivity of decalins and perhydrophenanthrenes; Conformational analysis of carbohydrates – nomenclature, methods of determining conformations, anomeric effect and $\square^2$ effect.

UNIT II Functional Group Interconversions

Functional group interconversions involving C=O, CHO, OH, SH, COOH, C=C, NH_2, COOR, CONHR, C-Cl and C-Br functional groups; Protection and deprotection of reactive sites.

UNIT III Retrosynthetic analysis and C-X disconnections

An introduction to synthons and synthetic equivalents, disconnection approach. The importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polaritiy, cyclization reactions, amine synthesis.

UNIT IV Organic Synthesis: C-C disconnections

One group C-C disconnections – Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, Olefination of carbonyl compounds-Mc Murry's method use of acetylenes and aliphatic nitro compounds in organic synthesis.

Two group C-C disconnections – Diels Alder reaction, Michael addition and Robinson annelation, Stark-Enamine reaction.

UNIT V Reagents in Organic Synthesis

Use of the following reagents in organic synthesis and functional group transformations - Complex metal hydrides, Gilman's reagent, lithium diisopropylamide (LDA), dicyclohexylcarbodiimide, 1,3-dithiane (reactivity umpolung), trimethylsilyl iodide, tri-n-butyltin hydride, DDQ, phase transfer catalysts, crown ethers, Merrifield resin, Wilkinson's catalyst and baker yeast; Woodward and Prevost hydroxylation, Peterson's synthesis.

Text Books

1. Ernest L. Eliel and Samuel H. Wilen, **Stereochemistry of Organic Compounds**, John Wiley & sons, INC, 1994.
2. D. Nasipuri, **Stereochemistry of Organic Compounds**, New Age International Publishers, II Edn. 1994.
3. R.E. Ireland, **Organic Synthesis**, Prentice Hall, 1969
4. R.K. Mackie, D. M.Smith and R.A. Aatkin, **Guide Book to Organic Synthesis**, 2nd edn, Longman Scientific and Technical, London, 1990

Reference Books

1. E.L.Eliel, N.C. Alliger, S.J. Angyal and G.A. Morrison, **Conformational Analysis,** Interscience, NY, 1965.
2. P.S. Kalsi, **Stereochemistry and Mechanism through solved problems**, II Edn., New Age International Publishers, 1994.
3. R.O.C. Norman, **Principles of Organic Synthesis**, II Edn., Chapman and Hall, 1993.
4. S.Warren, **Designing Organic Synthesis – A Programmed Introduction to Synthon Approach**, Wiley, NY, 1978.
5. S.Turner, **Design of Organic Synthesis**, Elsevier, 1976
6. Raymond K. Mackie, David M.Smith and R.A. Aatkin, **Guide Book to Organic Synthesis,** Longman Scientific and Technical, London, 1990.

09CHE C08 ADVANCED TOPICS IN ORGANIC CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Oxidation and reduction reactions

Mechanism and study of the following reactions – oxidation with chromium, manganese, osmium, lead, ruthenium and selenium.

Reductions: catalytic hydrogenations, metal hydride reductions (LAH, NaBH and their derivatives) Metal-ammonium reductions, Selectivity in reductions.

UNIT II Advanced NMR Spectroscopy

Non first order spectra – simplification of complex spectra, high fields, deutrium substitution, shift reagents, satellite peaks and spin decoupling; Dynamic NMR – hindered rotation, ring reversal, atomic inversion and valence tautomerization.

C, H coupling – relationship between J and s character; Nuclear Overhauser effect; 2D NMR with emphasis on the application of H-H COSY, NOESY and ROSY.

UNIT III Chiroptical Properties

ORD and CD – Circular bireferengence and Circular dichroism; Plain dispersion curves - single and multiple cotton effect curves and their applications; Octant rule; □-haloketone rule; Comparison of ORD and CD and their applications.

UNIT IV Bioorganic Chemistry

Characteristics of enzymes – mechanism of enzyme action; Chymotrypsin; Biological energy – ATP as universal currency of free energy, NADH, NADHP and $FADH_2$ as major electron carriers; Co-enzyme A as an universal carrier of acyl groups; Glycolysis – various stages of glycolysis and the enzymes involved; Citric acid cycle and Urea cycle – various stages of cycles and the enzymes involved; Link between glycolysis and citric acid cycle; Biological oxidation – mechanism of biological oxidation of glyceraldehydes-3-phosphate to 1,3-diphosphogylcerate as an example; biosynthesis of fatty acids.

UNIT V Vitamins and Antibiotics

Chemistry of the following antibiotics: penicillin, streptomycin, chloromycetin, oxy tetracycline and griseofulvin; Detailed chemistry and physiological action of Vitamin A, ascorbic

acid, thiamin, riboflavin and elementary aspects of Vitamin B_{12}.

Text Books

1. P.S. Kalsi, **Spectroscopy of Organic Compounds**, Wiley Eastern Ltd. Madras, 1995.
2. William Kemp, **NMR in Chemistry**, Mac Millan, 1986.
3. R.O.C. Norman, **Principles of Organic Synthesis**, Second edn., Chapman and Hall, 1993.
4. R.E. Ireland, **Organic Synthesis**, Prentice Hall, 1969.
5. R.K. Mackie, D. M.Smith and R.A. Aatkin, **Guide Book to Organic Synthesis**, 2nd edn. Longman Scientific and Technical, London, 1990
6. Ernest L. Eliel and Samuel H. Wilen, **Stereochemistry of Organic Compounds**, John Wiley & sons, INC, 1994.
7. C. Djerassi, **Optical Rotatory Dispersion,** Mc Graw Hill, 1960.
8. I.L. Finar**, Organic Chemistry, Vol.II**, Fifth edn. First Indian reprint, Pearson Education Asia Pvt. Ltd. 2000
9. A.L. Lehninger, **Biochemistry,** W.H. Freeman & Company, II Edn., 1975.
10. M.N. Hughes, **The Inorganic Chemistry of Biological Processes**, Wiley, London II edn., 1982.
11. Atta-Ur-Rahman and M.I. Choudhary, **New Trends in Natural Product Chemistry,** Gordon & Breach Science Publishers, I Edn., 1998.

Reference Books

1. M.R. Rifi and Frank H. Covitz, **Introduction to organic electrochemistry - techniques and applications in organic synthesis,** Marcel Dekker, New York, 1978.
2. S.Warren, **Designing Organic Synthesis – A Programmed Introduction to Synthon Approach**, Wiley, NY, 1978
3. S.Turner, **Design of Organic Synthesis**, Elsevier, 1976
4. D.Nasipuri, **Stereochemistry of Organic Compounds**, IInd Edn, New Age International Publishers, 1994.
5. H.Singh and V.K.Kapoor, **Organic Pharmaceutical Chemistry,** Vallabh, Prakashan, 2001.

09CHE C16 ADVANCED INORGANIC CHEMISTRY – ORGANOMETALLIC CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Structure and Bonding

Definition of organometallic compound; classification of organometallic compounds; the metal carbon bond types - ionic bond, covalent bond, electron deficient bond, delocalised bond, dative bond; metal carbonyl complexes - synthesis, structure and reactions of metal carbonyls; the nature of M-CO bonding, binding mode of CO; IR spectra of metal carbonyls, metal carbonyl anions, metal carbonyl hydrides, metal carbonyl halides; metal carbonyl clusters - Wades rule and isolobal relationship; metal nitrosyls; dinitrogen complexes; dioxygen complexes.

UNIT II Chemistry of Metal Alkyl Complexes

Metal alkyl complexes - stability and structure, synthesis by alkylation of metal halides, by oxidative addition, by nucleophilic attack on coordinated ligands; metal alkyl and 18 electron rule; reactivity of metal alkyls - M-C bond cleavage reactions, insertion of CO to M-C bonds, double carbonylation, insertions of alkenes and alkynes, insertions of metals with C-H bonds; alkylidene and alkylidyne complexes - synthesis of alkylidene complexes in low oxidation states and in high oxidation states, bonding in alkylidene complexes; synthesis and bonding in alkylidyne complexes; reactivity of alkylidene and alkylidyne complexes.

UNIT III Chemistry of Alkene and Alkyne Complexes

Alkene complexes - synthesis of alkene complexes by ligand substitution, by reduction and by metal atom synthesis; bonding of alkenes to transition metals - bonding in diene complexes; reactivity of alkene complexes; ligand substitution reactions with nucleophiles - olefin hydrogenation, hydrosilation; Wacker process; C-H activation of alkenes; alkyne complexes - bonding in alkyne complexes, reactivity, alkyne complexes in synthesis - Cobalt catalysed alkyne cycloaddition.

UNIT IV Chemistry of Cyclopentadienyl, Allyl and Arene Complexes

Cyclopentadienyl complexes – metallocenes - synthesis of metallocenes, bonding in metallocenes, reactions of metallocenes, Cp_2Fe/Cp_2Fe^+ couples in biosensors, bent sandwich

complexes, bonding in bent sandwich complexes, metallocene halides and hydrides; metallocene and stereospecific polymerization of 1-alkenes; cyclopentadiene as a non-spectator ligand; monocyclopentadienyl (half-sandwich) complexes; synthesis and structures of allyl complexes; arene complexes – synthesis, structure and reactivity of arene complexes; multidecker complexes.

UNIT V Homogeneous Catalysis by Transition Metal Complexes

Organometallic compounds in homogeneous catalytic reactions-coordinative unsaturation, acid-base behaviour reaction, migration of atoms or groups from metal to ligand, insertion reaction, reactions of coordinated ligands; catalytic reactions of alkenes - isomerisation of alkenes, hydrogenation, hydroformylation and hydrosilation of alkenes; alkene polymerization and oligomerisation.

Text Books

1. Bockmann, **Organometallics 1, complexes with transition metal-carbon □-bonds**, Oxford science publications, Oxford, 1996.
2. Bockmann, **Organometallics 2, complexes with transition metal-carbon □-bonds**, Oxford science publications, Oxford, 1996.
3. J. Haiduc and J.J. Zuckerman, **Basic Organometallic Chemistry,** Walter de Gruyter, Brelin, 1985.
4. J. E. Huheey, **Inorganic Chemistry – Principles of structure and reactivity**, Harper International Edition, Harper and Rone, New York, 1978.
5. F. A. Cotton and G. Wilkinson, **Advanced Inorganic Chemistry**, 5th Edition, 1988.

Reference Books

1. W.L. Jolly, **Modern Inorganic Chemistry,** McGraw-Hill, 2nd edition, 1991.
2. K.M. Mackey and R.A. Mackey, **Introduction to Modern Inorganic Chemistry,** Prentice Hall, 4th edition, 1989.
3. F. Basalo and R,G. Pearson, **Mechanisms of Inorganic Reactions,** Wiley Eastern, 2nd edition, 1977.
4. D.F. Shriver P.W. Atkins and C.H. Long ford, **Inorganic Chemistry,** ELBS 2nd Edition, 1994.

09CHE C17 ADVANCED INORGANIC CHEMISTRY - SOLID STATE AND BIOINORGANICS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Chemistry of lanthanides and Actinides

Electronic configurations, physical and chemical properties, stable oxidation states, the lanthanide contractions, spectral and magnetic properties of the compounds of lanthanides and actinides in comparison with the compounds of transition metals; Structure and bonding in highly coordinated lanthanide and actinide complexes; Uses of lanthanide compounds as shift reagents.

Actinides - Synthesis of elements; extraction of Th and U; technical production of Pu.

UNIT II Structure of Solids

Types of solids – NiAs, CdI2, Pervokite, Spinel-normal and inverse spinels, structures. Diffraction methods – X-ray diffraction, various methods of X-ray analysis of structure, X-ray diffraction pattern, X-ray scattering factor, results and uses of x-ray diffraction, limitations of x-ray diffraction. Comparison of x-ray, electron and neutron diffraction only.

