

**GOVERNMENT COLLEGE (A)  
RAJAMAHENDRAVARAM**

*(Accredited by NAAC "A+" Grade, CGPA 3.38/4.0, RAF 2017)*

**UG BOARD OF STUDIES 2021 - 22**



**DEPARTMENT OF CHEMISTRY**

**For the Academic Year 2021-22**

**B.Sc., GENERAL., B.Sc. (MCAC) & B.Sc.  
CHEM (HONS)**

On 17<sup>th</sup> Sep, 2021

**Curriculum for the Academic Year 2021-22**

**Proceedings of the Principal, Government College (Autonomous), Rajahmundry**

**Present: Dr.R.David Kumar Swamy, M.Sc, M.Phil., Ph.D**

**Rc. No: Spl./Acad.Cell-GC[A]-RJY/BOS/2021-1, Dated: 13 September 2021**

**Sub:- Government College (Autonomous), Rajahmundry– Boards of Studies (BoS)**

Nomination of Members - Orders Issued.

Ref:- UGC Guidelines for Autonomous Colleges - 2018.

**ORDER**

The Principal, Government College (Autonomous), Rajahmundry is pleased to constitute **Board of studies in CHEMISTRY** for framing the syllabi in Computer Science subject for all semesters duly following the norms of the UGC Autonomous guidelines.

S. No	Name	Designation
1	Sri J. Yacobe Lecturer In- Charge/HoD, Department of Chemistry, GC[A], Rajahmundry	Chairman
2	All Faculty members in the department	Member
3	Dr. T. Narasimha Murthy GDC, Mandapeta	Subject Expert
4	Sri V. Sridhar SVRK GDC (M), Nidadavole	Subject Expert
5	Dr. K. Deepthi, Dept. of Chemistry, UCST, ANUR	University Nominee
6	Dr. N. Ramana, Chemist, ONGC, Rajahmundry	Expert from Industry/Corporate Sector
7	Mr. N. Satish Kumar, III GMC	Student Nominee

The above members are requested attend the BOS meetings and share their valuable views, suggestions on the following functionaries:

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and national requirement for consideration and approval of the Academic Council
- Suggest methodologies for innovate teaching and evaluation techniques
- Suggest panel of names to the Academic council for appointment of examiners
- Coordinate research, teaching, extension and other activities in the department of the college.

The term of the members will be Three years from the date of issue of this proceedings. The Chairman of the BoS (HoD/lecturer In-Charge of the department) is directed to coordinate with the Principal of the College and conduct BoS meetings as and when necessary, but at least twice a year.



**PRINCIPAL**

**GOVERNMENT COLLEGE [A]  
RAJAHMUNDRY**

Copy to:

- The above individuals
- File

**DEPARTMENT OF CHEMISTRY,  
GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**Composition of the Board of Studies Committee**

<b>S.No.</b>	<b>Category</b>	<b>Designation</b>	<b>Names of the Members of Board of Studies</b>	<b>Remarks</b>
1	Educational	Chairperson	Sri J. Yacobe, Lecturer in charge/HoD, Department of Chemistry, Government College (A), Rajamahendravaram	
2	University Nominee	Member	Smt. K. Deepthi, Asst. Professor, Department of Chemistry, Adikavi Nannaya University, Rajamahendravaram	Nominated by University
3	Industrial Nominee	Member	Dr. S. Ramana, Chemist, ONGC, Rajamahendravaram	Nominated by the Principal
4	Subject Expert	Member	Dr. T. Nasimhamurthy Lecturer in Chemistry, GDC, Mandapeta	
5	Subject Expert	Member	Sri V. Sridhar, Lecturer in Chemistry S.V.R.K Govt. Degree College, Nidadavole.	
6	Faculty	Members	All Faculty Members, Department of Chemistry, Government College (A), Rajamahendravaram	Faculty Members
7	Student	Student Nominee	Mr. N. Sathish Kumar III GMC	Student

**DEPARTMENT OF CHEMISTRY,  
GOVERNMENT AUTONOMOUS COLLEGE,  
RAJAMAHENDRAVARAM**

**Board of Studies Resolutions for**

**Conventional Courses**

- **Mathematics, Physics & Chemistry (EM)**
- **Mathematics, Physics & Chemistry (TM)**
- **Botany, Zoology & Chemistry (EM)**
- **Botany, Zoology & Chemistry (TM)**
- **Geology, Mathematics & Chemistry (EM)**

**Re-Structured Courses**

- **Micro-Biology, Zoology & Chemistry (EM)**
- **Bio-Technology, Botany & Chemistry (EM)**
- **Food Micro-Biology, Food Zoology & Food Chemistry (EM)**
- **Agricultural Bio-Technology, Agricultural Botany & Agricultural Chemistry (EM)**
- **Mathematics, Chemistry & Analytical Chemistry**
- **Botany, Chemistry & Horticulture (EM)**
- **Zoology, Chemistry & Aquaculture (EM)**

**Honours Courses**

- **B.Sc. Chemistry ( Honours)**

**Skill Development course**

- **Food Adulteration**

**DEPARTMENT OF CHEMISTRY,  
GOVT. COLLEGE (A), RAJAMAHENDRAVARAM.  
LIST OF ACTIVITIES PROPOSED FOR THE ACADEMIC YEAR  
2021-22**

MONTH	ACTIVITY PROPOSED
<b>AUGUST 2021</b>	15 <sup>th</sup> – <b>Independence Day.</b> 26th - <b>Lavoisier birth day .</b>
<b>SEPTEMBER 2021</b>	16th- <b>World Ozone day</b> – Guest Lecture. One Day International Webinar.
<b>OCTOBER 2021</b>	2 <sup>nd</sup> Gandhi Jayanthi 23rd <b>MOLE Day .</b>
<b>NOVEMBER 2021</b>	11th <b>National Education Day</b> - Outreach Programme to nearby school One National Webinar.
<b>DECEMBER 2021</b>	4th <b>Chemical Disaster Prevention Day</b> <b>Chem. Fest-2021</b> (Group Discussions, Quiz competitions, Poster Presentation)
<b>JANUARY 2022</b>	26 <sup>th</sup> Republic Day 10 days coaching for PG entrance examinations in chemistry
<b>FEBRUARY 2022</b>	28th - <b>National Science Day</b>

**DEPARTMENT OF CHEMISTRY, GOVERNMENT COLLEGE (A),**

**RAJAMAHENDRAVARAM,**

**INDEX 2021-22**

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<b>3</b>	<b>List of Examiners And Paper Setters</b>

<b>B.Sc. CHEMISTRY (GENERAL) COURSE</b>	
<b>4</b>	<b>I B.Sc. I &amp; II Semesters, Paper – I &amp; II Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print, Practical – I &amp; II Syllabus and Scheme of Valuation</b>
<b>5</b>	<b>II B.Sc. III &amp; IV Semesters, Paper – III, IV &amp; V Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print.</b>
<b>6</b>	<b>II B.Sc. III &amp; IV Semesters Practical - III, IV &amp; V Syllabus and Scheme of Valuation.</b>
<b>7</b>	<b>III B.Sc. V Semester, Paper – V &amp; VI Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print.</b>
<b>8</b>	<b>III B.Sc. V Semesters Practical - V &amp; VI Syllabus and Scheme of Valuation.</b>
<b>9</b>	<b>III B.Sc. VI Semester, Paper – VII A,B,C Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print for Paper-VII.</b>
<b>10</b>	<b>III B.Sc. VI Semester Practical - VII Syllabus and Scheme of Valuation for Practical-VII</b>
<b>11</b>	<b>III B.Sc. VI Semester Paper – VIII A1,A2,A3 Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print for Paper- VIII A1,A2,A3</b>
<b>12</b>	<b>III B.Sc. VI Semester Paper – VIII B1,B2,B3 Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print for Paper- VIII B1,B2,B3</b>
<b>13</b>	<b>III B.Sc. VI Semester Paper – VIII C1,C2,C3 Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print for Paper- VIII C1,C2,C3</b>
<b>14</b>	<b>III B.Sc. VI Semester Paper – VIII D1,D2,D3 Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print for Paper- VIII D1,D2,D3</b>
<b>15</b>	<b>III B.Sc. VI Semester Paper – VIII E1,E2,E3 Syllabus, Scheme of Valuation, Model Question Paper &amp; Blue Print for Paper-VI</b>
<b>16</b>	<b>III B.Sc. VI Semester Practicals Syllabus and Scheme of Valuation for Practical-VIII A1,A2,A3/B1,B2,B3/C1,C2,C3/D1,D2,D3/E1,E2,E3</b>

<b>B.Sc. CHEMISTRY (HONOURS) COURSE</b>	
17	<b>II B.Sc. Chemistry (Honours) III &amp; IV Semesters Syllabus, Scheme of Valuation Model Question Paper &amp; Blue Print for Papers-III A, IIIB, IIIC, IVA, IVB, IVC.</b>
18	<b>II B.Sc. Chemistry (Honours) III &amp; IV Semesters Practicals Syllabus and Scheme of Valuation for Practical- IIIA, IIIB, IIIC, IVA, IVB, IVC.</b>
19	<b>III B.Sc. Chemistry (Honours) V Semester, Syllabus, Scheme of Valuation Model Question Paper &amp; Blue Print for Papers – VA, VB, DSE-1, DSE-2</b>
20	<b>III B.Sc. Chemistry (Honours) V Semester Practicals Syllabus and Scheme of Valuation for Practical - VA, VB, DSE-1, DSE-2</b>
21	<b>III B.Sc. Chemistry (Honours) VI Semester, Syllabus, Scheme of Valuation Model Question Paper &amp; Blue Print for Papers – VIA, VIB, DSE-3, DSE-4</b>
22	<b>III B.Sc. Chemistry (Honours) VI Semester Practicals Syllabus and Scheme of Valuation for Practical - VIA, VIB, DSE-3, DSE-4</b>
23	<b>Certificate Course on Basic Analytical Techniques- Syllabus, Blue Print Model Paper</b>
24	<b>Certificate Course on Basic Analytical Techniques-Practical Syllabus &amp; Scheme of Valuation.</b>
25	<b>Skill development course on Food Adulteration</b>
26	<b>Recommended Text Books and Reference Books</b>

<b>B.Sc. CHEMISTRY (MCAC) COURSE</b>	
27	<b>II B.Sc. (MCAC) III &amp; IV Semester, Paper – III &amp; IV Syllabus, Scheme of Valuation Model Question Paper &amp; Blue Print</b>
28	<b>II B.Sc. (MCAC) III &amp; IV Semester Practical – III &amp; IV Syllabus and Scheme of Valuation.</b>
29	<b>III B.Sc. (MCAC) V Semester, Papers – V &amp; VI Syllabus, Scheme of Valuation Model Question Paper &amp; Blue Print</b>
30	<b>III B.Sc. (MCAC) V Semester Practical – V &amp; VI Syllabus and Scheme of Valuation.</b>
31	<b>III B.Sc. (MCAC) VI Semester, Paper – VII &amp; VIII Syllabus, Scheme of Valuation Model Question Paper &amp; Blue Print</b>
32	<b>III B.Sc. (MCAC) VI Semester Practical – VII &amp; VIII Syllabus and Scheme of Valuation.</b>

## **AGENDA**

- 1. Adopted APSCHE Syllabus for I, II, III, IV Semesters (Both Theory and Practical).**
- 2. New Theory and Practical Syllabus for the Semesters V & VI For B.Sc (Chemistry), B.Sc. (MCAC), and B.Sc Chemistry (Honours) & Food Adulteration for Skill development Programmes.**
- 3. Internal Assessment Component,**  
  
**Internal marks are increased to 50 Marks and External marks reduced to 50 Marks for semester V & VI .**
- 4. From this Academic year B.Sc (Honours) Chemistry Programme entered in to V & VI Semesters.**
- 5. Model Question Papers.**
- 6. Blue Prints.**
- 7. Additional Inputs in the Curriculum.**
- 8. Practical's Scheme of Valuation.**
- 9. Other Academic Activities of the department.**
- 10. Any other proposal with the permission of the chair.**



**DEPARTMENT OF CHEMISTRY, GOVT. COLLEGE (A), RAJAMAHENDRAVARAM.**

**Minutes of the Board of Studies Meeting June 2021.**

**DATE: 17-09-2021**

**TIME: 11 AM**

The Board of studies meeting of Chemistry Department is convened on 17-09-2021 at 11 AM under the Chairmanship of Sri Sri J. Yacobe, in-charge of the department. The members present discussed various aspects such as changes made in the Syllabus and Model Question papers of 1, 2, 3, 4, 5, & 6 semesters both for theory and practical of B.Sc (Chemistry), B.Sc. (MCAC), and B.Sc Chemistry (Honours) Programmes for implementing them during the academic year 2021-2022 onwards.

**RESOLUTIONS:** It is resolved to

- 1 Design, introduce and implement Syllabus and Model Question papers of 3, 4, 5, & 6 semesters both for theory and practical of B.Sc (Chemistry), B.Sc. (MCAC), and B.Sc Chemistry (Honours) Programmes as per Choice Based Credit System from the Academic Year 2021-22.**
- 2 Implementing Research Based Pedagogical evaluation methods in the curriculum for internal assessment**
- 3 Implementing Certificate course on Basic Analytical Techniques from this Calendar year 2019.**
- 4 In view of the Corvid – 19 Disaster, Preparing e-content for the syllabus in four Quadrants as: Soft Copy of Notes, Video Lessons and Related Multiple Choice Questions**
- 5 The structure of all courses is given in tabular form**
- 6 As per the CBCS the core subject CHEMISTRY comprises of SIX courses in chemistry like six semesters as per previous practice.**
  - **For B.Sc. first year there will be CORE I in semester -I and Core II in semester –II**
  - **For B.Sc. second year there will be CORE III in semester -III and Core IV in semester -IV**
  - **For B.Sc. third year there will be CORE V in semester -V and Core VI in semester –VI**

5. **EVALUATION:** Evaluation for each course will be done as follows:

**For First & Second Years:**

It has been decided to introduce Continuous Internal assessment marks for a total of **50 marks from the academic year 2021-22**, which are to be distributed as follows:

S.No.	Component		Distribution of Marks
1	CIE I (after completion of 50% of syllabus)		20
2	CIE II (Online Exam)		10
3	ATTENDANCE	Above 95%	5
		91% to 95%	4
		86% to 90%	3
		81% to 85%	2
		75% to 80%	1
		Below 75%	0
Pedagogical Strategies			
4	ASSIGNMENT		5
5	Participation or Paper Presentation in Student Seminars/Workshops/Group Discussions/ Quiz/ Student Study Project/Field Visit/Survey		5
6	Viva-voce		5
TOTAL			50

**The minimum pass mark for both internal and external examinations is 18 marks (36%), but as a whole student is subjected to get 40% marks (40 out of total 100 marks) to pass the subject.**

**For Third Year:**

For Third year students from 2018-19 academic year onwards the following Evaluation pattern is followed.

- a) A continuous internal assessment (CIA) (for 50 marks) by the concerned Course teacher as well as by an end semester examination (for 50 marks) and will consolidated at the end of the course for 100 marks. The components for continuous internal assessment are:

Passing minimum for end semester exam will be 40% out of 50 marks (i.e 20 Marks)

Average of two	20 Marks	11/2 Hours	The passing minimum CIA will be 50% (IE., 20 marks)
CIE II (Online Exam)	10 Marks		
Assignments	5 Marks		
Attendance	5 Marks		
student Seminars	5 Marks		
Viva	5 Marks		
Total	50 marks		

(b) Semester end exam at the end of each semester.

Passing minimum for end semester exam will be 40% out of 50 marks (i.e. 20 marks)

6. The pattern of question papers of I & II Year semester end examinations,

**For First & Second Years for All Papers:**

- in section 'A' the candidate has to answer four essay questions from a total of **Eight** questions with internal choice      Marks:  $4 \times 7 = 28$
- In section 'B' the candidate has to answer four short answer type questions out of **Eight** Questions.      Marks:  $4 \times 4 = 16$
- In section 'C' the candidate has to answer all the **three** very short answer type questions. Marks:  $3 \times 2 = 6$
- Total Marks:  $28 + 16 + 06 = 50$  Marks

**For Third Years for All Papers:**

- In section 'A' the candidate has to answer four essay questions from a total of **Eight** questions with internal choice      Marks:  $4 \times 7 = 28$
- In section 'B' the candidate has to answer Four short answer type questions out of **Six** Questions Marks:  $4 \times 4 = 16$
- In section 'C' the candidate has to answer all the **Three** very short answer type questions. Marks:  $3 \times 2 = 6$
- Total Marks:  $28 + 16 + 06 = 50$  Marks

7. As per the request from student nominees, for the benefit of students facing entrance examinations of other universities and other competitive examinations, it is resolved to include Value addition/ additional inputs to the syllabus prescribed by AKNU to B.Sc. I, II& III year and to modify the

syllabus as per need by utilizing academic autonomy.

- 8 For First, Second and Third Years the Internal Practical Examination, will be conducted at the end of I, III and V semesters for 50 marks and External Practical Examination for I, II and III Years will be conducted at the end of II, IV and VI semesters for 50 marks respectively for those academic years.
- 9 For B.Sc. first year students admitted in 2019-20 onwards the practical syllabus is Qualitative Analysis, and for B.Sc. second year student's Spectroscopy and Physical Chemistry practicals and for third year Organic Chemistry and Physical Chemistry practicals along with Instrumentation will be implemented.

Chairman,

Board of Studies,

Department of Chemistry.

### **ADDITIONS AND DELETIONS FOR THE ACADEMIC YEAR 2021-22**

**Aim:** In order to prepare the students for attending various competitive exams and for M.Sc. Entrance tests of different Universities. To enrich the students in the path of application oriented learning.

#### **I B.Sc. CHEMISTRY PAPER-I**

<b>SEMESTER I</b>					
<b>S.No</b>	<b>Topic deleted</b>	<b>No. of hours</b>	<b>Topic incorporated</b>	<b>No. of hours</b>	<b>Justification</b>
1	-	-	Theory of Qualitative Analysis	04 Hours	To have thorough knowledge on what is happening in practicals

#### **B.Sc. CHEMISTRY PAPER-III**

<b>SEMESTER III</b>					
<b>S.No</b>	<b>Topic deleted</b>	<b>No. of hours</b>	<b>Topic incorporated</b>	<b>No. of hours</b>	<b>Justification</b>
1	-	-	Nucleophilic substitution reactivity of various halogen compounds, ram's rule, Nucleophilic substitution reactivity of various halogen compounds. Hoffmann Bromide Degradation	04 Hours	To have thorough for attending various competitive exams and for M.Sc. Entrance tests of different Universities

#### **B.Sc. CHEMISTRY PAPER-V**

<b>SEMESTER V</b>					
<b>S.No</b>	<b>Topic deleted</b>	<b>No. of hours</b>	<b>Topic incorporated</b>	<b>No. of hours</b>	<b>Justification</b>
1	Molecular Spectroscopy	05 Hours	Material Science	05 Hours	The deleted Topic was repeated in V Sem. To have knowledge on Nano Materials

**Note:** Introduced new papers for B.Sc. (MCAC) in V and VI semesters, and introduced remaining papers of B.Sc. Chemistry (Honours) III, IV, V and VI semesters with enriching them with new topics as detailed in their Credit tables.

## **JUSTIFICATION FOR THE INTRODUCTION OF VARIOUS COURSES IN OUR CURRICULUM:**

### **OBJECTIVES OF THE CONVENTIONAL B.Sc CHEMISTRY COURSES:**

We can hardly find any industry without the need of Chemists. Students with B.Sc. Chemistry are much sought after by the industry. This paper offers in depth knowledge

in chemistry to students and surely enhances the skills and thereby improves their future job/academic prospects. Therefore it is resolved to introduce Chemistry paper in B.Sc., course. Besides classical analysis, instrumental analysis is covered in the syllabus. Quantitative and mainly qualitative analytical techniques are discussed in detail.

**OUTCOMES OF THE CONVENTIONAL B.Sc CHEMISTRY COURSES:** The students have wide range of Job Oriented opportunities as Quality Control Analyst, Quality Assurance, Research and Development, Process Managers, Project Manager, Analytical Chemists etc.

### **OBJECTIVES OF THE JOB ORIENTED B.Sc FMZC, Ag. BBC COURSES:** The Food MZC

course is beneficial to provide professionals courses with knowledge about the development, Preservation, processing, packaging, distribution and usage of safe, nutritive and healthy foods.

Agricultural BBC course provides depth knowledge and practical skills to students regarding suitable fertilizer for the land, pest management, food preparation, entrepreneurship and food manufacturing and baking industries. Self-employment opportunities also exist in the form of dynamic delivery networks for those who want to work on their own.

**OUTCOMES OF THE JOB ORIENTED B.Sc FMZC, Ag. BBC COURSES:** After graduating in B.Sc FMZC & Ag. BBC courses the students have wide range of Job Oriented opportunities as Production Managers, Procuring Manager, Marketing sectors, Food Microbiologist, Food Standards Officer and Food Technologist.

### **OBJECTIVES OF THE RESTRUCTURED B.Sc. MCAC COURSE:**

Analytical Chemistry is an applied, experimental field of science and is based not only on chemistry, but also on physics, biology, information theory and many fields of technology. It is of fundamental importance not only to all branches of chemistry but also to all biological sciences, engineering sciences, health, medicine, pharmaceuticals, environment, industrial processes, quality control and implementation of legislation.

The objective of B.Sc Analytical chemistry course is to provide students exposure to chemistry, physics, biological sciences, environmental science, computer application, instrumentation and analytical techniques. In this three year course spread over six semesters, there are 10 papers of

Analytical chemistry 7 papers of chemistry and 7 Mathematics. In the last semester of this course, there is a provision for one cluster elective papers out of two cluster elective papers, viz.

**OUTCOMES OF THE RESTRUCTURED B.Sc. MCAC COURSE:** After graduating in Analytical Chemistry the students can pursue academics in Chemistry, bioinformatics, forensic science, biochemistry and other disciplines of interdisciplinary sciences. They can also use it as a stepping stone to pharmaceutical industry and for Research and Development in industry.

**OBJECTIVES OF THE B.Sc. CHEMISTRY (HONOURS) COURSE:**

It is of fundamental importance to all branches of chemistry dealing with pharmaceuticals, IT skills, Cosmetics & Perfumes, Environmental Protection, Pesticides etc. In this three year course spread over six semesters, there are 14 Core course papers and 8 Elective Papers of chemistry and 4 Mathematics papers.

**OUTCOMES OF THE B.Sc. CHEMISTRY (HONOURS) COURSE:**

After graduating in B.Sc. Chemistry (Honours) Course the students can pursue academics in Chemistry, Research, bioinformatics, Cosmetic science, Environmental Management System and other disciplines of interdisciplinary sciences. They can also use it as a stepping stone to pharmaceutical industry and for Research and Development in industry.

**OBJECTIVES & OUTCOMES OF THE CERTIFICATE COURSE:** This course will impart immense skills on qualitative and quantitative analysis in chemistry to both science and non-science students. The main objective of this course is to provide training to the candidates to work as technicians in chemistry labs in junior, degree and PG colleges and pharmaceutical laboratories.