UNIT III Band theory and defects in Solids

Metallic state; free electron and band theories; Non-stoichiometry point defects in solids - Schottky and Frenkel defects, linear defects; dislocations - effects due to dislocations; electrical properties of solids – insulators, intrinsic semiconductors, impurity semiconductors (n and P type) and superconductors.

UNIT IV Photo-electron Spectroscopy

Principle; theoretical-valence and core binding energies; PES of diatomic and polyatomic molecules (HCl, HBr, HI, CO, NH_3, H_2O and N_3^- ion); Koopman's theorem; chemical shifts in X-ray photoelectron spectroscopy; core electron PES, X-ray PES (ESCA); applications.

NMR Spectroscopy: Applications of ^{19}F and ^{31}P-NMR spectra of inorganic compounds; Lanthanide shift reagents; study of fluxional behaviour of molecules.

UNIT V Bioinorganic Chemistry

Metalloporphyrins - the porphyrin ring systems - Chlorophyll, cytochromes; Oxygen carriers - haemoglobin and myoglobin; Ferridoxins and rubredoxins; enzymes; vitamin B_{12} and B_{12} coenzymes - structure and function; synthesis model of enzyme action - Inhibition and poisoning; Nitrogen fixation; Biochemistry of essential and trace elements in biological systems.

Text Books

1. F.A. Cotton and G. Wilkinson, **Advanced Inorganic Chemistry**, Wiley Eastern (P) Ltd., 1988.
2. E.A.V. Ebsworth, D.WH. Rankine and S. Craddock, **Structural methods in Inorganic Chemistry,** Black well Scientific Publ., 1987.
3. R.S. Drago, **Physical Methods in Chemistry** Reinhold, New York, 1968.
4. D. M. Adams, **Inorganic Solids,** John Wiley Sons, 1974.
5. A. R. West, **Basic Solid State Chemistry,** John Wiley Sons, 1991.
6. S.J. Lippard and Berg, **Principles of Bioinorganic Chemistry**, Univ. Science Books 1994.
7. D.E. Fenton, **Biocoordination Chemistry,** Oxford Science Publication 1995.

Reference Books

1. C.N.R. Rao and J.R. Ferraro, **Spectroscopy in Inorganic Chemistry,** Methven Co., London, 1968.
2. HAO. Hill and P. Day, **Physical Methods in Adv. Inorganic Chemistry,** John Wiley, 1986.
3. G.W. King, **Spectroscopy and molecular structure,** Holt Rienehart and Winston, 1964.
4. A.R. West, **Solid state chemistry and its applications**, Wiley, New York, 1984.
5. A. Muller, **Inorganic Structural Chemistry,** Wiley, New York, 1993.
6. J. A. Cowan, **Inorganic biochemistry,** Wiley-VCH, New York, 1997.
7. W.E. Addision, **Structural principles of Inorganic Chemistry**, Longman, 1961.
8. J.E. Huheey, E.A. Keiter and R.L. Keiter, **Inorganic Chemistry- Principles of structure and reactivity**, Pearson-Education 4th Edition, 2002.

09CHE C20 ADVANCED KINETICS AND PHOTOCHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT – I Advanced Chemical Kinetics

Activated complex theory; Reaction coordinates; transmission coefficient; quantum mechanical tunneling; kinetic isotope effect; potential energy surfaces; influence of pressure on solution reactions; molecular cross sections and rate coefficients; reactions in crossed molecular beams; Shock tube technique; Marcus theory of electron transfer reactions.

UNIT – II Advanced Catalysis

Micellar effects on organic reactions; kinetics of excited state processes in micellar media and reverse micelles; photocatalytic aspects of semiconductor clusters and colloids; clays and zeolites; Catalysis of organic reactions, Electrochemical and photochemical applications.

UNIT- III Bioenergetics

Limitations of equilibrium thermodynamics; fluctuations; irreversible processes and steady states; irreversible thermodynamics of bio systems; energy flux; ATP and its role in bioenergetics; role of singlet oxygen in biology; membrane potentials; ion pumps; photoacoustic effect and its applications in biology.

UNIT – IV Photochemistry

Photochemical principles - absorption and emission of radiation, Franck-Condon principle; reaction paths of electronically excited molecules; Radiative and non-radiative processes-Jablanski diagram; fluorescence and phosphorescence; Chemiluminescence; principles of laser action; Flash and laser photolysis; Quantum yield and actinometry; properties of excited states - excited state acidity constants, dipole moments and redox properties; excimers and exciplexes; quenching processes and quenching mechanisms - electron transfer and heavy atom quenching; Stern Volmer equation;

UNIT – V Photochemistry and Radiation Chemistry

Photochemical reactions; Sources of ionizing radiations; dosimetry; radiolysis of water; pulse radiolysis. - photovoltaic and photo galvanic cells; photo electrochemistry; prospects of solar energy conversion and storage.

Text Books

2. J. Rajaram and J.C. Kuriacose, **Kinetics and Mechanism of Chemical Transformations**, MacMillan India Ltd., 1993.

3. K.J.Laidler, **Chemical Kinetics,** Harper and Row, New York 1987.

4. A.R.West, **Solid State Chemistry and its applications,** John Wiley and Sons, New York, 1984.

5. K.K.Rohatgi Mukherjee, **Fundamentals of photochemistry,** Wiley Eastern Ltd.,New York, 1978.

6. A.L.Lehninger, **Bioenergetics,** W.A.Benjamin Inc.,New York, 1965.

7. W.Hoppe, W.Lohmann, H.Markl and H.Uiegler, **Biophysics,** Springer-Verlag, 1983.

Reference Books

1. R.G. Frost and Pearson, **Kinetics and Mechanism**, Wiley New York, 1961
2. C.Capellos and B.H.J.Bielski, **Kinetic Systems**, Wiley Interscience, New York, 1968.
3. G.M. Harris, **Chemical Kinetics**, D.C. Healthand Co., 1966.
4. N.J.Turro, **Modern molecular photochemistry,** Benjamin/Cummings, Menlo Park, California, 1978

09CHE C21 ADVANCED TOPICS IN PHYSICAL CHEMISTRY AND SPECTROSCOPY

Hours	L	T	P	C
72	4	0	0	4

UNIT – I Advanced Quantum Chemistry

Hartree and Hartree –Fock SCF methods-application to He atom; Electron correlation; Roothan and Hartree schemes for polyatomic molecules; HMO method and its applications; PPP method and CNDO approximations.

UNIT – II Advanced NMR Spectroscopy

NMR in solids - magic angle spinning; analysis of complex NMR spectra - AB spectrum; NMR of paramagnetic compounds; Nuclear Overhauser effect; INDOR, CIDNP; ^{13}C spectra - decoupling techniques; 2-dimensional NMR, COSY and NOESY.

UNIT – III Advanced ESR Spectroscopy

ESR - first and second order spectra of hydrogen atom; ESR spectra of organic radicals; mechanism of hyperfine coupling; electron spin-spin interaction; triplet energy levels; half filled transitions; ENDOR; study of molecular rate processes; time scales of magnetic resonance experiments.

UNIT – IV Advanced Electrochemistry

Wien and Debye-Falkenhagen effects; Debye-Huckel-Onsager equation; transport properties in solution; diffusion and ionic mobility; Planck-Henderson equation; Onsager's reciprocity relations; zeta potential; polarisable and non-polarisable interfaces; dynamic electrochemistry - electrode processes; non-equilibrium electrode potential; polarization and over potential; Butler-Volmer equation; Tafel equation; Principles and applications of polarography, amperometry and cyclic voltammetry.

UNIT – V Solid State Chemistry

Elements of crystallography-laws of crystallography, space lattices and unit cells; crystal systems of lower symmetry and point groups; translational symmetry elements and space groups; X-Ray diffraction-mechanism, Bragg's method, rotating crystal method and powder methods of XRD; Interpretation of diffraction pattern.

Text Books

1. R.K.Prasad, **Quantum Chemistry**, Wiley Eastern, New Delhi,1992.
2. J. Rajaram and J.C. Kuriacose, **Kinetics and Mechanism of Chemical Transformations**, MacMillan India Ltd. (1993)
3. K.J.Laidler, **Chemical Kinetics**, Harper and Row, New York,1987.
4. C.N. Banwell, **Fundamentals of Molecular Spectroscopy**, Mc Graw Hill, New York, 1966.
5. J.O.M. Bockris and A.K.N. Reddy, **Electrochemistry**, Vols. 1 and 2, Plenum, NY 1977.
6. A.L.Lehninger, **Bioenergetics,** W.A.Benjamin Inc.,New York, 1965.
7. W.Hoppe, W.Lohmann, H.Markl and H.Uiegler, **Biophysics,** Springer-Verlag, 1983.
8. A.Walton, **Molecular and Crystal Structure Models,** Ellis Horwood, Chichester, 1978.
9. F.C.Phillips, **An Introduction to Crystallography,** John Wiley and Sons, New York, 1963.

Reference Books

1. I.N. Levine, **Quantum Chemistry**, Allyn and Bacon, Boston, 1983
2. H. Eyring, J. Walter and G.Kimball, **Quantum Chemistry**, John Wiley and Sons, New York, 1944.
3. M.W. Hanna, **Quantum Mechanics in Chemistry**, W.A. Benjamin Inc. London, 1965.
4. G.M.Harris, **Chemical Kinetics**, D.C.Healthand Co., 1966.
5. B.Viswanathan, **Catalysis: Principles and applications,** Narosa Publ. New Delhi, 2004.
6. A. Carrigton and A.D. Mc Lachlan, **Introduction to Magnetic Resonance**, Harper and Row, New York 1967.
7. C.W.King, Holt, **Spectroscopy and Molecular Structure**, Rienehart and Winston, 1964.
8. Raymond Chung, **Basic principles of spectroscopy,** McGraw Hill Ltd, New York,1971.
9. D.R. Crow, **Principles and applications of Electrochemistry,** Chapman and Hall, 1991.
10. P.H.Rieger, **Electrochemistry**, Chapman and Hall, New York, 1994.
11. E.Conn and K.Stump**, Outlines of Biochemistry,** John Wiley and Sons, New York, 1987.
12. F.M.Harolg, **The vital force: A study of Bioenergetics,** W.H.Freennan &Co, New York, 1987.

09CHE C09 SPECTROSCOPY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Molecular Spectroscopy

Interaction of matter with radiation, rotational, vibrational and electronic spectroscopy, Microwave, IR, Raman, UV-Visible- theory & instrumentation; rigid rotor, harmonic oscillator and anharmonicity; selection rules; vibrational spectra of polyatomic molecules, vibration frequencies, coupling, overtones, Fermi resonance.

UNIT II NMR Spectroscopy

NMR spectroscopy - theory & instrumentation, Zeeman effect, chemical shift, spin-spin coupling, NMR of simple AX and AMX type molecules, calculation of coupling constants, ^{13}C-NMR- Fourier Transformation, resonance coupled and decoupled spectra; 2D NMR, COSY, NOESY.

UNIT III Mass and Mössbauer Spectroscopy

Mass spectra – theory and instrumentation, McLafferty rearrangement fragmentation pattern. Mössbauer spectroscopy - Doppler effect, isomer shift, electron-neutron hyperfine interactions, Quadrupole interactions and magnetic interactions;

UNIT IV ESR Spectroscopy

ESR Spectroscopy-theory and instrumentation- line width, the ‘g’ values, factors affecting the magnitudes of g and A tensors, zero field splitting and Kramer’s degeneracy.