**The following members attended the Board of studies meeting:**

<b>S.No.</b>	<b>Name</b>	<b>Signature</b>
1.	Dr. K. Deepthi, University Nominee Adi Kavi Nannaya University, Rajahmundry.	
2.	Dr. N. Ramana, Industrial Nominee Chemist, ONGC, Rajahmundry.	
3.	Dr. T. Narsimhamurthy, Subject Expert GDC, Mandapeta	
4.	Sri V. Sridhar, Subject Expert, SVRK GDC (M), Nidadavolu	
5.	Dr. B. Madhav, Staff Member	
6.	Dr. B. Mallikarjuna, Staff Member	
7.	Dr. (Smt). K. Anitha, Staff Member	
8.	Dr. M. Trinadh, Staff Member	
9.	Sri V.S.Narayana Staff Member	
10.	Dr. V.Satyanarayan, Staff Member	
11.	Dr. P.Murali Krishna, Staff Member	
12.	Smt Ch.Rajani, Staff Member	
13.	Dr.M.Vanaja, Staff Member	
14.	Kum K.Vaishnavi, Staff Member	
15.	Sri M.Prasad, Staff Member	
16.	Smt. J. Sashi Sri, Staff Member	
17.	Dr. E.S.R.S. Sharma, Staff Member	
18.	Sri B.S.V. Prasad, Staff Member	



19.	Smt. N. Bhargavi, Staff Member	
20.	Smt. P. Surya Sree, Staff Member	
21.	Sri. K. Srinivasa Rao, Staff Member	
22.	Smt. B. Baby Nalini, Staff Member	
23.	Smt B. Maha Lakshmi, Staff Member	
24.	Sri I. Ramesh, Staff Member	
25.	Sri SVVS. Durga Prasad, Staff Member	
26.	Smt. R. Praneetha Sree, Staff Member	
27.	Sri Ch. Siva Krishna, Staff Member	
28.	Smt. G. Bhagyavathi, Staff Member	
29.	Smt P. Sravani Ratnam, Staff Member	
30.	Smt R.R.Keerthana, Staff Member	
31.	Kum T.M.Therisa, Staff Member	
32.	Mr. N.Sathish Kumar. III GMC	
33.	Kum P.Jahnavi, III MZC	

The following documents submitted to the Academic coordinator and Controller of Examinations:

1. Resolutions of Board of Studies Meeting
2. Syllabus of I to VI semesters.
3. Model question papers for I to VI semesters.
4. List of revised Examiners (if any)
5. Any other new proposals

Date: 16-09-2021.

Chairman,  
Board of Studies,  
Department of Chemistry.

**List of Examiners and Paper Setters:**

<b>S. No.</b>	<b>Name of the Lecturer/Reader</b>	<b>College</b>	<b>Paper Taught</b>
01	A. Sai Sundar	Govt. College, Jangareddigudem	All
02	Dr. T. Narasimha murthy	GDC, Mandapeta	All
03	U. Venkatacharyulu	Govt. College, Jaggampeta	All
04	Ms. V. Ananta Lakshmi	ASD GDC(W), Kakinada	All
05	T.V.V. Satyanarayana	GDC, Ramachandrapuram	All
06	T. Sreevaram	GDC, Ravulapalem	All
07	D. Suneetha	GDC, Yeleswaram	All
08	V. Badrinarayana Rao	GDC.(W) Kakinada	All
09	E.V.S Subrahmanyam	GDC, Razole	All
10	U. Satyanarayana	GDC, Tuni	All
11	T. Vara Prasad	P.R.G. C.(A) Kakinada	All
12	D. Ramarao	P.R.G. C.(A) Kakinada	All
13	K. Anand	GDC, Chinthalapudi	All
14	V. Mallikrajuna Sharma	P.R.G.C, Kakinada	All
15	G. Srinivasa Reddy	DCR College, G.Mamidada	All
16	D. Chenna Rao	ASD GDC(W), Kakinada	All
17	T. Srinivasa Rao	GDC (M), Nidadavolu	All
18	V. Sridhar	GDC (M), Nidadavolu	All

19	M. V. Prem Sagar	GDC (M), Nidadavolu	All
20	DSN. Raju	---Do--	All
21	B.Venkata Rao	GDC, Ramachandrapuram	All
22	T. Nageswara Rao	K.G.R.L., Bhimavaram	All
23	B. Rama Krishna	SKST(W)DC, Tanuku	All
24	Dr. G. V. Ramana	SKVT C, Rajahmundry	All
25	P. Siva Kumar	GDC, Mandapeta	All
26	University Nominee	Local Nominee	

**Date: 15-09-2021.**

**Chairman,  
Board of Studies,  
Department of Chemistry.**

**Government College (A), Rajamahendravaram**

*(Accredited by NAAC "A+" Grade)*

**Department of Chemistry**

**Certificate of Submission**

These following documents are submitted to the Academic Coordinator and Controller of Examinations:

1. Hard copy of the approved curriculum which includes minutes of U.G. Board of studies, approved syllabus, blue print for the question papers and model question papers for all semesters and list of approved examiners .
2. CD containing the approved curriculum which includes minutes of U.G. Board of Studies, approved syllabus, blue print for the question papers and model question papers for all semesters and list of approved examiners.

Chairman  
(J.Yacobe)

Academic Coordinator

Controller of Examinations

**GOVERNMENT COLLEGE (A)  
RAJAMAHENDRAVARAM**

*(Accredited by NAAC "A+" Grade, CGPA 3.38/4.0, RAF 2017)*

**UG BOARD OF STUDIES - 2021-22**



**DEPARTMENT OF CHEMISTRY  
For the Academic Year 2021-22**

**B.Sc (General)**

**Curriculum for the Academic Year 2021-22**

**DEPARTMENT OF CHEMISTRY, GOVERNMENT COLLEGE (A),**

**RAJAMAHENDRAVARAM,**

**INDEX 2021-22 for B.Sc (General)**

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**DEPARTMENT OF CHEMISTRY,  
GOVT. COLLEGE (A), RAJAMAHENDRAVARAM**

**TABLE SHOWING ALLOCATION OF CREDITS FOR B.Sc. (GENERAL)**

S.No.	Course Code	Title of the Course	Hrs/Week	Max. Marks	Marks in SEE	Marks In CIA	Credits
<b>I B.Sc. Semester - I</b>							
1	CHE-101	Module: Inorganic Chemistry Module: Organic Chemistry	04	100	50	50	03
2	CHE-101P	Practical-I: Analysis of Salt Mixture	03	50	50	-	02
<b>I B.Sc. Semester – II</b>							
3	CHE-102	Module: General Chemistry Module: Physical Chemistry	04	100	50	50	03
4	CHE-102P	Practical-II: Volumetric Analysis	03	50	50	-	02
<b>II B.Sc. Semester - III</b>							
5	CHE-103	Module: Organic Chemistry Module: Spectroscopy	04	100	50	50	03
6	CHE-103P	Practical: Organic Preparations and IR Spectral Analysis	03	50	50	-	02
<b>II B.Sc. Semester - IV</b>							
7	CHE-104	Module: Inorganic Chemistry Module: Organic Chemistry Module: Physical Chemistry	04	100	50	50	03
8	CHE-104P	Practical IV: Organic Qualitative Analysis	03	50	50	-	02
9	CHE-104A	Module: Inorganic Chemistry Module: Physical Chemistry	04	100	50	50	03
10	CHE-104AP	Practical-V Course Conductometric and Potentiometric Titrimetry	03	50	50	-	02
<b>III B.Sc. Semester - V</b>							
9	CHE-105	Module: Applied Inorganic Chemistry Module: Applied Organic Chemistry	04	100	50	50	03
10	CHE-105P	Practical: Organic Functional Group Analysis	03	50	50	-	02
11	CHE-106	Module: Applied Organic Chemistry Module: Applied Physical Chemistry	04	100	50	50	03
12	CHE-106P	Practical: Physical Chemistry	03	50	50	-	02

**III B.Sc. Semester - VI**

13	CHE-111	VII-A: Analytical Methods In Chemistry	03	100	50	50	03
14	CHE-111P	Practical:	03	-	50	-	02
15	CHE-112	VII-B: Environmental Chemistry	03	100	50	50	03
16	CHE-112P	Practical:	03	-	50	-	02
17	CHE-113	VII-C: Green Chemistry	03	100	50	50	03
18	CHE-113P	Practical:	03	-	50	-	02
19	CHE-114	VIII-A1: Polymer Chemistry	03	100	50	50	03
20	CHE-115	VIII -A2: Instrumental Methods of Analysis	03	100	50	50	03
21	CHE-116	VIII -A3: Analysis of Drugs, Food Products & Biochemical Analysis	03	100	50	50	03
22	CHE-117	VIII -B1: Fuel Chemistry & Batteries	03	100	50	50	03
23	CHE-118	VIII -B2: Inorganic Materials of Industrial Importance	03	100	50	50	03
24	CHE-119	VIII -B3: Analysis of Industrial Products	03	100	50	50	03
25	CHE-120	VIII -C1: Organic Spectroscopic Techniques	03	100	50	50	03
26	CHE-121	VIII -C2: Advanced Organic Reactions	03	100	50	50	03
27	CHE-122	VIII-C3: Pharmaceutical & Medicinal Chemistry	03	100	50	50	03
28	CHE -	VIII -D1: Organic Spectroscopic Techniques	03	100	50	50	03
29	CHE -	VIII -D2: Advanced Organic Reactions	03	100	50	50	03
30	CHE -	VIII-D3: Pharmaceutical & Medicinal Chemistry	03	100	50	50	03
31	CHE -	VIII - E1: Organic Spectroscopic Techniques	03	100	50	50	03
32	CHE -	VIII - E2: Advanced Organic Reactions	03	100	50	50	03
33	CHE -	VIII- E3: Pharmaceutical & Medicinal Chemistry	03	100	50	50	03
34		Practical VIIIA1/B1/C1/D1/E1:	03	-	50	-	02
35		Practical VIIIA2/B2/C2/D2/E2:	03	-	50	-	02
36		Practical VIII A3/B3/C3/D3/E3: Project Work	03	-	50	-	02



# **FIRST YEAR SEMESTER - I**

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**B.Sc. FIRST YEAR CHEMISTRY SEMESTER –I**

**CHE 101: INORGANIC AND PHYSICAL CHEMISTRY**

60 hrs. (4h/w)

**Course Outcomes:**

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

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

**INORGANIC CHEMISTRY**

24 h

**UNIT -I**

Chemistry of p-block elements

8h

**Group 13:** Preparation & structure of Diborane, Borazine

**Group 14:** Preparation, classification and uses of silicones

**Group 15:** Preparation & structures of Phosphonitrilic halides  $\{(PNCL)_n$  where  $n=3, 4$

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

**Group 17:** Pseudo halogens, Structures of Interhalogen compounds.

**UNIT-II**

Chemistry of d-block elements:

6h

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

1. Chemistry of f-block elements:

6h

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

3. Theories of bonding in metals: 4 h

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

### **PHYSICAL CHEMISTRY (36 h)**

UNIT-III

**Solid State** 10 h

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

Unit-IV

1. **GasEous state:** Vanderwaals equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and Vanderwaals constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature.

2. Liquid state

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

UNIT-V: Solutions, Ionic equilibrium & dilute solutions 6h

1. Solutions: Azeotropes-HCl-H<sub>2</sub>O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. Ionic equilibrium 3h

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

### 3. Dilute solutions

7h

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

#### Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester- end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

#### List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J.E. Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Atkins, P.W. & Paula, .de Atkin's Physical Chemistry Ed., Oxford University Press 10<sup>th</sup> Ed (2014).
10. Castellan, G.W. Physical Chemistry 4thEd. Narosa (2004).
11. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
12. Barrow, G.M. Physical Chemistry

**Practical-I** Analysis of SALT MIXTURE (At the end of Semester-I)  
Qualitative inorganic analysis (Minimum of Six mixtures should be analysed)

50 M

Course outcomes:

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

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

Analysis of SALT MIXTURE

50 M

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

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

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

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.**

**B.Sc. FIRST YEAR CHEMISTRY SEMESTER –I**

**QUESTION PAPER BLUE PRINT**

**INORGANIC & PHYSICAL CHEMISTRY**

**TIME: 2½ hr.**

**MARKS: 50 M**

**PART -A**

Answer **ALL** the Questions

**4X7 = 28 M**

**2 Questions from UNIT- I**

- 1. 2 Questions from UNIT- II**
- 2. 2 Questions from UNIT-III AND IV**
- 3. 2 Questions from UNIT V**

**PART – B**

Answer any **FOUR** Questions

**4x4 = 16 M**

- 4. 1 Question from UNIT- I**
- 5. 2 Questions from UNIT- II**
- 6. 1 Question from UNIT- III**
- 7. 2 Questions from UNIT- IV**
- 8. 2 Questions from UNIT- V**

**PART-C**

Answer **ALL** Questions

**3x2 = 6M**

- 9. UNIT- II**
- 10. UNIT- III**
- 11. UNIT- IV**

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**FIRST YEAR B.Sc., DEGREE EXAMINATION**  
**SEMESTER-I, MODEL PAPER (From 2020-21)**

**CHEMISTRY COURSE-I: INORGANIC & PHYSICAL CHEMISTRY**

Time: 2½ hr

Maximum Marks: 50

**PART- A**

4 X 7 = 28 Marks

Answer **All** the questions. Each carries **Ten** marks

1. Explain Classification, Preparations & uses of Silicones

సీలికొనల వర్గీకరణ, తయారీ మర్ణియ ఉపయోగములను వివరించుము.

(or) (లేదా)

2. (i) What are Pseudohalogens?

సాధో హేలోజనులు అనగానేమి?

(ii) Explain the Structures of any one AX<sub>3</sub> & AX inter halogen compounds.

AX<sub>3</sub> మరియు AX తీతర హేలోజను సమ్మేళనముల నిర్ణయములను వివరించుము.

3. What is Lanthanide Contraction? Explain the Consequences of Lanthanide Contraction.

లంథానిడ్ సంకోచము ? య తమములను  
ధనడ అనగానమి లంథానిడ్ సంకోచమునకం పరణ  
దారణ

వివరించుము.

(Or)/ (లేదా)

4. (i) Explain the magnetic properties of d- block elements.

డీ-బ్లౌక్ మూలకాల అయస్కాంత ధర్మములను వివరించుము

(ii) Explain about Conductors, Semi-Conductors & Insulators using Band Theory.

వహకములు, అరద వహకములు, నిరోధకములు ధాంతములను  
మర్ణియ పటికా సద వివరించుము.

5. Write an essay on Crystal defects.

సఫటిక లోపములను గురించి ఒక వాసములను వాయము.

(Or)/

(లేదా)

6. Derive the relationship between Critical constants & Vanderwaals constants.

సంధి తంకము య వాండర్ వాల్ సీరికంకములు మధా సంబంధములను  
గదనో మర్ణయ ఉత్తాదించుము.

7. Explain Nernst distribution Law. Explain its applications

నేర్స్ట్ వితరణ నియమములను వివరించుము. దాని అనువరతనములను  
వివరించుము.

(or) / (లేదా)

8. What are colligative properties? Write experimental methods for determination

of molar mass of a non-volatile solute by using Elevation in boiling point & depression in freezing point.

కణాధార ధరణీమలల అనగానేమి? ఒక అభిషేకశీల దశావితమ యొకక మోలార్  
దశావారశాని బిషిభవన సాని ఉనతీ మరణీయ దశావీభవన సాని  
నిమత ఉపయోగించి పయోగ పద్ధతులలో కనుగొనుట వాయుము.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**



**PART- B**

4 X 4 = 16 Marks

Answer any **FOUR** of the following questions. Each carries **FOUR** marks

9. Explain the preparation & structures of Phosphonitrilic compounds.  
ఫాస్ఫోనైట్ సమ్మేళనముల తయారీ మరియు వివరణించుము.
10. Explain in brief, catalytic properties & stability of various oxidation states of d- block elements.  
d-బ్లౌక్ మూలకముల ఉత్తరీకరణ ధర్మముల మరియు వాటి  
వివిధ ఆకరణ స్థితుల స్థిరత్వము గూర్చి సంగ్రహముగా  
వివరణించుము.
11. Write short note on Bravais lattices and crystal systems.  
బ్రౌవియన్ లాటిస్ మరియు సాటిక్ వ్యాసనీల గూర్చి కొంత ముగ్ధ వర్ణనము.
12. What are Smectic & Nematic liquid Crystals? Explain.  
స్మెక్టిక్ మరియు నెమాటిక్ మూలము ? వివరణించుము.  
ద్రవ స్ఫటిక అనగానవి
13. Write account on Common ion effect & Solubility product.  
ఉమ్మడి అయానీ ప్రభుత్వము మరియు తౌల్య లబ్ధి ముగ్ధ గూర్చి వర్ణనము.  
అయానీ ప్రభుత్వ ద్రావణ్యము
14. Describe Andrew's isotherms of carbon dioxide.  
కార్బన్ డై ఆక్సైడ్ యొక్క ఆంధ్రాన్ ఐసోథర్మల్స్ వివరణించుము.
15. Explain Actinide Contraction.  
ఆక్టినైడ్ సంకోచమును వివరణించుము.
16. Explain the Effects of impurities on Critical Solution Temperature.  
కరటికల్ సొల్యూషన్ టెంపరేచరు ప్రభుత్వము వర్ణనము వివరణించండి.  
అయానీ ఉమ్మడి ప్రభుత్వము మలినముల ప్రభుత్వము

**PART- C**

3 X 2 = 6 Marks

Answer ALL questions. Each carries **TWO** marks

17. Define Actinide Contraction.  
ఆక్టినైడ్ సంకోచమును నిర్వచించండి.
18. Define the law of Symmetry.  
సౌష్ఠ్య నియమాని నిర్వచించండి
19. Write about Ionic Product.  
అయానీ లబ్ధి ముగ్ధ గుర్తించి వర్ణనము

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

# **FIRST YEAR SEMESTER - II**

# **GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

## **B.Sc. FIRST YEAR CHEMISTRY SEMESTER –II SYLLABUS**

### **COURSE II - ORGANIC AND GENERAL CHEMISTRY**

60 hrs (4h/w)

Course outcomes:

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

1. Understand and explain the differential behaviour of organic compounds based on fundamental concepts learnt.
2. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.
4. Correlate and describe the stereo chemical properties of organic compounds and reactions.

### **ORGANIC CHEMISTRY**

#### **UNIT-I:**

Recapitulation of Basics of Organic Chemistry Carbon-Carbon sigma bonds  
(Alkanes and Cycloalkanes)

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

#### **UNIT-II:**

12h

Carbon-Carbon pi Bonds (Alkenes and Alkynes) General methods of preparation, physical and of E1, E2, E1 reactions, Saytzeff and Hoffmann eliminations, Additions, mechanism (Markownikoff / Anti Markownikoff suitable examples, Syn and anti-addition; addition of H<sub>2</sub>, X<sub>2</sub>,

Chemical properties. Mechanism Electrophilic addition) with HX. oxymercuration -

demercuration, hydroboration-oxidation, Ozonolysis, hydroxylation, Diels Alder reaction, 1,2- and 1,4- addition reactions in conjugated dienes. Reactions of alkynes: acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

**UNIT-III:****12h**

Benzene and its reactivity, Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclo propenyl cation, cyclopentadienyl anion and tropylium cation). Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO<sub>2</sub> and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)

**GENERAL CHEMISTRY****UNIT-IV:****24Hrs**

Surface chemistry and chemical bonding Surface chemistry

**6h**

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

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

**1. Chemical Bonding****6h**

Valence bond theory, hybridization, VB theory as applied to CIF<sub>3</sub>, Ni(CO)<sub>4</sub>, Molecular orbital theory - LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N<sub>2</sub>, O<sub>2</sub>, CO and NO).

**3. HSAB****2h**

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

**UNIT-V:**

Stereochemistry of carbon compounds

**10h**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria(Symmetry elements)- Definition of enantiomers and diastereomers - Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L, R,S and E,Z- configuration with examples.

Definition of Racemic mixture - Resolution of racemic mixtures (any 3 techniques)

### Co-curricular activities and Assessment Methods:

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Work sheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Semester-End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

#### List of Reference Books Theory:

Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.

Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.  
Practical:

Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

#### Additional Resources:

Solomons, T. W. G.; Fryhle, C. B. & Snyder, S. A. Organic Chemistry, 12th Edition, Wiley.

Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.

Clayden, J.; Greeves, N. & Warren, S. Organic Chemistry, Oxford.

Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, New Age International.

Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

## Practical-II Volumetric Analysis

(At the end of Semester-II)

Course outcomes:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Understand and explain the volumetric analysis based on fundamental concept learnt in ionic equilibria
3. Learn and identify the concepts of a standard solutions, primary and secondary standards
4. Facilitate the learner to make solutions of various molar concentrations. This may include:  
The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis

50 M

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using  $\text{KMnO}_4$  with oxalic acid as primary standard.
3. Determination of Cu (II) using  $\text{Na}_2\text{S}_2\text{O}_3$  with  $\text{K}_2\text{Cr}_2\text{O}_7$  as primary standard.
4. Estimation of water of crystallization in Mohr's salt by titrating with  $\text{KMnO}_4$

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM,**  
**B.Sc. SECOND YEAR CHEMISTRY SEMESTER –II**  
**QUESTION PAPER BLUE PRINT**  
**ORGANIC CHEMISTRY & GENERAL CHEMISTRY**

TIME: 2½ hr.

MARKS: 50 M

**PART -A**

Answer ALL the Questions

4X7 = 28 M

2 Questions from UNIT- I

1. 2 Questions from UNIT- II
2. 2 Questions from UNIT-III
3. 2 Questions from UNIT IV & UNIT-V

**PART – B**

Answer any FOUR Questions

4x4 = 16 M

4. 1 Question from UNIT- I
5. 2 Questions from UNIT- II
6. 1 Question from UNIT- III
7. 2 Questions from UNIT- IV
8. 2 Questions from UNIT- V

**PART-C**

Answer ALL Questions

3x2 = 6M

9. UNIT- II
10. UNIT- III
11. UNIT- IV
12. UNIT- V



**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**FIRST YEAR B.Sc., DEGREE EXAMINATION**  
**SEMESTER-II, MODEL PAPER (From 2020-21)**  
**CHEMISTRY COURSE -II: ORGANIC & GENERAL CHEMISTRY**

Time: 2½ hr

Maximum Marks: 50

**PART- A**

4 X 7 = 28 Marks

Answer **ALL** the questions. Each carries **SEVEN** marks

1. (i) Write the preparation of alkanes by Wurtz and Corey-House reaction.  
ఉర్ట్జ్ మర్కసియం కోర్-హౌస్ చరణల ద్వారా ఆలకనాలను తయారీచేయుటను వర్ణించుము.  
(ii) Explain Halogenation of alkanes. Explain the reactivity and selectivity in free radical substitutions.  
ఆలకనాల హేలోజనీకరణ వివరణించుము. ఫ్రీ రేడికల్ పాతస్థితి చరణశీలత మర్కసియం సలకవివరణించుము.  
వివరణించుము. (or)
2. (i) Explain Baeyer Strain Theory  
బేయర్ పాతన సదృశీకరణ వివరణించుము.  
(ii) Draw the conformations of Cyclohexane and explain their stability by drawing energy profile diagram.  
సైక్లోఆలకనం అనురూపక సాదృశీకరణాలను వోల్టేజీ పట్టు ద్వారా దాని చిత్రించు, ఎనర్జీ సిరితవమును వివరణించుము.
3. (i) Write any two methods of preparation of alkenes.  
ఆలకనాలను తయారీచేయు రీతులు పేర్కొనుము.  
(ii) Explain the mechanism of Markownikoff and Anti-Markownikoff addition of HBr to alkene.  
ఆలకనాలకు HBr సమీకరణ చరణ విధానమును మార్కొవిచ్ నికాఫ్, ఆంటి-మార్కొవిచ్ నికాఫ్ విధానములలో వివరణించుము.  
(or)
4. (i) Explain the acidity of 1-alkynes  
1-అల్కైన్ల ఆమ్లత్వ వివరణము.  
(ii) How will you prepare acetaldehyde and acetone from alkynes?  
ఆలకనాల నుండి ఎసెటిల్ అల్డిహైడ్ మరియు అసెటోన్ తయారీచేయు నుపాయము?  
(ii) Write alkylation reaction of Terminal alkene.  
టెర్మినల్ అల్కైన్ల అల్కైలేషన్ చరణ వర్ణించుము.
5. Define Huckel rule of aromatic compounds. What are benzenoid and non-benzenoid aromatic compounds? Give examples.