UNIT V Applications of spectroscopy

Applications of UV, VIS, IR, Raman, NMR and Mass spectral data for the structural elucidation of Organic and inorganic molecules. Problems involving the above spectral data to be worked out in detail. Applications of ESR to few biological molecules containing Cu(II), Fe(II) and Fe(III); Jahn-Teller distortions in Cu(II) complexes; simple applications of Mossbauer spectroscopy to Iron and Tin compounds.

Text Books

1. R.M Silverstein, C.G. Bassler and Morril, **Spectrometric identification of organic compounds**, VI Edn., John Wiley & Sons, New York, 2002.
2. P.S. Kalsi, **Spectroscopy of organic compounds**, Wiley Eastern Ltd., Madras, 1995.
3. C.F. Banwell, **Fundamentals of Molecular Spectroscopy**, McGraw Hill, New York, 1966.
4. R.S. Drago, **Physical methods in chemistry**, Reinhold, New york,1968.

Reference Books

1. G.M.Barrow, **Introduction to Molecular Spectroscopy**, McGrawHill, NewYork, 1962.
2. J.R.Dyer, **Application of absorption spectroscopy of organic compounds**, Prentice Hall of India Pvt. Ltd., New Delhi, 1974.
3. William Kemp, **Organic Spectroscopy**, ELBS, New Delhi, 1982.
4. A.Carrigton and A.D.McLachlan, **Introduction to Magnetic Resonance**, Harper and Row, New York 1967.
5. William Kemp, **NMR in Chemistry**, MacMillan Ltd., 1986.
6. C.N.R.Rao and J.R.Ferraro, **Spectroscopy in Inorganic Chemistry**, Methven Co., London, 1968.
7. Raymond Chang, **Basic Principles of Spectroscopy,** Mc Graw Hill Ltd., New York, 1993.
8. E.A.V. Ebsworth, D.WH. Rankine and S. Craddock, **Structural methods in Inorganic Chemistry,** Black well Scientific Publ., 1987.

09CHE C10 ORGANIC CHEMISTRY PRACTICAL

Hours	L	T	P	C
108	0	0	6	5

1. Organic analysis – separation of two-component mixture and identification of components. The components are to be separated, purified and derivatives are to be prepared. The physical constants of the compounds and derivatives are to be found out.
2. Organic preparations involving double stages:
    a. Sym-tribromobenzene from aniline.
    b. *meta*-nitrobenzoic acid from methyl benzoate
    c. *par*a -nitroaniline from acetanilide.
    d. Benzanilide from benzophenone.
    e. *meta*-nitroaniline from nitrobenzene
    f. Anthraquinone from phthalic anhydride.

Reference Books

1. B.S.Furniss, A.J.Hannaford,, P.W.G.Smith and A.R.Tatchell, **Vogel's Practical Organic Chemistry,** 5^{th} edn. ELBS, 1989.
2. Raj K. Bansal, **Laboratory Manual of Organic Chemistry**, III Edn., New Age International (P) Ltd.1996.

09CHE C11 INORGANIC CHEMISTRY PRACTICAL

Hours	L	T	P	C
108	0	0	6	5

1. Semimicro Qualitative Analysis

Qualitative analysis employing semimicro methods and spot tests of mixtures of common cations and ions of the following less familiar elements.

Thallium, Tungsten, Selenium, Tellurium, Molybdenum, Cerium, Thorium, Titanium, Zirconium, Vanadium, Beryllium, Uranium and Lithium.

2. Preparations

About ten preparations involving different techniques selected from the following: dipyridinium hexachloroplumbate, *ortho* and *para*- hydroxyphenylmercuric chloride, potassium cupricchloride, chrome alum, tris(thiourea)copper(I)nitrate, potassium trisoxalatoaluminate(III), potassium trisoxalatochromate(III), potassium trisoxalatoferrate(III), hexamminecobalt(III) chloride, chloropentamminechromium(III) nitrate, tetramminecopper(II) sulphate, ammonium hexachlorostannate(IV).

Reference Books

1. G. Svehla, **Vogel's qualitative Inorganic analysis,** VI Edition, Orient Longman, 1987.
2. V.V. Ramanujam, **Inorganic Semimicro Qualitative analysis,** National Publishing Co., 1971.

09CHE C12 PHYSICAL CHEMISTRY PRACTICAL

Hours	L	T	P	C
108	0	0	6	5

Experiments in conductivity, Chemical Kinetics, Phase rule, adsorption and distribution methods

1. Distribution Method

a. Determination of concentration of KI solution

b. Determination of partition coefficient of iodine between CCl_4 and water

2. Phase Rule

a. Construction of phase diagram for a simple binary system(naphthalene-phenanthrene).

b. Construction of phase diagram for a three component system (chloroform-water-acetic acid)

3. Adsorption Isotherm

a. Adsorption of oxalic acid/acetic acid on charcoal.

4. Kinetics

a. Kinetics of potassium iodide and potassium persulphate.

b. Acid hydrolysis of methyl acetate/ethyl acetate

5. Conductometry

a. Titration of mixture of acids against strong base

b. Titration of $KMNO_4$ Vs Oxalic acid

6. Potentiometry

a. Titration of acid Vs strong base
b. Titration of mixture of acids Vs strong base

Reference Books

1. B.P.Levitt (Ed.), **Findlay's Practical Physical Chemistry,** 9^{th} edn., Longman, London,1985.
2. J.N.Gurtu and R.Kapoor, **Advanced Experimental Chemistry**, Vol.I, S.Chand & Co. Ltd., New Delhi, 1980.

09CHE C 13 ADVANCED ORGANIC CHEMISTRY PRACTICAL – I

Hours	L	T	P	C
108	0	0	6	5

1) Estimation of Phenol, ketone, carboxylic acid, glucose, ester, amines, ascorbic acid and glycine.

2) Multistage preparation involving a few special reaction techniques: Cannizzaro reaction, Grignard reaction, Fries rearrangement, Beckmann rearrangement and multistage preparation involving oxidations and reductions: Preparation of cyclohexanone, adipic acid, ethyl benzene, benzhydrol and Preparation and stereochemistry of azobenzene

Reference Books

1. Raj K. Bansal, **Laboratory Manual of Organic Chemistry**, III Edn., New Age International (P) Ltd.,1996.
2. B.S.Furniss, A.J.Hannaford, P.W.G.Smith and A.R.Tatchell, **Vogel's Practical Organic Chemistry,** 5^{th} edn. ELBS, 1989.

09CHE C14 ADVANCED ORGANIC CHEMISTRY PRACTICAL – II

Hours	L	T	P	C
108	0	0	6	5

1. Extraction of natural products such as caffeine, embelin and piperin.

2. Determination of iodine value and saponification value of oils.

3. Column Chromatographic separation of mixtures of organic compounds

2. Separation and identification of aminoacids and sugars by paper and thin layer Chromatography.
5. Interpretation of spectra of simple organic compounds.

Reference Books

1. Raj K. Bansal, **Laboratory Manual of Organic Chemistry**, III Edn., New Age International (P) Ltd.1996.

2. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R.Tatchell, **Vogel's Practical Organic Chemistry,** 5th edn. ELBS, 1989.

09CHE C 18 ADVANCED INORGANIC CHEMISTRY PRACTICAL – I

Hours	L	T	P	C
108	0	0	6	5

1. Titrimetry

a) Complexometric titrations involving the estimation of Ca, Mg, Ni, Zn and hardness of water.

b) Oxidation using cerium and vanadium salts.

2. **Spectrophotometric Experiments**

a) Compositions and stability using Job's method

b) Compositions and stability using mole ratio method

c) Determination of Fe^{3+} with thiocyanate

3. Colorimetric Estimations:

Estimations of (using Nessler technique and/or spectrophotometry) Copper, iron, Nickel, Manganese, Chromium and Zirconium.

Note: A minimum of six inorganic mixtures containing, two common and two rare elements should be analysed by a student. Each student should do a minimum of six preparations.

Reference Books

1. J. Basset, R.C. Denney, G.H. Jeffery and J. Mendham, **Vogel's text book of quantitative inorganic analysis,** ELBS, 1994.
2. W.G. Palmer, **Experimental Inorganic Chemistry,** Van Nostrand Reinhold Co., London, 1972.
3. D.N. Grindley, **An advanced course in practical Inorganic Chemistry,** Butterworths, 1964.

09CHE C 19 ADVANCED INORGANIC CHEMISTRY PRACTICAL – II

Hours	L	T	P	C
108	0	0	6	5

1. Quantitative Analysis

Volumetric and gravimetric estimations of mixtures of cations like copper and nickel, copper and zinc, iron and nickel, iron and zinc, calcium and magnesium.

1. Preparation, Analysis and Study of the Properties of Co-ordination Complexes

Note: Quantitative analysis (involving volumetric and gravimetric estimations) of atleast five mixtures of cations should be done by a student. The volumetric procedure may also include EDTA titrations for the estimation of mixture of cations.

Reference Books

1. J. Basset, R.C. Denney, G.H. Jeffery and J. Mendham, **Vogel's text book of quantitative inorganic analysis,** ELBS, 1994.
2. W.G. Palmer, **Experimental Inorganic Chemistry,** Van Nostrand Reinhold Co., London, 1972.
3. D.N. Grindley, **An advanced course in practical Inorganic Chemistry,** Butterworths, 1964.

09CHE C 22 ADVANCED PHYSICAL CHEMISTRY PRACTICAL – I (KINETICS AND CONDUCTOMETRY)

Hours	L	T	P	C
108	0	0	6	5

Experiments in Chemical kinetics, Adsorption and Conductivity measurements:

1. **Distribution Method**
   a. Determination of equilibirium constant of a reaction by partition method.
2. **Adsorption**
   a. Comparision of acid adsorption on molecular sieves and charcoal
   b. Comparision of base adsorption on molecular sieves and charcoal
   c. Comparision of dye adsorption on molecular sieves and charcoal
3. **Kinetics**
   a. Determination of orders of the reaction between KI and potassium persulphate
   b. Salt effect on the kinetics of KI and potassium persulphate
   c. Determination of energy of activation for an acid catalysed hydrolysis of ester
4. **Conductometry**
   a. Determination of dissociation constant of acetic acid by Ostwald's dilution law
   b. Verification of Debye-Huckel-Onsager equation
   c. Determination of order of reaction between ethyl acetate and NaOH
   d. Solubility product (Sodium sulphate Vs Barium Chloride).
   e. Titration potassium dichromate against FAS.

Reference Books

1. B.P.Levitt (Ed.), **Findlay's Practical Physical Chemistry,** 9th Edn., Longman, London,1985.
2. J.N. Gurtu and R. Kapoor, **Advanced Experimental Chemistry**, Vol.I, S. Chand & Co. Ltd., New Delhi,1980.

09CHE C 23 ADVANCED PHYSICAL CHEMISTRY PRACTICAL –II (POTENTIOMETRY, METAL FINISHING AND SPECTROPHOTOMETRY)

Hours	L	T	P	C
108	0	0	6	5

1. Potentiometry

a. Titration of mixture of acids Vs strong base

b. Titration of KI against standard $KMnO_4$

c. Titration of ferrous ammonium sulphate against potassium dichromate

d. Determination of the P^H of a given solution by emf method using hydrogen electrode and quinhydrone electrode.

e. Determination of the composition and instability constant of a complex by mole ratio method.

f. Determination of the formation constant of silver ammonia complex and stoichiometry of the complex potentiometrically.

g. Determination of pH of the given buffer solution using quinhydrone electrode

h. Determination of the dissociation constant of weak acid

i. Precipitation titration between KCl/KI Vs $AgNO_3$

j. Precipitation titration mixture of halides Vs $AgNO_3$

k. Determination of solubility product of AgCl.