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(or)

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6. Explain the mechanisms of Nitration and Friedel-Craft's alkylation of Benzene.  
బ్లెంజీన్ నీండ్ల ఫ్లైడ్ కర్నా నైట్రికేషన్ మర్కీయం అల్కైలేషన్ చర్కా విధానములను వివర్ణించుము.
7. Construct the Molecular Orbital diagram for O<sub>2</sub> and NO and explain their bond order and magnetic property.  
O<sub>2</sub> మర్కీయం NO ల మూలకాలర్ ఆర్బిటల్ చిత్రములను నిర్ణయించి, బ్లెంజీన్ ఆర్బిటల్ మర్కీయం అయసాకింత ధర్మములను వివర్ణించుము.  
(or/లేదా)
8. Define racemic mixture. Explain any two techniques for resolution of racemic mixture.  
రేసిమిక్ మిశ్రమమును నిర్ణయించుము. రేసిమిక్ మిశ్రమమును వేర్పరచుటకు ఏవైనా బ్లెంజీన్ విధానములను వివర్ణించుము.

**PART- B**

4 X 4 = 16 Marks

Answer any **FOUR** of the following questions. Each carries **FOUR** marks

9. Write different conformations of n-butane. Explain their relative stability.  
n - బ్లెంజీన్ యొక్క వివిధ అనురూపముల తపమును వివర్ణించుము.  
బ్లెంజీన్ వాయుము. వాటర్ సీర్ ిన్
10. Explain 1,2- & 1,4- addition reactions of conjugated dienes.  
కాంజుగేటెడ్ డయీన్ల యొక్క 1,2 మర్కీయం 1,4 సీంకలన చర్కాలను వివర్ణించుము.
11. Explain the orientation effect of halogens on mono substituted benzene.  
ఏక ప్లైజీన్ త బ్లెంజీన్ లో హాలోజన్ లవమును వివర్ణించుము.  
యొక్క ప్లైజీన్ దర్శకతప ప్లైజీన్
12. Explain the mechanism of E1<sup>CB</sup> elimination reaction.  
E1<sup>CB</sup> విలోపన చర్కా యొక్క చర్కా విధానమును వాయుము.
13. Explain the structure of ClF<sub>3</sub> by Valence Bond theory.  
వల్లెన్జీ బ్లెంజీన్ సదదర్శకత దర్శక ClF<sub>3</sub> యొక్క సర్కాణమును వివర్ణించుము.
14. What are Hard & soft acids & bases? Explain with examples.  
కట్టిన మర్కీయం మ్యూదర్ ఆమా ముల మర్కీయం క్షరముల అనగనానీమి? ఉదాహరణములతో వివర్ణించుము.
15. Define Optical activity and Specific rotation.  
ఆప్టికల్ యొక్క బ్లెంజీన్ లను నిర్ణయించుము.  
ఆకటివ్ మర్కీయం సీర్
16. Draw the R- & S- isomers of Alanine, Glyceraldehyde.  
అలనైన్ మర్కీయం గ్లైసెరల్ డిహైడ్రేట్ యొక్క R- & S- ఐసోమర్లను చిత్రీకరించుము

**PART- C**

3 X 2 = 6 Marks

Answer **ALL** questions. Each carries **TWO** marks

1. Write Hoffmann Elimination.
2. Give Examples of *meta*-directing groups of Aromatic compounds

3. Draw the Wedge, Fischer, Newman & Saw-Horse representations for Tartaric acid.

టర్టారిక్ ఆమ్లం యొక్క వజ్ర, ఫిషర్, న్యూమాన్ & సా-హోర్స్ నిరూపణలను  
ఫర్షింగ్, న్యూమాన్ మరియు సా-హోర్స్ రూపాలు.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**



# **SECOND YEAR SEMESTER -III**

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.**

**B.Sc. SECOND YEAR CHEMISTRY SEMESTER –III**

**CHE 103: ORGANIC CHEMISTRY & SPECTROSCOPY**

**SEMESTER - III Course III**

**(ORGANIC CHEMISTRY & SPECTROSCOPY) 60hrs (4 h / w)**

**Course outcomes: At the end of the course, the student will be able to;**

- 1. Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.**
- 2. Use the synthetic chemistry learnt in this course to do functional group transformations.**
- 3. To propose plausible mechanisms for any relevant reaction**

**ORGANIC CHEMISTRY**

**34h**

**UNIT – I**

**1. Chemistry of Halogenated Hydrocarbons:**

**6h**

Alkylhalides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis.

Arylhalides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and arylhalides towards nucleophilic substitution reactions.

**2. Alcohols & Phenols**

**6h**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt Blanc Reduction; Oxidation of diols by periodic acid and lead tetra acetate, Pinacol-Pinacolone rearrangement; Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism;

**UNIT-II**

**Carbonyl Compounds**

**10h**

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann haloform reaction and BaeyerVilliger oxidation,  $\alpha$ substitution reactions, oxidations and reductions (Clemmensen, wolf–

Wittig reaction (with  $\text{LiAlH}_4$  &  $\text{NaBH}_4$ ). Addition reactions of  $\alpha, \beta$ -unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethylacetoacetate.

#### UNIT-III

12h

##### Carboxylic Acids and their Derivatives

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength. Typical reactions of dicarboxylic acids, hydroxyacids and unsaturated acids. Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism. Of acidic and alkaline hydrolysis of esters, Claisen condensation, Reformatsky reactions and Curtius rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Hunsdiecker reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard-Zelinsky reaction.

#### SPECTROSCOPY

26 h

##### UNIT-IV

##### Molecular Spectroscopy:

18h

Interaction of electromagnetic radiation with molecules and various types of spectra;

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

**Vibrational spectroscopy:** Classical equation of vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental frequencies, overtones and hotbands.

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

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

Application of Spectroscopy to Simple Organic Molecules Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{\text{max}}$  of conjugated dienes and  $\alpha,\beta$  – unsaturated compounds. Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on  $>\text{C}=\text{O}$  stretching absorptions).

#### Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Semester end Examination: critical indicator of student's learning and teaching methods adopted by teachers through out the semester.

#### List of Reference Books

1. A Text Book of Organic Chemistry by Bahl and Arunbahl
2. A Text Book of Organic chemistry by I L Finar Vol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
11. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012) 17
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).



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

Practical Course-III Organic preparations and IR Spectral Analysis (At the end of Semester- III)

Course outcomes: On the completion of the course, the student will be able to do the following:

1. how to use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

#### **Organic preparations: 40M**

- i. Acetylation of one of the following compounds: amines (aniline, o-, m-, p-toluidines and o-, m-, p-anisidine) and phenols ( $\beta$ -naphthol, vanillin, salicylic acid) by any one method:
  - a. Using conventional method.
  - b. Using green approach
- ii. Benzoylation of one of the following amines (aniline, o-, m-, p-toluidines and o-, m-, p-anisidine)
- iii. Nitration of any one of the following:
  - a. Acetanilide/nitrobenzene by conventional method
  - b. Salicylic acid by green approach (using ceric ammonium nitrate).

#### **IR Spectral Analysis 10M**

IR Spectral Analysis of the following functional groups with examples a) Hydroxyl groups b) Carbonyl groups c) Amino groups d) Aromatic groups

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**B.Sc. SECOND YEAR CHEMISTRY SEMESTER –III**

**QUESTION PAPER BLUE PRINT**

**ORGANIC CHEMISTRY & SPECTROSCOPY**

TIME: 2½ hr.

MARKS: 50 M

**PART -A**

Answer ALL the Questions

4X7 = 28 M

1. 2 Questions from UNIT- I
2. 2 Questions from UNIT- II
3. 2 Questions from UNIT-III
4. 2 Questions from UNIT IV & UNIT-V

**PART – B**

Answer any FOUR Questions

4x4 = 16 M

5. 1 Question from UNIT- I
6. 2 Questions from UNIT- II
7. 1 Question from UNIT- III
8. 2 Questions from UNIT- IV
9. 2 Questions from UNIT- V

**PART-C**

Answer ALL Questions

3x2 = 6M

10. UNIT- II
11. UNIT- III
12. UNIT- IV
13. UNIT- V

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**SECOND YEAR B.Sc., DEGREE EXAMINATION, SEMESTER-III,**  
**CHEMISTRY COURSE -II: ORGANIC CHEMISTRY & SPECTROSCOPY**

Time: 2½ hrs

Maximum Marks: 50

**PART- A**

**4X 7 = 28 Marks**

Answer **ALL** the questions. Each carries **SEVEN** marks

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

(or)

2. Explain the following reactions with mechanism. (i) Reimer-Tiemann reaction (ii) Fries rearrangement.

3. Discuss the mechanism for following reactions. (i) Perkin reaction. (ii) Cannizaro reaction

(or)

4. Write the preparation and any three synthetic applications of diethyl malonate.

5. Explain acid and base hydrolysis reaction of esters with mechanism.

(or)

6. Explain the mechanisms of Curtius rearrangement & Arndt –Eistert reaction.

7. (i) Write a note on vibrational degrees of freedom for polyatomic molecules. (ii) Explain different modes of vibrations & selection rules in IR spectroscopy.

(or)

8. What is Fingerprint region. Explain its significance with an example.(ii) Write IR spectral data for any one alcohol, aldehyde and ketone

**PART- B**

**4 X 4= 16 Marks**

Answer any **FOUR** of the following questions. Each carries **FOUR** marks

9. Discuss two methods for preparation of aryl halides.

10. Explain the mechanism for Pinacol-Pinacolone rearrangement.

11. Discuss the mechanism for Bayer-villiger oxidation reaction.

12. Explain the effect of substituents on acidic strength of mono-carboxylic acids.

13. Write the mechanism for Claisen Condensation reaction.

14. Write the selection rules in rotational spectroscopy.

15. Explain Spin – Spin coupling and Coupling Constant.

16. Explain types of electronic transitions in UV spectroscopy.

**PART- C**

**3 X 2= 6 Marks**

Answer any of the following questions.

Each carries TWO marks

17. How do you distinguish 1°, 2°, 3° alcohols with  $\text{KMnO}_4$ .
18. What is Hypsochromic shift?
19. Write about Tautomerism.

**SECOND YEAR  
SEMESTER - IV**

**GOVT. COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS FOR II B.Sc., IV SEMESTER**

**(INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY) 60hrs (4 h / w)**

**Course outcomes:**

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

1. To learn about the laws of absorption of light energy by molecules and the subsequent photochemical reactions.
2. To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

**UNIT – I: Organometallic Compounds**

8h

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

**UNIT – II Carbohydrates**

8h

Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides – Elementary treatment of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch.

**UNIT- III Amino acids and proteins**

6h

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis. Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins. Heterocyclic Compounds 7h  
Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis. 21 Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

## UNIT- IV

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

### 1. Nitro hydrocarbons

3h

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

### 2. Amines:

11h

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation. Properties: Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann Bromamide reaction, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination. Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitrocompounds. Coupling reactions of diazonium salts (preparation of azo dyes).

## UNIT- V

### Photochemistry

5h

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

### Thermodynamics

12 h

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

Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Worksheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

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

### List of Reference Books

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

**LABORATORY COURSE -IV**      **30hrs (2 h / w)**  
Practical Course-IV  
Organic Qualitative analysis 50 M (At the end of Semester- IV)

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

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Determine melting and boiling points of organic compounds
3. Understand the application of concepts of different organic reactions studied in theory part of organic chemistry

**Organic Qualitative Analysis**

**50 M**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars



**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**B.Sc. SECOND YEAR CHEMISTRY SEMESTER –IV**

**QUESTION PAPER BLUE PRINT**

**INORGANIC, ORGANIC & PHYSICAL CHEMISTRY**

TIME: 2½ hr.

MARKS: 50 M

**PART -A**

Answer ALL the Questions

4X7 = 28 M

1. 1 Question from UNIT- I & 1 Questions from UNIT- II
2. 2 Questions from UNIT-III
3. 2 Questions from UNIT IV
4. 2 Questions from UNIT-V

**PART – B**

Answer any FOUR Questions

4x4 = 16 M

5. 1 Question from UNIT- I
6. 1 Questions from UNIT- II
7. 2 Question from UNIT- III
8. 2 Questions from UNIT- IV
9. 2 Questions from UNIT- V

**PART-C**

Answer ALL Questions

3x2 = 6M

10. UNIT- III
11. UNIT- IV
12. UNIT- V

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**SECOND YEAR B.Sc., DEGREE EXAMINATION, SEMESTER-IV**

**CHEMISTRY COURSE -IV: INORGANIC, ORGANIC & PHYSICAL CHEMISTRY**

**Time: 2½ hr**

**Maximum Marks: 50**

**PART- A**

**Answer ALL the questions. Each carries SEVEN marks**

**4 X 7 = 28 Marks**

1. What are organometallic compounds? Discuss their Classification on the basis of type of bonds with examples.  
(or)
2. Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose.
3. What are amino acids? Write any three general methods of preparation of amino acids.  
(or)
4. Discuss the aromatic character of Furan, Thiophene and Pyrrole.
5. Write the mechanism for the following.  
(i) Nef reaction (ii) Mannich reaction  
(or)
6. (i) Explain Hinsberg separation of amines.  
(ii) Discuss any three synthetic applications of diazonium salts.
7. What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine.  
(or)
8. Define entropy. Describe entropy changes in the reversible and irreversible process.

**PART- B**

**4 X 4 = 16 Marks**

**Answer any FOUR of the following questions. Each carries FOUR marks**

9. Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples.
10. What are epimers and anomers. Give examples.
11. Discuss about iso electric point and zwitter ion.
12. Discuss the Paul-Knorr synthesis of five membered heterocyclic compounds.
13. Explain Tautomerism shown by nitro alkanes
14. Discuss the basic nature of amines.
15. Write the differences between thermal and photochemical reactions.
16. Derive heat capacities and derive  $C_p - C_v = R$

**PART- C**

**3 X 2 = 6 Marks**

**Answer ALL the following questions. Each one carries TWO marks**

17. What is Mutarotation
18. Write the structures of Alanine, Glycine
19. Define Molar Heat Capacity at constant Pressure

## SEMESTER - IV

### Course-V (INORGANIC & PHYSICAL CHEMISTRY)

60 hrs (4 h / w)

Course outcomes:

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

1. Understand concepts of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation values
2. Application of quantization to spectroscopy.
3. Varioustypes of spectra and their use instructure determination.

#### INORGANIC CHEMISTRY

26 h

##### UNIT –I

##### Coordination Chemistry

12 h

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

##### UNIT –II

##### 1. InorganicReactionMechanism:

4h

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

##### 2. Stability of metal complexes:

2h

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

##### BioinorganicChemistry:

8h

Metal ions present in biological systems, classification of elements according to their action in biological system. Geo chemical effect on the distribution of metals, Sodium/Kpump, carbonicanhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of

metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis platinasanti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

## PHYSICAL CHEMISTRY

34 h

### UNIT-III

#### Phase rule

6h

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

### UNIT-IV

#### Electrochemistry

14h

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

### UNIT-V

#### Chemical Kinetics

14 h

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

Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning Class Tests, Work sheets and Quizzes Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

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

#### List of Reference Books

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

## SEMESTER - IV

Course-V (LABORATORY COURSE) 30hrs (2 h / w)

Practical-Course -V : Conductometric and Potentiometric Titrimetry 50 M

Course outcomes: At the end of the course, the student will be able to; 1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory 2. Apply concepts of electrochemistry in experiments 3. Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current ( amperes) in an electrochemical cell containing the analyte Conductometric and

Potentiometric Titrimetry 50 M

1. Conductometric titration- Determination of concentration of HCl solution using standard NaOH solution.
2. Conductometric titration- Determination of concentration of CH<sub>3</sub>COOH Solution using standard NaOH solution.
3. Conductometric titration- Determination of concentration of CH<sub>3</sub>COOH and HCl in a mixture using standard NaOH solution.
4. Potentiometric titration- Determination of Fe (II) using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
5. Determination of rate constant for acid catalyzed ester hydrolysis.

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**B.Sc. SECOND YEAR CHEMISTRY SEMESTER -IV**

**QUESTION PAPER BLUE PRINT**

**COURSE-V (INORGANIC & PHYSICAL CHEMISTRY)**

TIME: 2½ hr.

MARKS: 50 M

**PART -A**

Answer ALL the Questions

4X7 = 28 M

1. 1 Question from UNIT- I
2. 2 Questions from UNIT-II
3. 1 Question from UNIT III & 1 Question from UNIT IV
4. 2 Questions from UNIT-V

**PART - B**

Answer any FOUR Questions

4x4 = 16 M

5. 1 Question from UNIT- I
6. 1 Questions from UNIT- II
7. 2 Question from UNIT- III
8. 2 Questions from UNIT- IV
9. 2 Questions from UNIT- V

**PART-C**

Answer ALL Questions

3x2 = 6M

10. UNIT- III
11. UNIT- IV
12. UNIT- V

MODEL PAPER SECOND YEAR B.Sc., DEGREE EXAMINATION, SEMESTER-IV

CHEMISTRY COURSE V: INORGANIC & PHYSICAL CHEMISTRY

Time: 2½ hr

Maximum Marks: 50

PART- A

4 X 7 = 28 Marks

Answer ALL the questions. Each carries SEVEN marks

(1). Explain Valence Bond theory with Inner and Outer orbital complexes.

Write limitations of VBT.

(or)

(2). Define CFSE. Explain the factors effecting the magnitude of crystal field splitting energy.

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

(or)

(4). (i) Write the biological functions of Haemoglobin and Myoglobin. (ii) Write note on use of chelating agents in medicines.

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

(or)

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

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

(or)

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

PART- B

4 X 4 = 16 Marks

Answer any FOUR of the following questions. Each one carries FOUR marks

9. Write note on Jahn-Teller distortion.

10. Explain Labile & inert complexes.

11. Explain Job's method for determination of composition of complex.

12. Explain Thermodynamic derivation of Gibb's phase rule.

13. Explain any two conductometric titrations.

14. Write note on Fuel Cells with examples and applications.

15. What is enzyme catalysis? Write any three factors effecting enzyme catalysis.

16. Derive Michaels- Menten equation.

PART- C

3 X 2 = 6 Marks

Answer any TWO of the following questions. Each one carries TWO marks

17. Define Eutectic Point.

18. Write the difference between order and molecularity of the reaction.

19. Write Nernst Equation.

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**FINAL YEAR  
SEMESTER - V**

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**New CBCS Syllabus for B.Sc. III Year**

**PAPER – V, SEMESTER – V (Effective from 2017 – 2018 onwards)**

**CHE 105: APPLIED INORGANIC CHEMISTRY AND ORGANIC CHEMISTRY**

**MODULE – I (INORGANIC CHEMISTRY)**

**1. Coordination Chemistry: 10 Hrs.**

- ❖ **IUPAC Nomenclature of Co-ordination Compounds :**
- ❖ **Bonding Theories of Co-ordination Compounds :**
  - Review of **Werner's Theory** and **Sidgwick's Concept** of Coordination.
  - **Valence Bond Theory** – Geometries of any two complexes with coordination numbers 4 (tetrahedral and Square planar) and 6 (Octahedral) – limitations of Valence Bond Theory.
  - **Crystal Field Theory** – Splitting of d-orbitals in Octahedral, tetrahedral and square planar complexes (with one example each) – low spin and high spin complexes – factors affecting crystal – field splitting energy – merits and demerits of crystal – field theory.
- ❖ **Isomerism in coordination compounds :** Structural isomerism and stereo Isomerism (with two examples each) – Stereochemistry of complexes with 4 and 6 coordination numbers (with two examples each).

**2. Stability of Metal Complexes : 4 Hrs.**

- ❖ Thermodynamic Stability and Kinetic Stability.
- ❖ Any five factors affecting the stability of metal complex.
- ❖ **Chelate** Effect.
- ❖ Determination of Composition of complex by : **Job's Method & Mole ratio method.**

**Additional Input :** Any four factors influencing the complex formation.

**3. Spectral and Magnetic Properties of Metal Complexes: 4 Hrs.**

- ❖ Electronic absorption spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  ion.
- ❖ Types of magnetic behavior, spin – only formula, calculation of magnetic moments (taking any four examples), experimental determination of magnetic susceptibility – Gouy method.

**Additional Input:** Any four applications of complex compounds.

#### 4. Reactivity of Metal Complexes

4 Hrs.

- ❖ **Labile and inert complexes** (with two examples each),
- ❖ Ligand substitution reactions –  $SN_1$  and  $SN_2$ ,
- ❖ Substitution reactions of **Square Planar Complexes** (with two examples),
- ❖ Trans effect and applications of trans effect.
  
- ❖ **Hard and Soft Acids Bases (HSAB)**
- ❖ Classification of hard and soft acids and bases.
- ❖ Pearson's concept of hardness and softness.
- ❖ Two applications of HSAB Principles – Stability of compounds / complexes, predicting the feasibility of reaction.

**Additional Input :** Acid base strength of HSAB.

#### 5. Bioinorganic Chemistry

3 Hrs.

- ❖ Essential elements – definition & classification.
- ❖ Any four biological functions of Na, K, Ca, Fe, Co, and Chloride (Cl).
- ❖ Metalloporphyrins – Hemoglobin, structure and function, Chlorophyll – its role in photosynthesis.