2. Spectrophotometry

a. Determination of the pH of the given solutions using buffer solutions.

b. Verification of Beer-Lambert's Law

3. Metal Finishing

a. To electrodeposit copper/Nickel on a given Mild steel

b. To anodize the given aluminium specimen

c. To electropolish the given specimen (Al or SS)

d. To polish the given Al foil chemically and to find out the rate of polishing

Reference Books

1. B.P.Levitt (Ed.), **Findlay's Practical Physical Chemistry,** 9^{th} edn., Longman, London,1985.
2. J.N.Gurtu and R.Kapoor, **Advanced Experimental Chemistry**, Vol.I, S.Chand & Co. Ltd., New Delhi 1980.

ELECTIVE PAPERS

09CHE E01 ANALYTICAL CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Analytical Data, Treatment and Evaluation

Definition of Terms – Mean, Median, Precision and accuracy; Errors in chemical analysis- systematic errors and random errors.

Treatment of data - Basic statistical concepts and frequency distribution, Average and measure of dispersion; Significance of Gaussian distribution curves; Null hypothesis; confidence interval of mean, Criteria for rejection of data; Regression and correlation; quality control and control chart.

UNIT II Sampling and sample handling

Objectives and sampling – sample handling, transfer and storage samples; Microchemical laboratory - Design, safety screen, fume chamber, heating, water supply, dry box/glove box, Microbalance, quartz balance, fiber microgram balance.

Trace analysis in solution- Nature of trace analysis, scale of working sensitivity, sources of errors; Contamination control in trace analysis.

UNIT III Titrimetric Analysis

Neutralization reactions – theory of acid-base titrations, mono and polyprotic systems, Titration curves and feasibility of reactions, Indicators-theory and choice, calculation of pH during titrations at different stages.

Redox titrations – Redox potentials, theory and feasibility of redox titration, redox indicators, their choice and application.

Precipitation titrations – Theory and types, Volhard, Mohr and Fejan's methods.

UNIT IV Complexometric Titrations

Complexometric titrations – Theory, stepwise and overall formation constants, titration involving monodendate (Cl^-) and multidentate ligands (EDTA); Metallochromic indicators – theory and choice; Masking and demasking reagents; Direct, indirect (including substitution) titration and applications.

UNIT V Computer Applications in Chemistry

BASIC constants and variables; BASIC expressions; BASIC statements-Input and Output statements; Transfer and control statements; programming in BASIC only for calculation of equilibrium constants pH of an acidic and basic buffers.

MS-Word, MS-Excel, MS-Power Point and Internet usages.

Text Books

1. D.A.Skoog and D.M.West, **Fundamentals of Analytical Chemistry**, Holt Rinehart and Winston Publications, IV Edn, 1982.
2. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, **Fundamentals of Analytical Chemistry,** Thomson Asia Pte Ltd., Singapore, Viiith Edn., 2004.
3. D.A. Skoog, **Principles of Instrumental Analysis**, Saunders College Pub.Co, III Edn., 1985.
4. J.G. Dick, **Analytical Chemistry**, McGraw Hill Publishers, 1974.
5. T.S.Ma and V. Horak, **Microscale-Manipulations**, John, Wiley and Sons, 1976.
6. P.C.Jurns, T.L. Isenhour and C.C. Wilkins, **BASIC Programming for Chemists,** JW.& Sons 1987.
7. K.V. Raman, **Computers in Chemistry,** Tata McGraw Hill, New Delhi, 1993.
8. A.I Vogel, **Text Book of Quantitative Inorganic Analysis,** Pearson V Edn., 2001.

Reference Books

1. Albert Paul Malvino, **BASIC Programming,** PMH Publishers, III Edn., 1984.
2. N.Subramanian, **Programming for BASIC,** A.H. Wheeler and Co. Pvt.Ltd III Edn.,1987
3. Willard, Merit, Dean and Settle, **Instrumental Methods of Analysis,** CBS Publishers and Distributors, IV Edn.,1989
4. G. D. Christian and J.E.O Reilly, **Instrumental Analysis,** Allyn and Bacon Inc, II Edn., 1986.
5. G.W.Ewing, **Instrumental Methods of Chemical Analysis**, McGraw Hill Pub, 1975.
6. A.I Vogel, **Text Book of Quantitative Inorganic Analysis,** ELBS III Edn., 1987.

09CHE E02 INSTRUMENTAL METHODS OF ANALYSIS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Absorption, Emission and Reflection Spectroscopy

Absorption spectrometry – Beer Lamberts law; Spectrophotometry: UV visible spectroscopy- photometric titrations; Fluorimetry, turbidimetry and nephelometry.

Flame Photometry–Theory, instrumentation and a few important applications; Atomic absorption spectroscopy (AAS) – Theory, instrumentation and applications; Atomic fluorescence.

UNIT II Infra-red and Raman Spectroscopy

Infra-red spectroscopy – Theory and instrumentation - source, monochromators, detectors; dispersive and non dispersive instruments; sample handling techniques; qualitative analysis and quantitative applications.

Raman spectroscopy – Theory, instrumentation – source of radiation and detectors; few qualitative and quantitative applications; Resonance Raman spectroscopy.

UNIT III Nuclear Magnetic Resonance and Electron Spin Resonance Spectroscopy

Nuclear Magnetic Resonance Spectroscopy –Theory, relaxation and saturation processes, Environmental effects; instrumentation - type of magnets, source, detector and sample handling; few application of proton NMR; qualitative and quantitative analysis.

Electron Spin Resonance –Theory, instrumentation and a few applications in qualitative and quantitative analyses.

UNIT IV Polarography and Amperometry

Polarography – Theory, apparatus, DME, diffusion kinetic catalytic currents, current voltage curves for reversible and irreversible system, qualitative and quantitative application to inorganic systems.

Amperometric titrations – Theory, apparatus, types of titration curves, successive titrations and two indicator electrodes-applications.

UNIT V Chromatography

Gas liquid chromatography-principle, retention time values, instrumentation, carrier gas, column, detectors- thermal conductivity, flame ionization and electron capture; few applications of GLC.

Text Books

1. Willard, Merit, Dean and Settle, **Instrumental Methods of Analysis**, CBS Publishers and Distributors, IV Edn. 1986
2. Schoog, Holler, Nieman, **Principles of Instrumental Analysis,** Thomson Asia Pte Ltd., Singapore, 2004.
3. D.A. Skoog, **Principles of Instrumental Analysis,** Saunders College Pub.Co, III Edn., 1985
4. A.I Vogel, **Text Book of Quantitative Inorganic Analysis**, ELBS III Edn, 1987.
5. J.O.M. Bockris and AKN Reddy, **Modern Electrochemistry,** Plenum, 1970.
6. D.A.Skoog and D.M.West **Fundamentals of Analytical Chemistry,** Holt Rinehart and Winston Publications, IV Edn, 2004.
7. W. Kemp, **NMR in Chemistry,** MacMillan Ltd,1986.

Reference Books

1. Albert Paul Malvino **Electronic Principles**, PMH Publishers, III Edn, 1984.
2. J.G. Dick, **Analytical Chemistry,** McGraw Hill Publishers, 1974.
3. G.W.Ewing, **Instrumental Methods of Chemical Analysis,** McGraw Hill Pub, 1975.
4. B. H. Vassos and G.W. Ewing, **Electroanalytical Chemistry,** John Wiley and Sons, NY, 1983
5. R. Greef, R. Peat, L.M. Peter, D. Pletcher and J. Robinson, **Instrumental methods in Electrochemistry**, Ellis Horwood, Chichester, 1985.
6. A.J. Bard and L.R.Faulkner, **Electrochemical methods; Fundamentals and applications,** J. Wiley and Sons, NY, 1980.

09CHE E03 ENVIRONMENTAL CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Fundamentals

Fundamentals of Environmental Chemistry- Chemical potential, chemical equilibria, acid base reactions and carbonate system, sampling techniques for air, water, and soil.

UNIT II Water Chemistry

Water chemistry- properties of water, nature of metal ions in water, solubility of gases in water, occurrence of chelating agents in water; Redox potential, Significance of redox equilibiria in natural and waste water; microorganisms; The catalyst of aquatic chemical reactions, water pollution and its effects, eutrophication concept of DO, BOD, COD, Sedimentation. Coagulation and filtration.

UNIT III Atmospheric Chemistry

Atmosphere- Nature and composition of atmosphere, chemical and photochemical, reactions in the atmosphere – OZONE and PAN ions and radicals in the atmosphere; gaseous organic and inorganic pollutions in the atmosphere; Global warming and effects of CO, SO_2, NO_x.

UNIT IV Soil Chemistry

Soil chemistry- inorganic and organic components of soil, Nitrogen pathways. NPK in soils; Toxic chemicals in the environment pesticides and their toxicity; biochemical aspects of arsenic, cadmium, lead & mercury.

UNIT V Wastes

Environmental chemistry of hazardous wastes, hazardous wastes in hydrosphere, geosphere and atmosphere, industrial production of hazardous wastes; Health effects of hazardous wastes.

Text Books

1. Sharma and Kaur, **Environmental Chemistry,** Krishna Publishers, New Delhi, 2000.
2. A.K. De, **Environmental Chemistry**, Wiley Eastern Ltd, New Delhi, 1989.

Reference Books

1. J.Rose Gordon and Breach (Ed.), **Environmental Toxicology**, Science Publication, New York, 1993.
2. S.Ladsberger and Creatchman (Ed.), **Elemental Analysis of Airborne Particles**, Gordon and Breach Science Publication New York, 1998.
3. S.E Manahan, **Environmental Chemistry**, Lewis Publishers, London, 2001.
4. S.M. Khopkar, **Environmental Pollution analysis**, Wiley Eastern, New Delhi, 1994.
5. S.K. Banerji, **Environmental Chemistry**, Prentice Hall of India, New Delhi, 2003.

09CHE E04 POLYMER CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Basic Concepts

Basic concepts: Monomers, repeat units degree of polymerization, linear, branched and network polymers. Condensation polymerization: Mechanism of stepwise polymerization. Kinetics and statistics of linear stepwise polymerization. Addition polymerization: Free radicals, cationic and anionic polymerization. Polymerization conditions. Polymerization in homogeneous and heterogeneous systems.

UNIT II Coordination and Copolymers

Coordination Polymerization: Kinetics, mono and bimetallic mechanism of copolymers. Copolymerization: Block and graft copolymers, kinetics of copolymerization. Evaluation of monomer. Reactivity ratio. Rate of copolymerization.

UNIT III Molecular Weight

Molecular weight and properties of polymers; Polydispersion-average molecular weight concept, number weight and viscosity average molecular weights. Measurement of molecular weights. Gel permeation chromatography, viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties –crystalline melting point T_m. The glass transition temperature. Determination of T_g. Relationship between T_m and T_g.

UNIT IV Processing

Polymer Processing: Plastics elastomers and fibres. Compounding processing techniques: calendaring, die casting, rotational casting, film casting, injection moulding, blow moulding extrusion moulding, thermoforming, foaming, reinforcing and fibre spinning.

UNIT V Commercial Polymers

Properties of Commercial Polymers: Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers-Fire

retarding polymers and electrically conducting polymers. Biomedical polymers- contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

Text Books

1. F.W.Billmeyer, **Text Book of Polymer Science**, 3rd Edn., John Wiley & Sons, New York, 2003.
2. V.R.Gowarker, N.V.Viswanathan and J. Sreedhar, **Polymer Science**, New Age International, New Delhi, 2003.

Reference Books

1. H.R.Alcock and F.W.Lamber, **Contemporary Polymer Chemistry**, Prentice Hall,1981.
2. P.J.Flory, **Principles of polymer chemistry**, Cornell University press, Newe York, 1953.
3. G.Odian, **Principles of polymerization**, 2nd Edn., John Wiley & Sons, New York,1981.

09CHE E05 MATERIALS CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Structure and properties of metals and alloys

Crystal structure of metals and alloys, intermetallic compounds, interstitial compounds, electronic compounds; electrical and magnetic properties of metals-resistivity, magnetoresistance, de Hass Van Alphen effect, cyclotron resonance, hall effect, thermoelectric power, superconductivity, diamagnetism, ferromagnetism, anti-ferromagnetism, Pauli paramagnetism, Einstein de Hass effect, magnetic resonance spectroscopy.

UNIT II Solid Electrolytes, Semiconductors and Super Conductors

Semiconductors- properties, semiconductor and metal electrodes, semiconductor-electrolyte interface, semiconductor – electrolyte junction, space charge layer, depletion layer, Helmholtz and Gouy layer and flat band potential; Solid electrolytes – Ag^+ conductors, Li^+ conductors, Cu^+ conductors, F^- conductors, O_2^{2-} conductors, beta-alumina and other conductors; applications of solid electrolytes; super conductors-super conducting materials and compounds, magnetic properties, heat capacity, energy gap, MW and IR properties, super conducting magnets, high T_c superconductors; characterization.

UNIT III Photoconductors, Photovoltaics, Solar Cells and Solar Coatings

Photocells-photoemissive, photo conductive and photovoltaic cells; photo conductive effect, photo current, photo conductivity, speed of response, photosensitivity, preparation of photoconductors and photovoltaic effect; photoelectrochemical cells, photoelectrolytic cells; Applications. Solar coatings-solar foils, black chrome, black nickel, black alumina, black zinc, black copper, blackened steel, blackened SS and black cobalt.

UNIT IV Oxide Films, Thin Films and Membranes

Growth of oxide films-barrier oxide layer, composition, structure and physical properties; Thin films-various stages of film growth, defects during growth, grain boundaries, surface area and roughness; techniques of film growth- PVD, CVD, CSVT, sputtering and plasma deposition. Membranes-types of diaphragm and membrane materials; Preparation of membranes-physical

methods, Leach or Cook out method, gelatin process; Applications

UNIT V Luminescent Materials and Conducting Polymers

Luminescence - photoluminescence, electroluminescence and cathadoluminescence; Fluorescent phosphors-Calcium tungstate phosphor, Zinc silicate green phosphor, Magnesium fluogermanate red phosphor and Calcium halophosphate day light phosphor

Conducting polymers-intrinsically conducting polymers, extrinsically conducting polymers, non-bridged polymers and chain bridged polymers; Synthetic methods; methods of doping-simple chemical doping, electrochemical doping and photochemical doping.

Text Books

1. V.A. Myamlin and Y.V. Pleskov, **Electrochemistry of semiconductors**, Plenum press, New York, 1979.
2. J.M.Blatt, **Theory of super conductivity**, Academic press, 1964.
3. K.L. Chopra, **Thin films**, Mc.Graw Hill Book Co.,1982.
4. V.Ragavan, **Materials Science and Engineering, First Course**, 2nd Edn., Prentice-Hall India, 1985.
5. N. Cusack, **Electrical and magnetic properties of solids**, Langmans, 1958.

Reference Books

1. E.C.Subba Rao, **Solid electrolytes and their applications**, Plenum Press, 1980.
2. H.J. Hovel, **Semiconductors and semiconducting materials Vol.2. Solar cells**, Academic press, 1975.
3. R.H. Bube, **Photoconductivity of solar cells**, John Wiley & sons. Inc.,1967.
4. D. Curie, **Luminescence in crystals**, John Wiley & Sons, Inc., New York, 1963.
5. A.Skothem (Ed.), **Hand book of conducting polymers** – Vol. I and II, Marcel Dekkar, 1986.

09CHE E06 MEDICINAL CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

Unit I Basic Concepts

Drug design - analogues and pro-drugs, factors governing drug design, rational approach,method of variation and tailoring of drugs; Physical properties-factors governing drug action at active site, factors governing ability of drugs to reach active site, dissociation constants, isosterism and bioisosterism; general anaesthetics-inhalation anaesthetics, intravenous anaesthetics and basal anaesthetics;mode of action; local anaesthetics-classification and syntheses, sedatives and hypnotics-classification, synthesis, mode of action and structure-activity relationship.

Unit II Anticonvulsants, Stimulants and Antipyretic Analgesics

Anticonvulsants - classification, synthesis and mode of action; Muscle relaxants-classification, synthesis and mode of action. Central nervous system stimulants- classification, synthesis and mode of action; Antipyretic analgesics- classification, synthesis and mode of action;

Unit III Other Analgesics

Narcotic or Opiate analgesics - classification, preparation and mode of action; Narcotic antagonists; Cardiovascular drugs-classification, synthesis and mode of action; Autonomic drugs-synthesis and mode of action of sympathomimetic drugs, antiadrenergic drugs, cholinomimetic drugs, antimuscarinic drugs, ganglionic blocking agents and adrenergic neurone blocking agents; Diuretics - synthesis and mode of action of mercurial and non-mercurial diuretics.

Unit IV Antihistamines, Anti-inflammatory and Antiparkinson drugs

Antihistaminics - synthesis and mode of action of histamine H_1 receptor antagonists and histamine H_2-receptor blockers; prevention of histamine release; structure-activity relationships amongst H_1-receptor blockers. Non-steroidal anti-inflammatory drugs(NSAID)-synthesis and mode of action of heteroarylacetic acid analogues, arylacetic acid analogues, arylpropionic acid analogues, naphthalene acetic acid analogues, gold compounds, salicylic acid analogues and pyrazolones and pyrazolodiones; Antiparkinsonism agents-synthesis and mode of action of

piperidine analogues, pyrolidine analogues and phenothiazine analogues.

Unit V Other drugs

Expectorants and antitussives-synthesis and mode of action of sedative expectorants, stimulant expectorants and centrally acting antitussive agents. Sulphonamides-preparation and mode of action of sulphonamides for general, urinary, intestinal and local infection; sulphonamide inhibition. Antimalarials-synthesis and mode of action of aminoquinoline analogues, aminoacridine analogues, guanidine analogues, pyrimidine analogues, sulfone and quinine analogues; Steroids-synthesis and mode of action of sterols, sex harmones, cardiac glycosides, bile acids and sapogenins. Antibiotics-synthesis and mode of action of penicillins, aminoglycoside antibiotics, chloramphenicol and tetracyclines.

Text Books

1. Ashutosh Kar, **Medicinal Chemistry**, New Age International, 1996.
2. W.O.Foye, **Principles of medicinal chemistry**, 2nd edn., Lea & Febiger, Philadelphia, 1981.

Reference Books

1. M.E.Wolff, **Burger's medicinal chemistry**, 4th Edn., John Wiley &Sons, New York, 1981.
2. F.F.Blicke and R.H.Cox, **Medicinal Chemistry**, John Wiley &Sons, New York, 1959.
3. D.Lednicer and L.A.Mitscher, **Organic Chemistry of drug synthesis**, John Wiley & Sons, New York, 1959.
4. J.E.Hoover, **Remington's Pharmaceutical sciences**, 15th Edn. Mack Publ.Company, Easton, 1975.

09CHE E07 DYE CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

Unit I Introduction

Colour and chemical constitution - chromophore, auxochrome and resonance, various theories; History of natural and synthetic dyes; Names of commercial dyes; Study of raw materials and dyestuff intermediates; Unit operations - nitration, sulphonation, halogenation, amination, diazotisation and alkali fusion; Colour index and its significance; Classification of dyes based on chemical constitution and method of applications; General properties - linearity, coplanarity and fastness.

Unit II Direct, Acid and Basic Dyes

Direct cotton dyes (substantive dyes) – Classification, properties, structure and mechanism of dyeing, post treatment of dyeing; Acid dyes and Basic dyes – Classification, Characteristics, trade names, Mechanism of dyeing, Nature of affinity on cellulose and protein fibres.

Unit III Mordant, Azo and Vat Dyes

Mordant dyes – classification, methods of application; Metal complex dyes – types of bond formation between dye and various fibres; Azo dyes – Azoic coupling components, protective colloids, electrolytes, stabilisation of diazonium salts, principles and application; Vat dyes and solubilised vat dyes – classification, methods of application, trade names, principles and application, Stripping agents and correction of faulty dyeing.

Unit IV Other Dyes

Chemistry involved in the production of Aniline black; Prussian black; Sulphur colours; phthalocyanines; Disperse dyes - classification based on chemical structure, properties and principles of application; Solvent soluble dyes - Nigrosines and Indulines; Cyanine dyes.

Unit V Colour and Brightening

Fluorescent brightening agents (FBA) - Theory and applications; Identification and

estimation of dyes on fibres; The action of light on dyes and dyed fibres; Mechanism of fading.

Text Books:

1. K. Venkataraman, **The chemistry of synthetic dyes** Part I & II, Academic Press, New York, 1952.
2. V. A. Shenai, **Introduction to Chemistry of Dyesuffs**, Sevak Prakashan Pub., Mumbai, 1991.

Reference books

1. V. A. Shenai, **Chemistry of Dyes and Principles of Dyeing** Vol.-II, Sevak Prakashan, Mumbai, 1987.
2. V. A. Shenai, **Ecology and Textiles**, Sevak Publications, Mumbai, 1997.
3. D. M. Nunn, **The Dyeing of Synthetic Polymer and Acetate Fibres**, Dyers Company, Publication Trust, 1979.
4. V. A. Shenai, **Toxicity of Dyes and Intermediates**, Sevak Publications, Mumbai, 1998.
5. **Directory of safe dyes conforming to German Consumer Goods Ordinances**, The Dyestuff Manufacturers Association of India, 1996.

09CHE E08 CHEMISTRY OF WATER TREATMENT

Hours	L	T	P	C
72	4	0	0	4

Unit I Introduction

Sources of Water; Physical and chemical characteristics of water; Water analysis; Potable water – WTO standard: uses of water

Unit II Water Pollution

Water pollution – wastewater generation - classification of water pollutants; constituents and characteristics of wastewater; measurement techniques – sampling, colour & odour, dissolved oxygen, BOD, COD, TOC, N & P, suspended solids and bacteriological measurements.

Unit III Wastewater Treatment

Wastewater treatment: Pretreatment – screening, grit removal and pre-chlorination; Primary treatment – settling and sedimentation; Secondary treatment – trickling filter process, activated sludge process; Aeration.

Unit IV Industrial Wastewater Treatment

Industrial wastewater treatment: Activated sludge treatment plants – mass balances, with and without recycle plants; Types of plants – single tank, contact stabilization, biosorption plants.

Biofilters: Hydraulic film diffusion, two component diffusion; Types of plants – trickling filters, submerged filters and rotating disc; removal of particulate organic matter.

Unit V Treatment Plants

Treatment plants for nitrification – mass balances, nitrifying plants and types of plants.

Treatment plant for denitrification - mass balances, denitrifying plants and types of plants; redox zones in the biomass.

Anaerobic wastewater treatment: Plant types – pretreatment, plant with suspended sludge and filter process.

Text books

1. A.K.De, **Environmental Chemistry**, Wiley Eastern, 1989.
2. S.K.Banerji, **Environmental Chemisty**, Prentice Hall of India, New Delhi, 2003.

Reference books

1. L.Winther, **Wastewater Engineering**, Polyteknisk Forlag, Lyngby, 1978.
2. M.Henze, P.Harremoes, J.C.Jansen and E.Arvin, (Ed.), **Wastewater treatment**, Springer Verlag, New York, 1995.
3. P.Harremoes, **Water Chemistry**, Polyteknisk Forlag, Lyngby, 1989.