**Additional Input :** Cyanocobalamine (Vitamin  $B_{12}$ ) – functions.

### MODULE – II (ORGANIC CHEMISTRY)

#### (1). NITROGEN COMPOUNDS :

15 Hrs.

##### ❖ Nitrohydrocarbons :

- **Nomenclature**, classification and structure of aliphatic nitro hydrocarbons
- **Tautomerism** of nitroalkanes leading to aci and keto form.
- Any two **preparations** of Nitroalkanes
- **Reactivity** of nitroalkanes –
  1. Halogenation (**without mechanism**)
  2. Reaction with HONO (Nitrous acid) – (**without mechanism**)
  3. Nef reaction (**without mechanism**)

4. Mannich reaction (**without mechanism**)
5. Mannich reaction leading to Michael addition and **Reduction (without mechanism)**

❖ **Amines**

**Aliphatic Amines**

I. **Nomenclature**, Classification into 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> Amines and Quarternary ammonium compounds.

II. **Preparative methods of primary amines :**

*For 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> Amines :* Reductive Amination (**without mechanism**).

*For 1<sup>o</sup> Amines :*

1. Ammonolysis of alkyl halides (**without mechanism**)
2. Gabriel synthesis (**without mechanism**)
3. Hoffman's bromamide reaction (**with mechanism**)

III. **Chemical Properties:**

1. Hinsberg separation of mixture of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> amines.
2. Alkylation of primary and secondary amines (**without mechanism**).
3. Acylation of primary and secondary amines (**without mechanism**).
4. Carbylamine reaction of primary amines (**without mechanism**).
5. Reaction with Nitrous acid of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> (**without mechanism**).
6. Oxidation of primary amines (**without mechanism**).

➤ **Aromatic Amines**

I. **Nomenclature**, Classification into 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> Amines and Quarternary ammonium compounds.

II. **Preparative methods of primary aromatic amines :**

1. Amination of aryl halides (**without mechanism**)
2. From carboxylic acids – Schmidt reaction (**without mechanism**)
3. Hoffman's degradation reaction – from amides (**without mechanism**)

III. **Chemical Properties of primary aromatic amines :**

1. Alkylation (**without mechanism**)
2. Acylation (**without mechanism**)

3. Carbylamine reaction (**without mechanism**)
4. Reaction with Nitrous acid (**without mechanism**)
5. Oxidation (**without mechanism**)

#### IV. Physical Properties and basic character of amines :

- ❖ Substituent effect (Electron releasing, Electron withdrawing groups) on basicity of amines taking one example for each substituent group.
- ❖ **Steric effect** – Comparative basic strength of N-methylaniline and N-ethylaniline.
  - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline.
  - Comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous medium)

#### Applications of Amines in Biological Systems:

Definition, two examples and two functions of the following:

- ❖ **Hormones** : Adrenalin and Noradrenaline
- ❖ **Neurotransmitters**: Dopamine and Serotonine.
- ❖ **Analgesic alkaloids**: Morphine and Codeine.
- ❖ **Electrophic Substitution of Aromatic Amines** – Bromination and Nitration (**with mechanisms**).

**Additional Input:** Sulphonation of Aniline – Importance of Sulphanilic acid in Sulpha drugs.

#### (2). **HETEROCYCLIC COMPOUNDS:**

**5 Hrs.**

##### Five – Membered ring compounds:

- ❖ **Introduction and definition:** Simple Five membered ring compounds with one hetero atm. Ex. **Furan, Thiophene and Pyrrole.**
- ❖ **Numbering** the ring systems of **Furan, Thiophene and Pyrrole** as per Greek letter and numbers.
- ❖ **Aromatic character of Furan, Thiophene and Pyrrole** – 6 – electron system (four-electrons from two double bonds and a pair of non-bonded electrons from the hetero atom).

- ❖ **Resonance structures of Furan, Thiophene and Pyrrole** : Indicating electron surplus carbons and electron deficient hetero atom.

**Preparation of furan, pyrrole and thiophene** from 1,4-dicarbonyl compounds only (Paul-Knorr synthesis).

- ❖ **Physical properties** – Explanation of feebly acidic character of pyrrole.

- ❖ **Chemical Properties** –

1. Electrophilic substitution of **Furan, pyrrole and thiophene** at 2 or 5 position – Halogenation, Nitration and Sulphonation under mild conditions (**without mechanism**)
2. Reactivity of furan as 1, 3-diene, Diels Alder reaction.
3. Sulphonation of thiophene (**without mechanism**)

### Six – Membered rings

#### Pyridine :

1. **Resonance structure** of pyridine
2. **Basicity of pyridine** – Comparison with pyrrole.
3. Any one Electrophilic and one Nucleophilic Reactions of pyridine (**without mechanisms**)
4. Importance of heterocyclic ring system in natural products like Haemoglobin, Chlorophyll, antibiotics like Penicillins.

**Additional Input** : Structure of alkaloids quinoline and Isoquinoline.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**III B.Sc. Chemistry Paper – V**

**QUESTION PAPER BLUE PRINT**

**Semester – V**

**Applied Inorganic Chemistry and Organic Chemistry**

Sl. No.	Chapter	Essay Question (7 M)	Short Answer Question (4 M)	Very Short Answer Questions (2 M)
		<b>Unit – I</b>		
1.	Coordination Chemistry	2	1	-
2.	Stability of Metal Complexes	1	1	-
3.	Spectral and Magnetic Properties of metal complexes	--	1	1
4.	Reactivity of metal complexes	1	1	-
		<b>Unit – II</b>		
5.	Hard and Soft acids bases (HSAB)	1		1
6.	Bioinorganic Chemistry	--	2	1
7.	Nitrogen Compounds	2	1	
8.	Heterocyclic Compounds	1	1	-
	<b>Total Questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

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MODEL QUESTION PAPER

GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM

FIFTH SEMESTER END EXAMINATIONS

III B.Sc., CHEMISTRY PAPER - V

INORGANIC AND ORGANIC CHEMISTRY

Time: 2½ hr

Max. Marks: 50M

**SECTION – A**

Answer all questions

4x7= 28M

అనిచే పాశ్చేలకు సమాధానములు వ్రాయుము.

UNIT – I

1. Discuss the valence bond theory of complex compounds. How does this theory explain the geometry of coordination number 6.

సంఖ్యాపేది సమన్వేళనల సంయోజకత బంధ సదృశాంతమయన గూర్కొని చర్చించుము. సమనవయ సంఖ్య 6 గల

సంఖ్యాపేదిమయల ధృశాంతం ఏ విధమయగా వివరణింంది.  
నిరంతరమయన ఈ సద

(OR)

2. What are thermodynamic and kinetic stabilities of metal complexes. Give any four factors affecting the stability of metal complexes.

లోహ సంఖ్యాపేది సమన్వేళనల య త్థమయ అనగా నేమి? లోహ సంఖ్యాపేదిమయల సరి ఉష్ణోగతిక మయల సరి తిరతావనీ

పాభువతిం నీస ఏవనా నలయగయ అంశాలయ వాయుంింి.

3. (a). Explain Nucleophilic uni molecular substitution (SN<sup>1</sup>) in metal complexes with mechanism.

(ఎ). లోహ సమన్వేళనల ఏక అణయక నూకయోఫిలిక్ పాతక్షిణ చరణ (SN<sup>1</sup>) యుకక చరణా విధానమయనయ

వివరణింపుమయ.

- (b). What is Trans effect and write its applications.

(బి). ట్రాన్సాఫెక్ట్ ఫలితం అనగా నేమి? దాని అనవరతనలయ వాయుంింి.

(OR)

4. What are amines ? Explain Hinsberg's separation of mixture of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> amines.

ఎమీనయ అనగా నేమి? 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> ఎమీన్ ల మిశ్రణమయనయ హిన్సర్గ్ పద్ధతిలో ఎలా వేరయ న్నయతయ?

5. (a). How did Furan, Pyrrole, Thiophene's are prepared from 1, 4-di Carbonyl compounds.

(ఎ). ఫ్యూరన్, పైర్రోల్, థియోఫేన్ వాయుంింి.

పిర్రోల్, థియోఫేన్ సత



లనం 1, 4-డ కారకొబనశైల్

సమర్మశనాల నుండి ఎలా తయారవు

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(b). Write any two substitution reactions of Furan, Pyrrole and Thiophene.

(బి). రోలర్, ల ఏవైనా రింగ్‌లను పాతర్‌లపై చరణలు వలాయించండి.  
ఫ్యూరన్, పర్ థయోఫేన్

(OR)

6. Explain Pearson's concept of hard and soft acids and bases and write its applications.  
పీయర్సన్ కఠిన, మృదుల ఆమ్లాల క్షారాల నియమం వ్రాసి, ఆ నియమం అనువరతనాలను వివరించండి.

7. What is Crystal Field Splitting? Explain Crystal Field Splitting in tetrahedral complexes.  
స్పటిక క్షతా విభజన ? ా హెడ్రల్ సమన్వేళనములలో స్పటిక క్షతా అనగానమి ట్ట్ విభజనను వివరించండి. (OR)

8 a. Write any two methods of preparation of Aryl Amines.

అరీల్ అమీన్లను తయారు చేసే ఏవైనా రింగ్‌లను పేర్లు వ్రాయండి.

b. Compare the basic strength of Ammonia, methyl amine, N,N – dimethyl amine and aniline.

అమోనియా, N - ల అమీన్లు, N, N- డి మిథైల్ అమీన్లు మరియు అనిలీన్ల మధ్య బలాలను పోల్చండి.

**SECTION-B**

Answer any FOUR questions

4x4= 16M

ఏవైనా ఐదో పాఠశాలకు సమాధానములు వ్రాయండి

9. Explain the Adsorption spectrum of  $[Ti(H_2O)_6]^{3+}$ .

$[Ti(H_2O)_6]^{3+}$  యొక్క అధిశోషణ వర్ణపటాన్ని వివరించండి.

10. Write about optical isomerism in coordination number 6 complexes.

సమన్వయ సంఖ్య 6 గల సంకీర్ణాలలో ఆప్టికల్ సైడోమర్లను వివరించండి.

11. Discuss about crystal field splitting of d - orbitals in tetrahedral complexes.

స్పటిక క్షతా విభజనలో d - ఆర్బిటల్‌లలో స్పటిక క్షతా విభజన ఎలా జరుగుతుంది?

12. How did composition of complexes determined by Mole - Ratio method?

కాంప్లెక్స్లను నిర్ణయించే మోలీ-రేషియో మెథాడ్ ద్వారా ఎలా నిర్ణయించారు?

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13. Write about substitution in square planar complexes.

సమతల చతురస్రా సమమ్లేళనాలలో పక్షిస్థాన చరణల గుర్రుంచు వఱాయుండు.

14. Write Nef reaction.

నఫ్ చరణం వఱాయుండు.

15. Write a note on basicity of Pyridine.

పిరైడిన్ యొక క్షారతవం మిద్ వఱాఖ్యం వఱాయుండు.

16. Write structure and functions of Haemoglobin.

హిమోగ్లోబిన్ నిర్ణయం, విధంలం వఱాయుండు.

### SECTION- C

Answer ALL questions

3x2= 6 M

ఈ క్షుదరి అని పఱశ్యంలకం సమాధానంలం వఱాయుండు

17. Give any two functions of Cobalt.

కొబాల్టు మంలకం యొక ర్ణంలం విధంలం వఱాయుండు.

18. Give examples to Soft and Hard bases.

మృదుం, కఠిన ష్టారంలకం ఉదాహరణలం ఇవ్వండి.

19. What is spin- only formula?

స్పిన్ ఓన ఫారూలా అనగా నేమి?