SUPPORTIVE COURSES FOR OTHER DEPARTMENTS

09CHE S01 FUNDAMENTAL ASPECTS OF ELECTROANLAYTICAL TECHNIQUES

Hours	L	T	P	C
72	4	0	0	4

UNIT I Basic Electrochemical principles

Mass transfer processes – migration, diffusion and convection– planar and spherical diffusion – Reversible and Irreversible processes.

UNIT II Methods Based on Diffusion

Principle, instrumentation and applications of the following techniques: Chronoamperometry; Polarography - Ilkovic equation - Square wave polarography; Linear Sweep voltammetry – Randles Sevrik equation; Cyclic voltammetry - Normal pulse, Differential pulse and Squarewave voltammetry.

UNIT III Coulometric and Potentiometric Methods

Galvanostatic and potentiostatic methods.

Principle, instrumentation and applications of the following techniques: Controlled potential coulometry and electrolysis; Chronocoulometry; Potentiometry and Chronopotentiometry.

UNIT IV Stripping voltammetry

Principle, instrumentation and applications of Anodic stripping voltammetry, Cathodic stripping voltammetry and Adsorptive stripping voltammetry.

UNIT V Sine wave methods (Electrochemical Impedance Spectroscopy)

Principle of Impedance technique - Analysis of Faradaic impedance – Bode Diagrams.

Dynamic electrode techniques

Principle, instrumentation and applications of RDE and RRDE techniques.

Text Books

1. D.A.Skoog and D.M.West, **Fundamentals of Analytical Chemistry,** Holt Rinehart and Winston Publications, IV Edn, 1982.
2. Willard, Merit, Dean and Settle, **Instrumental Methods of Analysis,** CBS Publishers and Distributors, IV Edn. 1986

Reference Books

1. B. H. Vassos and G.W. Ewing, **Electroanalytical Chemistry,** John Wiley and Sons, NY,

1983.

2. A. J. Bard and L.R. Faulkner, **Electrochemical methods; Fundamentals and applications,** J. Wiley and Sons, NY, 1980,
3. J.Wang, **Stripping Analysis,** VCH Publications, 1985.
4. A.M. Bond, **Modern Polarographic methods in analytical chemistry,** Macel Decker Inc., 1980.

09CHE S02 CONDUCTING POLYMERS

Hours	L	T	P	C
72	4	0	0	4

UNIT – I Basic Concepts and Synthetic methods

Basics of conducting polymers - Organic - conjugated unsaturated hydrocarbons-

Chemical Synthesis of conducting polymers – Other synthetic methods

UNIT – II Electrochemical Synthesis

Electrochemical synthesis of conducting polymers – monomers, electrolytic condition, electrodes and mechanism; Electrochemical synthesis of derivatives of poly pyrrole, polythiophene, polyazulene, polycarbazole, polyindole, polyaniline and polyphenylene.

UNIT – III Semiconducting and Metallic Polymers

Structural basis for semiconducting and metallic polymers – introduction; Organic meta polymers - Synthetic route, isomers and electronic structure (polymers like polyacetylene, poly(p-phenylene), polypyrrole, polythiophene, etc.,).

UNIT – IV Doping

Electrochemical doping; deadline to the development of conducting polymers; role of reduction and oxidation potential in doping; polyacetylene as electrode materials.

UNIT – V Catalytic Conducting Polymers

Catalytic properties of conducting polymers; catalysis of electron donor-acceptor complexes; electrocatalysis by semiconducting polymers.

Text Books

1) Terje A. Skotheim, Ronald L. Elsenbaumer, John R. Reynolds, **Handbook of Conducting Polymers,**

Second Edition, Marcel Dekkar, 1995.

2) Hari Singh Nalwa (Edn), **Handbook of Organic Conductive Molecules and Polymers,** Four Volumes, Wiley, 1997

Reference Books

1) Jean-Pierre Farges, **Organic Conductors**, Marcel Dekkar, 1994
2) David B Cotts, Z Reyes, **Electrically Conductive Organic Polymers for Advanced Applications**, William Andrew Inc,1987
3) Larry Rupprecht, **Conductive Polymers and Plastics,** William Andrew Inc, 1999.
4) Raymond B Seymour, **New Concepts in Polymer Science, Polymeric Composites**, VSP, 1990.
5) Wallace Gordon, Gordon G Wallace, Geoffrey M Spinks, **Conductive Electroactive Polymers,** CRC Press, 2002

SUPPORTIVE COURSES FOR OTHER DEPARTMENTS

09CHE S03 INDUSTRIAL AND AGRICULTURAL CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT-I Water, Fuels and Industrial Gases

Water - Treatment for domestic and industrial purpose; Fuels- Calorific value, requirement of a fuel, types, refining crude petroleum, octane number, anti-knocking compound; Industrial gases-Manufacture and industrial applications of coal gas, producer gas, water gas, semi-water gas and LPG.

UNIT-II Irrigation

Crop seasons - seeds, seed development organization, natural seeds project phase-III, new policy on seed development; Soil- soil reclamation, alkali soil, saline soils, methods for soil reclamation; Irrigation- Environmental degradation and irrigation projects.

UNIT-III Conservation and Fertilizers

Soil and water conservation - plant protection; integrated pest management; Technology mission on oil seeds and pulses; Fertilizers; Effect of nitrogen, potassium and phosphorous on plant growth. Manufacture and composition of urea, triple super phosphate, complex fertilizers, mixed fertilizers and biofertilizers; secondary nutrients and micro nutrients-their function in plants.

UNIT-IV Pesticides and Insecticides

Pesticides - classification, organic, inorganic and general; methods of application and toxicity; safety measures in using pesticides; Insecticides: plant products-nicotine and pyrithrin; Inorganic pesticides-borates; organic pesticides-DDT and BHC

UNIT-V Fungicides and Herbicides

Fungicides - sulfur compounds, copper compounds and boredeaux mixture; Herbicides-Acaricides, Rodenticides, Attractants; Repellents; Preservation of seeds

Text Books

1. B.K.Sharma, **Industrial Chemistry**, Goel Publishing House, Meerut,1992.
2. N.C. Brady, **The nature and properties of soils**, Eurasia Publishing House, New Delhi, 1977.
3. G.N. Pandey, **A Textbook of Chemical Technology, Vol. I & II,** Vikas Publishing House Pvt Ltd, 1997.

Reference Books

1. B.N.Chakrabarthy, **Industrial Chemistry**, Oxford and IBH, New Delhi, 1981.
2. P.P. Singh and T.M. Joseph, **College Industrial Chemistry**, Himalaya Publishing House, Bombay, 1987.
3. V.S. Jones, **Fertilizers and soil fertility**, Prentice Hall of India, New Delhi,1993.
4. D.E.H. Freer, **Chemistry of pesticides**, D.Van Nostrand Co, Reinhold,1969.

09CHE S04 CHEMISTRY OF NATURAL PRODUCTS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Carbohydrates

Introduction, definition and classification; Monosaccharides – configuration of aldotrioses, aldotetroses, aldopentoses, aldohexoses, Ketohexoses; Deoxy-sugars; Ring structure of monosaccharides; mutarotation; a brief introduction on the structure of disaccharides (sucrose and maltose as representative examples) and polysaccharides (starch, cellulose and cyclodextrins as representative examples).

UNIT II Terpenoids

Classification; Isoprene rule; Monoterpenoids – structure elucidation and total synthesis of citral, □– terpineol and □ – pinene.

UNIT III Carotenoids

Introduction – carotenes, xanthophylls, apocarotenoids, epipasic carotenoids and hypophasic carotenoids; Structure elucidation and total synthesis of □ – carotene and vitamin – A.

UNIT IV Steroids

Classification with examples; nomenclature of steroids; Structure of Cholesterol; Structure of bile acids.

UNIT V Alkaloids

Definition; Occurrence; Extraction of alkaloids; General properties; Classification of alkaloids; Structure elucidation and synthesis of piperine and nicotine.

Text Books

1. I.L. Finar**, Organic Chemistry, Vol.II**, 5th Edn. Pearson Education Asia Pvt. Ltd. 2000
2. Atta-Ur-Rahman and M.I.Choudhary, **New Trends in Natural Product Chemistry,** Gordon & Breach Science Publishers, I Edn., 1998.

3. Pinder, **The Chemistry of Terpenes,** Chapman and Hall, 1960.
4. Bentley, **The Natural Pigments,** Interscience, 1960
5. Fisher and Fisher, **Steroids,** Reinhold, 1959.

Reference Books

1. S.W. Pelletier,Van Nostrand, **Chemistry of Alkaloids,** Reinhold, 1970.
2. A.A. Newman (Ed.), **Chemistry of Terpenes and Terpenoids**, Academic Press, London, 1972.
3. Hendry, **The Plant Alkaloids**, Churchill Publishers, IV Edn., 1949
4. Templeton, **An Introduction to the Chemistry of Terpenoids and Steroids**, Butterworths, 1969.

09CHE S05 CHEMISTRY OF INDUSTRIAL PRODUCTS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Glass

Glass - Introduction, raw material, steps involved for manufacture of glass, some special glasses, fused silica glasses, high silica, optical glasses, coloured glasses, opal glasses, safety glasses, bottle glasses.

UNIT II Cement

Cement - Introduction, types of cement, types of Portland cement, raw materials, quantitative requirements, setting of cement, factors affecting quality of cement.

UNIT III Dyes

Dyes - Sensation of colour, classification of dyes, acid dyes, basic dyes, direct dyes, mordant dyes, vat dyes, ingrain dyes, food dyes, application of dyes for cotton fabric.

UNIT IV Pigments and Paints

Pigments - white pigment, white lead, blue pigment, ultramarine blue, red pigment, red lead, green pigments, Chrome green.

Paints - constitutions of paint, requirement of a good paint, paint failure.

UNIT V Fertilizers

Fertilizers - Plant nutrients, need for fertilizers requirement, classification of fertilizers, natural fertilizers, artificial fertilizers, phosphate fertilizers.

Text Books

1. B.K. Sharma, **Industrial Chemistry,** Goel Publishing House Pvt Ltd, 1999.
2. M.G. Arora and M. Singh, **Industrial Chemistry,** Anmol Publications, 1st edition, 1994.
3. G.N. Pandey, **A Textbook of Chemical Technology, Vol. I & II,** Vikas Publishing House Pvt Ltd, 1997.

Reference Books

1. B.N. Chakrabarty, **Industrial Chemistry,** Oxford & IBH Publishing Co. Pvt Ltd, 1991
2. V. Subrahmaniyan, S. Renganathan, K. Ganesan, S. Ganesh, **Applied Chemistry,** Scitech Publications, 1998.
3. J.E. Kuria Cose and J. Rajaram, **Chemistry in Engineering & Technology, Vol. I & II,** Tata Mc Graw Hill, 1984.

09CHES06 FUNDAMENTALS OF ANALYTICAL CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Analytical Data Treatment and Evaluation

Definition of Terms – Mean, Median, Precision, accuracy. Errors in chemical analysis-systematic errors and random errors.

Treatment of data - Basic statistical concept - Frequency distribution, Average and measure of dispersion, Significance of Gaussian distribution curves, confidence interval of mean, Criteria for rejection of data. Regression and correlation, quality control and control chart.

UNIT II Sampling

Preparing the sample for analysis - The effect of sampling uncertainities, gross sample, determination of the size of the sample, analytical sample.

Sampling of solids - Preparation of laboratory sample from gross sample, moisture in the sample, sampling of gases and liquids.

UNIT III Titrimetric Analysis :

Neutralization reactions – theory of acid-base titrations, Tirtration curves and feasibility of reactions, Indicators-theory and choice, calculation of pH during titrations.

Redox titrations – Redox potentials, theory and feasibility of redox titrations, redox indicators, their choice and application.

Precipitation titrations – Theory and types, Volhard, Mohr and Fejan's methods.

UNIT IV Analysis of Industrial samples -I

Ore and cement analysis – Oxides, sulphides and carbonate ores, one example each. Cement, silicate and glass.

Liquid fuels – Flash point, viscosity, carbon residue aniline point, pour point.

UNIT V Analysis of Industrial samples -II

Gaseous fuels – sampling procedure, ultimate and proximate analysis, specific volatile index, ash content, calorific value by bomb colorimeter, and Junker's calorimeter.

Water analysis – BOD, COD and hardness of water.

Text Books

1. D.A.Skoog and D.M.West, **Fundamentals of Analytical Chemistry,** Holt Rinehart and
2. Winston Publications, IV Edn,, 1982.

3. A.I Vogel, **Text Book of Quantitative Inorganic Analysis,** ELBS III Edn, 1987.
4. A.I Vogel, **Text Book of Quantitative Inorganic Analysis,** Pearson V Edn 2001.
5. J.G. Dick, **Analytical Chemistry**, McGraw Hill Publishers, 1974.
6. T.S.Ma and V. Horak, **Microscale-Manipulations**, John Wiley and Sons, 1976.

Reference Books

1 . D.A. Skoog, D.M.West, F.J. Holler and S.R.Crouch, **Fundamentals of Analytical Chemistry**, VIII Edn., Thomson Brooks/Cole Publishers, 2004.

2. H.A. Stobel Addison, **Chemical Instrumentation,** Wesley Publishers Co., 1976.

09CHE S07 PHARMACEUTICAL CHEMISTRY

Hours	L	T	P	C
72	4	0	0	4

UNIT I Introduction

Important terminologies - pharmaceuticals, drugs, pharmacodynamics, Pharmacokinetics, pharmacopoea, virus, bacteria, fungus, actinomycetes, metabolites, antimetabolites ,LD50 and ED50; Therapeutic index- their use in selecting drugs; assay of drugs; Use of plaster of paris in bone – fracture;

UNIT II Antibiotics, Sulpha drugs and Vitamins

Antibiotics-synthesis, assay and structure and uses of penicilline, chloramphenicol and tetracyclines. Sulphonamides- mechanism and action of sulpha drugs, preparation and uses of sulphadiazine, sulphapyridine, sulphathiazole and sulphafurazole; Vitamins-classification as water soluble and liquid soluble vitamins, sources, deficiencies and assay of vitamins A,B_1, B_2 and C

UNIT III Analgesics and Antiseptics

Narcotic analgesics-isolation, pharmacological action and uses of morphine, heroin and codeine; Synthetic analgesics-pethidine and methodone; Antipyretic analgesics-synthesis and structure and action of methyl salicylate, aspirin, paracetamol and phenacetin; Antiseptics and disinfectants-phenol as disinfectant and phenol coefficient; dyes and organo mercurials and cationic surfactants

UNIT IV Anaesthetics, Tranquilisers and Antineoplastics

Anaesthetics - classification as general, local and intravenous anaesthetics, chemistry of anaesthetic ether, nitrous oxide, halothane, chloroform, thiopental sodium methohexitone, cocaine and benzocaine; Alkaloids - detection of alkaloids, colour reagents; Isolation, colour reaction and SAR of quinine; Tranquilisers, hypnotics and sedatives; Antineoplastic and hypoglycemic agents - detection sugar and serum in urine; cause and control of diabetes; Oral hypoglycemic agents; causes and control of cancer; Praparation and uses of thiotepa and cyclophosphoramide.

UNIT V Organic pharmaceutical aids

Preservatives and antioxidants, colouring, flavouring and sweetening agents and ointment bases; Blood-blood groups, Rh factor, blood pressure normal, high and low; control of pressure; Causes and control of anaemia-antianaemic drugs, coagulants and anticoagulants; causes and control of AIDS.

Text Books

1. T.C. Daniels and E.C. Jorgensen, **Text book of organic medicinal and pharmaceutical chemistry**, J. B. Lippincott, Philadelphia, 1977.
2. Ashutosh Kar, **Medicinal Chemistry**, New Age International, 1996.

Reference Books

1. M. Gordon, **Psychopharmacological agents**, Academic press, New York, 1965.
2. J.M. Ritchie and P.J. Cohen, **The pharmacological basis of therapautics**, 5th Edn., Macmillan, New York, 1975.
3. D.Lednicer and L.A. Mitscher, **Organic Chemistry of drug synthesis**, John Wiley &Sons, New York, 1959.
4. J.E. Hoover, **Remington's Pharmaceutical sciences**, 15th Edn. Mack Publ.Company, Easton, 1975.

09CHE S08 APPLIED CATALYSIS

Hours	L	T	P	C
72	4	0	0	4

UNIT I Reaction Rates

Activation energy concepts - arrhenius theory, collision theory – biomolecular and unimolecular reactions, ARR theory, influence of □S, □H and □G on reaction rates with and without catalyst.

UNIT II Homogeneous Catalysis

Concepts of acidity – Bronsted – Lewis acids. Concept of base – Brosted – Lewis bases. Acid base strength. Application of acid – base catalysis – alkylation, oxidation and reduction of organic molecules. Advantage and disadvantage of homogeneous catalysts.

UNIT-III Heterogeneous Catalysis

Metal and metal oxide catalyst - Metal oxide supported catalyst, polymer supported catalyst. Solid acid and base catalyst – molecular sieves – neutral catalyst – alumino phosphate molecular sieves. Isomorphous substitution. High temperature reactions. Product selectivity concept – pore size, reactant ratio, time on stream, coke deposition and conversion.

UNIT IV Photocatalysts

Light absorption, laws of photochemistry, quantum yield, semiconductor concept, photo chemical application of dye degradation, molecular sieves based photo chemical applications.

UNIT V Enzyme Catalysts

Reaction specificity, enzyme catalysis mechanism – induced fit, lock and key. Coenzyme – mechanism. Factors influencing enzyme action – temperature, pH, enzyme concentration and substrate concentration. Michaelis – Menton theory and Lineweaver – Burk plot.

Text Books

1. K.J. Laidler, **Chemical Kinetics,** IIIrd Edn., Harper and Row publisher, New York, 1987.
2. B.Viswanathan, **Catalysis: Principles and applications,** Narosa Publ., New Delhi, 2004.

3. V. Ramamurthy, **Photochemistry in organized and constrained media**, VCH Edn., New York, 1991.

Reference Books

1. V. Murugesan, **Recent trends in catalysis**, Narosa publ., New Delhi, 2004.
2. K. Kalyanasundaram, **Photochemistry in microheterogenous systems**, Academic Press, New York, 1987.
3. Samuel H. Maron, **Principles of Physical Chemistry**, Mac Millan, Publisher, New York, 1972.
4. E. Conn and K.Stump, **Outlines of Biochemistry**, John Wiley and Sons, 1987.
5. Friedlich Liebau, **Structural Chemistry of Silicates,** Springer-Verlog, Berlin, 1985.

XVIII MODEL QUESTION PAPERS

M.Sc., DEGREE EXAMINATION, NOVEMBER - 2009

First Semester

ORGANIC CHEMISTRY -I

Time Three hours **Maximum: 75 marks**

Part A- (5 x 3 = 15 Marks)

Answer ALL question

1. (a) Write about the stereochemistry of addition of singlet carbene ($:CCl_2$) to *cis*-2-butene and *trans*-2-butene.

(or)

(b) Explain with an example, how will you predict a correct mechanism using isotope labeling.

2. (a) Why neopentyl halides undergo very slow reaction both by S_N1 and S_N2 mechanism?

(or)

(b) Explain with an example, what is an ambient nucleophile.

3. (a) Write briefly on Reimer-Tieman reaction.

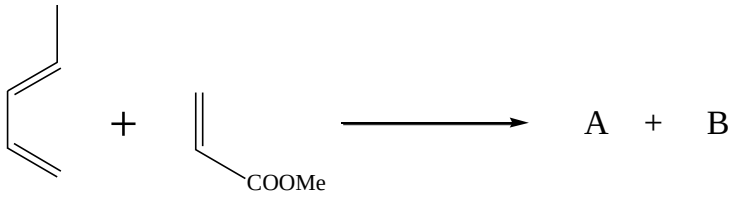
(or)

(b) Explain the benzyne mechanism of aromatic nucleophilic substitution.

4. (a) Write note on Cope rearrangement

(or)

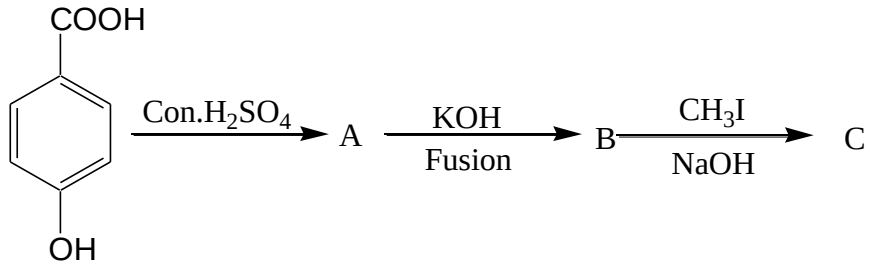
(b) Identify the compounds A and B and explain the reaction.



5. (a) How many double bonds are present in zingeberene and how will you account for it?

(or)

(b) Complete the following reaction.



Part- B (5 x12=60 Marks)

6. (a) (i) Explain with an example, the thermodynamically and kinetically controlled reaction. (8)

(ii) Describe any two non-kinetic methods to predict the reaction mechanism. (4)

(or)

(b) (i) Derive Hammett equation and Taft equation (8)

(ii) Give the significance of magnitude and sign of □ value. (4)

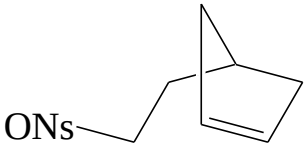
7. (a)(i) Give an account of effect of reaction medium on S_N1 and S_N2 reactions. (8)

(ii) Write a brief note on the stereochemistry of S_N2 reaction. (2)

(iii) Why bridgehead compounds can undergo S_E2 mechanism? (2)

(or)

(b) (i) The cyclopentane derivative I undergoes solvolysis in acetic acid 95 times faster than the analogous saturated compound II. (4)



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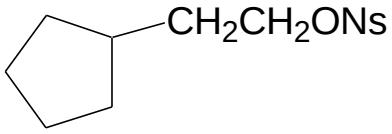


II

(ii) The rate of solvolysis of benzyl bromide in aq.acetone is decreased in the presence of LiBr but not in the presence of $LiNO_3$. Why? (4)

(iii) Arrange the following compounds in the order of reactivity towards S_N2 reactions. Give reasons.

1-bromo-2,2-dimethylpropane, 1-bromopentane, 2-bromopentane, 1-bromo-3-methylbutane (4)

8. (a) (i) Benzene in presence of $AlCl_3$ reacts with n-propylbromide to give isopropyl

benzene. Why? How will you get n-propylbenzene alternatively? (8)

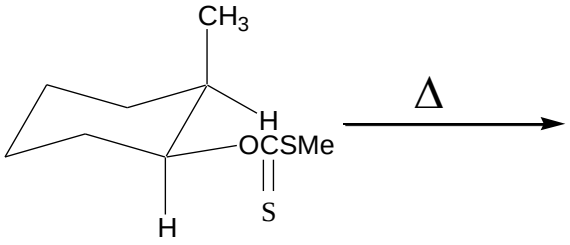
(ii) Write the product(s) of mononitration of ortho nitrotoluene and discuss the mechanism (4)

(or)

(b) Explain the orientation and reactivity of electrophilic substitution of monosubstituted benzene. (12)

9. (a) (i) Discuss the dehydrohalogenation reactions of erythro and threo isomers of 1-bromo-1,2-diphenylpropane. (7)

(ii)Predict the product and explain the mechanism (5)



(or)

(b) Write the mechanism of the following reactions (4x3 = 12)

(i) Aldol condensation

(ii) Perkin condensation

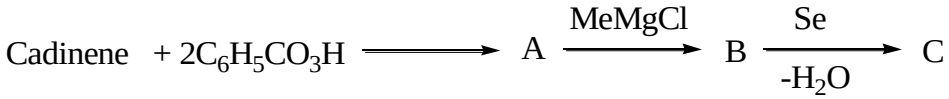
(iii) Michael addition

(iv) Addition of halogen to olefin

10. (a) Give the total synthesis of reserpine

(or)

00 (b) (i)



(4)

(ii) Give the ozonolysis product of zingeberene. (4)

(iii) How will you convert abietic acid to abietinol (4)

M.Sc., DEGREE EXAMINATION, NOVEMBER - 2009

First Semester

INORGANIC CHEMISTRY -I

Time Three hours **Maximum: 75 marks**

Part - A (5 x 3 = 15 Marks)

Answer ALL question

1. (a) What is H-bonding? Why H_2S is gas but H_2O is liquid at room temperature?

   (or)

   (b) Draw the structure of a cyclic silicate $(Si_3O_9)^{6-}$ with proper labeling.
2. (a) What are boranes? How are they classified? Give one example for each type.

   (or)

   (b) What are Wade's rules? Discuss its applications.
3. (a) Radioactive decay of □-emission is common with nuclides of mass number greater than 210-Explain.

   (or)

   (b) $_4Be^8$ contains even number of protons and neutrons and yet it is unstable- Explain
4. (a) What are transmutation reactions? Give an example.

   (or)

   (b) What do you mean by fissile and fertile nuclides? Give suitable examples.
5. (a) Why is a GM counter not suitable in detecting "high counting rates"?

   (or)

   (b) What do you mean by nuclear emulsion?

Part-B (5 x 12 = 60 Marks)

6. (a) i)Explain HSAB concept. Discuss its applications. (8)

   ii) What are pyroxenes and amphiboles? Give one example for each type. (4)

   (or)

   (b) i) Discuss the nature and origin of vanderWaals forces? (8)

   ii) What are zeolities? Give its uses? (4 marks)
7. (a) Explain the preparation, structure and any two reactions of i) B_4H_{10} ii) $C_2B_{10}H_{12}$ (6 + 6)

   (or)

   (b) i) Discuss the structure of $Re_2Cl_8^{2-}$? (6)

   ii) Give the preparation of tetrahydroborate ion. (6)
8. (a) Discuss nuclear isomerism with an example.

   (or)

   (b) Give an account of i) electron capture ii) positron emission. (6 + 6)
9. (a) Why are fusion reactions in nuclear chemistry referred to as thermonuclear reactions? Explain.

   (or)

   (b) What are the characteristics of nuclear fission reactions?
10. (a) Describe the working of Cyclotron.

    (or)

    (b) Describe the working of Betatron.

M.Sc., DEGREE EXAMINATION-November 2009

Model Question paper

First Semester

PHYSICAL CHEMISTRY-I

Time Three hours **Maximum: 75 marks**

Part- A (5 x 3= 15Marks)

Answer ALL questions

1. (a) What are the characteristics of chain reactions?

Or

(b) Describe the effect of temperature on enzyme catalysed reactions.

2 (a). Define chemical potential

Or

(b) Explain the concept of fugacity

3. (a) Explain the principles of photo electron spectroscopy

Or

(b) Define surface tension and give its units.

4. (a) Write notes on Heisenberg's uncertainty peinciples

Or

(b) Write the postulates of quantum mechanics

5. (a) Derive the de Broglie equation and give its significance.

Or

(b) What is the zero point energy of an electron confined in one dimensional box having width of 0.2nm.

Part-B (5 x12= 60Marks)

Answer ALL questions

6.(a)	i)	Derive the kinetic equation for a parallel reaction	(6)
	ii)	Write the details of Rice-Herzfeld mechanism	(6)
		Or	
(b)	i)	Discuss the kinetics and mechanism of complex reactions	(6)
	ii)	Briefly explain Michaelis-Menton theory of enzyme catalysed reactions	(6)
7.(a)		Derive the Langmure adsorption isotherm. What are its limitations	(12)
		Or	
(b)		Derive BET theory of multi layer adsorption	(12)
8.(a)	i)	State and explain second law of thermodynamics	(5)
	ii)	Derive Gibbs-Duhem equation	(7)
		Or	
(b)	i)	Derive Gibbs-Helmholtz equation	(6)
	ii)	Explain the variation of chemical potential with temperature and pressure.	(6)

9.(a) Set up and solve the Schrodinger wave equation for a particle in three dimensional box. (12)

Or

(b) Set up and solve the Schrodinger wave equation for a one dimensional simple harmonic oscillator (12)

10.(a) Set up and solve the Schrodinger wave equation for the hydrogen atom (12)

(b) Apply variation method to helium atom to solve the Schrodinger wave equation f (12)

MODEL QUESTION PAPER
M.Sc., CHEMISTRY DEGREE EXAMINATION - NOVEMBER 2009

First semester
Chemistry

ANALYTICAL CHEMISTRY

Time Three hours **Maximum: 75 marks**

Part-A (5 x 3 = 15 marks)

Answer ALL questions

1 (a) Consider the following sets of replicate measurements:
3.5, 3.1, 3.1, 3.3, 2.5
Calculate the (i) mean; (ii) median; (iii) spread or range;
(iv) standard deviation; (v) coefficient of variation

(or)

(b) Explain
(a) Upper control limit (UCL) and lower control limit (LCL) in the control chart
(b) Null hypothesis

2. (a) Define
(i) Coning and quartering
(ii) Gross sample and sub sample

(or)

(b) Explain the term Pitfalls

3 (a) Distinguish between
(i) The equivalence point and the end point of titration
(ii) Primary standard and secondary standard

(or)

(b) The changes in ionic concentration, which occur during the titration of 100 mL of 0.1 M NaCl with 0.1 M $AgNO_3$. The solubility product of AgCl at the laboratory temperature is 1.2×10^{-10}. The initial concentration of chloride ions $[Cl^-]$ is $molL^{-1}$, or $pCl^- = 1$. When 50 mL of 0.1 M $AgNO_3$ have been added, 50 mL of 0.1 M AgCl remains in a total volume of 150 mL. At this point calculate the Cl^- ion concentration.

4. (a) Define
(i) Chelate
(ii) Tetradentate chelating agent
(iii) Ligand

(or)

(b) What are complexometric titrations?. Discuss the advantages and uses of EDTA titrant in complexometric titration.

5. (a) Identify the valid numeric constants from the following list and point out the reason for the invalidity

(i) 16,585 (ii) $500 (iii) 2.50 E4.5 (iv) 5.8×10^{-5} (v) 35.5 E16

(or)

(b) Explain the purpose of INPUT and LET statements with one example

Part- B (5 x12 = 60 Marks)

6 (a) (i) Apply the Q test to the following data set to determine whether the outlying result should be retained or rejected at the 95%confidence level.
41.27, 41.61, 41.84, 41.70 (6)
Note: Q_{crit} for 4 observations at 95% confidance = 0.829

(ii) An atomic absorption method for the determination of the amount of iron present in used jet engine oil was found, from pooling 30 triplicate analysis, to have a standard deviation s = 2.4 □g Fe/mL. If s is a good estimate of □, calculate the 95% confidence interval for the result, 18.5 □g Fe/mL, if it was based on (A) single analysis, (B) the mean of two analysis (C) the mean of four analysis (6)

(or)

(b) Distinguish between (12)
(i) accuracy and precision
(ii) sample standard deviation and population standard deviation
(iii) random error and systematic error
(iv) mean and median
(v) sample variance and population variance

7. (a) Why should the sampling process is important and what are the different methods of sampling process. (12)

(or)

(b) Enumerate the methods and equipments needed for micro scale manipulation. (12)

8. (a) Derive an expression for the relationship between stepwise stability constants and overall stability constants of a complex MLn (12)

(or)

(b) (i) What is masking agent?. With suitable example explain how masking is usefull in qualitative and quantitative analysis (7)
(ii) Write a short note on replacement titration (5)

9. (a) Construct a curve for the titration of 50 mL of a 0.01 M solution of HCl with a 0.01M solution of NaOH in the following volumes. During the course of the titration calculate the pH after addition of 0.00, 25.00, 30.00, 35.00, 40.00, 45.00, 47.00, 49.00, 49.50, 49.80, 49.90, 50.00, 50.01, 50.05, 50.10, 50.20, 50.50, 60.00, 70.00, 80.00, 100.00 mL of NaOH. (12)

(or)

(b) Explain in what respect is the Fejans method superior to Volhard method for the titration of chloride ion? (12)

10.(a) (i) Write a programme in BASIC to calculate the pH of an acidic buffer (6)

(ii) Write a program in BASIC to calculate the equilibrium constant of a chemical reaction (6)

(or)

(b) (i) Discuss briefly the essential requirements for the preparation of a research report (6)

(ii) Out line the method of creating Excel format file. (6)

XIX List of Question Paper setters / Examiners

Organic Chemistry and related papers

From Periyar Univ & Affliated Colleges		Outside Periyar University	
S.No.	**Name and Address**	**S.No.**	**Name and Address**
1.	Dr.A.Lalitha Lecturer Department of Chemistry, Periyar University, Salem – 636 011.	1.	Dr. K. Pitchumani Professor of Organic Chemistry School of Chemistry Madurai Kamaraj University Madurai- 625 021
2.	Dr. V. Sujatha Lecturer Department of Chemistry, Periyar University, Salem – 636 011.	2.	Dr. P. Rajkumar Professor and Head Dept. of Organic Chemistry University of Madras Chennai – 600 025.
3.	Dr. Shanmugam HOD of Chemistry Muthayammal College of Arts & Science Kakkaveri, Rasipuram – 637 411.	3.	Dr. C. R. Ramanathan Lecturer in Chemistry Pondicherry University Pondicherry – 14.
4.	Mrs. K. Indirani SG Lecturer in Chemistry Govt. Arts College, Salem – 636 007.	4.	Dr.S. Kumaresan Professor of Organic Chemistry Manonmanium Sundaranar University Tirunelveli
5.	Mrs. B. Muthulakshmi SG Lecturer in Chemistry Govt. Arts College, Salem – 636 007.	5.	Dr. C. Venkata Rao Dept.of Chemistry Sri Venkataswara (S.V.) University Tirupati-517502

DEPARTMENT OF CHEMISTRY
PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM- 636 011

Dr.V.RAJ
Professor and Head

28.12.2012

To
Member Secretary
Tamil Nadu State Council for Higher Education
Lady Willingdon College Campus
Kamarajar Salai
Chennai-600 005

Respected Sir,

Sub: Tamil Nadu Government-study abroad programme-sending curricula of PG courses-reg
Ref: Your letter No. D.O.Rc.No.569/2012 A dated 20.12.2012

As per your request, I am sending herewith the curricula of 4 semesters for our PG Chemistry course for Tamil Nadu Government-Study abroad programme for further action.

Thanking you

Yours sincerely

(V.RAJ)

To
Member Secretary
Tamil Nadu State Council for Higher Education

Lady Willingdon College Campus
Kamarajar Salai
Chennai-600 005