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DEPARTMENT OF CHEMISTRY

CBCS Syllabus for B.Sc. III Year

SEMESTER – V, Paper – VI (Effective from 2017 – 2018 onwards)

CHE 106: APPLIED PHYSICAL CHEMISTRY AND ORGANIC CHEMISTRY

MODULE – I (Applied Physical Chemistry)

1. Chemical Kinetics:

8 Hrs.

- ❖ **Rate of reaction**, factors influencing the rate of a reaction – concentration, temperature, light, catalyst.
- ❖ Any one **experimental method** to determine the rate of reaction.
- ❖ Definition of **order and molecularity** of simple reactions with two examples each.
- ❖ Derivation **rate constants and time half change** for first, second (where  $2A \rightarrow$  Products i.e., when both reactants are same and two reactants are different  $A + B \rightarrow$  products) and zero order reactions.
- ❖ **Two examples** each for first, second and zero order reactions.
- ❖ Any one method to **determine the order of reactions**.
- ❖ **Effect of temperature** on rate of reaction, Arrhenius equation, concept of activation energy.
- ❖ **Theories of reaction rates – collision theory** of bimolecular gaseous reactions. **The transition state theory** of bimolecular reactions (elementary treatment).

**Additional Input :** Order and molecularity of complex reactions.

2. Thermodynamics :

14 Hrs.

- ❖ **Some basic concepts of Thermodynamics –**
  1. System and surroundings
  2. Types of thermodynamic systems
  3. Macroscopic system and macroscopic properties
  4. State of a system and state variables
  5. Extensive and intensive properties
  6. Types of thermodynamic processes
  7. Reversible and irreversible processes
  8. Internal energy and enthalpy
  9. State and path functions

- ❖ The first law of thermodynamics – statement
- ❖ Heat capacities and their relationship
- ❖ Joule's law
- ❖ Joule – Thomson coefficient
- ❖ Calculation of  $w$ ,  $q$  for the expansion of perfect ideal gas under isothermal and adiabatic conditions for reversible processes.
- ❖ Temperature dependence of enthalpy of formation – Kirchoff's equation.
- ❖ Second law of thermodynamics – Different statements of the law.
- ❖ Carnot cycle and its efficiency
- ❖ Carnot theorem
- ❖ Concept of entropy – entropy as a state function
- ❖ Entropy changes in reversible, and irreversible processes.
- ❖ The Gibbs ( $G$ ) and Helmholtz ( $A$ ) energies
- ❖ Variation of  $G$  with  $P$ ,  $V$  and  $T$ .
- ❖ Gibbs – Helmholtz equations – one application of Gibbs – Helmholtz equations.

**Additional Input :** Different statements of First Law of Thermodynamics.

### 3. Photochemistry :

**6 Hrs.**

- ❖ Differences between **thermal and photochemical** processes.
- ❖ Laws of photochemistry – **Grothus – Draper's Law** and **Stark – Einstein's law** of photochemical equivalence.
- ❖ **Quantum Yield**
- ❖ Photochemical hydrogen – chlorine, hydrogen – bromine reactions.
- ❖ **Jablonski diagram** depicting various processes occurring in the excited state, qualitative description of **fluorescence, phosphorescence**, non-radiative processes (internal conversion, intersystem crossing).
- ❖ **Photosensitized reactions** – energy transfer processes (simple example).

**Additional Input :** Applications of fluorescence & Phosphorescence processes.

## MODULE – II (Applied Organic Chemistry)

### 1. Carbohydrates :

6 Hrs.

#### Monosaccharides :

All discussion to be confined to (+) glucose as an example of aldohexoses and (-) fructose as example of ketohexoses.

#### Structural Elucidation of D-(+) glucose :

- Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n-hexane, cyanohydrins formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acid).
- Configuration of glucose based on D-glyceraldehyde as primary standard (no proof for configuration is required).
- Evidence for cyclic structure of glucose (some negative aldehydes tests and mutarotation).
- Cyclic structure of glucose.
- Decomposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers).
- Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformational formula).

#### Structural Elucidation of Fructose :

Evidences of 2 – Keto Hexose structure, formation of Penta Acetate, formation of Cyanohydrin its hydrolysis and reduction by HI. Cyclic structure of Fructose (Furanose structure and Haworth formula) Osazone formation from Glucose and Fructose. Definition of Anomers with examples.

#### Interconversion of Monosaccharides :

- Aldopentose to aldo hexose. Ex : Arabinose to D-Glucose, D-Mannose (Kiliani – Fischer method).
- Epiers, Epimerisation – Lobry de bruyn van Ekenstein rearrangement.
- Aldohexose to Aldopentose. Eg : D-glucose to D-arabinose by Ruff's degradation.
- Aldohexose (+) (glucose) to ketohexose (-) (Fructose) and Ketohexose (fructose) to aldohexose (Glucose).

**Additional Input :** Disaccharide – Sucrose (Elementary treatment)

## 2. Biomolecules : Amino acids and proteins – Nucleic acids :

6 Hrs.

### Amino acids Introduction :

❖ **Definition** of Amino acids

❖ **Classification** of Amino acids into :

1. Alpha, beta, and gamma amino acids.
2. Natural and essential amino acids – definition and examples,
3. Classification of alpha amino acids into acidic, basic and neutral amino acids with two examples each.

### 4. Methods of Synthesis:

General methods of synthesis of alpha amino acids (specific examples – Glycine, and leucine) by following methods:

- a) From halogenated carboxylic acid (**without mechanism**)
- b) Malonic ester synthesis (**without mechanism**)
- c) Strecker's synthesis (**without mechanism**)

### Physical Properties :

- Optical activity of naturally occurring amino acids : L-configuration, irrespective of sign rotation.
- **Zwitterion structure** – salt like character
- Solubility, melting points, amphoteric character
- Definition of **isoelectric point**.

### Chemical Properties:

**Two reactions of alpha amino acids** involving both amino and carboxyl groups – Action of heat, action with metallic ions. (**without mechanism**).

#### ➤ **Peptides and Proteins :**

Definition and primary structures with two examples each.

#### ➤ **Nucleic acids – Elementary treatment :**

Definition and two examples of the following :

- Nucleic acids
- Nucleosides
- Nucleotides



- Nitrogen bases

**Additional Input:** Importance of amino acids in biological systems.

### **3. Material Science:**

**5 Hrs.**

Superconductivity, Characteristics of Superconductors, Meissner effect, types of Superconductors and applications.

Nano-materials - Synthetic, techniques, bottom – up – sol – gel method, top – down- electro deposition method, Properties and applications of nano – materials, Composites – definition, general characteristics, particle reinforce and fiber composites and their applications.

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III B.Sc. Chemistry Paper – VI

Semester – V

Applied Physical Chemistry and Organic Chemistry

Sl. No.	Chapter	Essay Question (7 M)	Short Answer Question (4 M)	Very Short Answer Questions (2 M)
1.	Chemical Kinetics	2	1	1
2.	Thermodynamics	2	3	
3.	Photochemistry	1	1	1
4.	Carbohydrates	1	2	1
5.	Amino acids & Proteins	1	1	
6.	Material Science	1	-	
	<b>Total Questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

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(OR)

6. How did alanine is prepared by Malonic ester Synthesis and Strecker Synthesis. Write two chemical reactions of  $\alpha$ - aminoacids.

మల్కొలొనిక్ ఎసిడ్ ఐమం, సీకర్ ఐ పద్ధతులలో ఎలనైనం ఎలా తయారు చేసారు?  $\alpha$ - సీంశామ్ సీంశామ్ ఎమినో

ఆమె ల రసాయన ధర్మాల్నం ర్హిండ్ల వాయుండ్లి.

7 . Explain any two methods of determination of Order of a reaction.

చరణా కరమింకం నం ల ర్హిండ్ల పద్ధతులం వివరింపిండ్లి.  
కనంగం ఎవన

(OR)

8 What are Nano-materials? Write the methods of preparation of Nano materials? Write any two applications?

నానో పధర్మాల్నం ? నానో పధర్మాల్నం తయారు పద్ధ వాటర్ ర్హిండ్లం  
తలనం వాయుండ్లి?  
అనగనమీడపయోగాలు

వాయుండ్లి?

### SECTION-B

Answer any FOUR questions

4x4= 16M

ఎవైనా ఐదం పాశల్కం సమాధానమలం వాయుండ్లి

9. Write the differences between order and molecularity of a reaction.

చరణా కరమింకం, అణుకతల మధా భూలను వాయుండ్లి

10. Derive Kirchoff's equation

కర్హాకఫ్ సమీకరణమలం ఉతర్హాదరింపిండ్లి.

11. What are Gibb's free energy (G) and Helmholtz free energy (A)?

గిబ్స్ స్వనాశక్తి (G), హెల్మ్హోల్ట్స్ స్వనాశక్తి (A) అనగన మి

12. Write short notes on Einstein's law of Photo Chemical Equivalence.

ఐన్ స్టీన్ కాంతి రసాయన తుల్యా నియమంను లఘం వాఖర్ వాయుండ్లి.  
గూర్

13. Explain why Glucose and Fructose gives same osazone.

గ్లూకోజ్, ఫ్రక్టోజ్ లం ఒక ఒసజోన్ నం ఇసతయి, ఎండ్లవలనో వివరింపిండ్లి.

14. Write brief note on the following (a) Epimerization (b) Mutarotation.

ఈ క్షుదరి వాటర్ గుర్హింపి లఘం వాఖర్ వాయుండ్లి. (ఎ). ఎపిమర్హిజిజిన్ (బి). క్షీణమణత

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15. Write about classification of amino acids

ఎమినిన్ ఆమ్లాలు వర్గీకరణను గుర్తించి వర్ణించండి.

16. Calculate work done and heat absorbed in expansion of Ideal gas under isothermal processes.

సమోష్ణ ప లో ఆదర్శ వాయువు దశనిపలుడని పని, గ్రహించిన  
ఫీ గ్రా కయ వర్కాకోచం నీ జరగ ఉపయోగించి

గణించి

ండి.

### SECTION- C

Answer ALL questions

3x2= 6 M

ఈ క్షుడి అని పాశ్చాత్య సమాధానములు వర్ణించండి

17. What is activated complex?

ఉత్తజిత జట్లం అనగా నేమి?

18. What is Photosensitization? Give one example.

కాంతి ఉదదపన అనగానేమి? ఉదాహరణ ఇమి.

19. What are anomers?

ఎనోమర్ లు అనగా నేమి?

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**LABORATORY COURSE – V**

**CHE 105P: PRACTICAL PAPER – V (ORGANIC CHEMISTRY)**

**45 Hrs. (3 H / W)**

**I. Organic Qualitative Analysis :**

- i) Identification of an organic compound through the functional group analysis, determination of melting point/ boiling point and preparation of suitable derivatives.

Carboxylic acids, Phenols, Aldehydes, Ketones, Aromatic Primary Amines,  
Amides and Simple sugars.

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**B.SC., III YEAR V SEMESTER PRACTICAL PAPER – V**

**ORGANIC CHEMISTRY (WITH EFFECT FROM 2017 – 18)**

**SCHEME OF VALUATION**

**Total – 50 Marks**

**Record – 10 Marks**

**Practical – 40 Marks**

**Break up of Practical – I (40 Marks)**

*Identification of function group of an organic compound (Systematic procedure should be adopted).*

❖ Colour	-	1 Marks
❖ Physical State	-	1 Marks
❖ Odour	-	1 Marks
❖ MP / BP	-	2 Marks
❖ Ignition Test	-	2 Marks
❖ Litmus Test	-	2 Marks
❖ Solubility & Classification basing on solubility data	-	5 Marks
❖ Detection of extra elements	-	4 Marks (2 Marks for extract)
❖ Unsaturation Test (with bromine water and Bayer's Test)	-	4 Marks
Identification of functional group	-	5 Marks
❖ Confirmatory test for function group (1 test)-	-	5 Marks
❖ Anyone derivative of the organic compound-	-	4 Marks (1 x 4)
Report	-	4 Marks
<b>Total Marks</b>	<b>-</b>	<b>40 Marks</b>

**LABORATORY COURSE – VI**

**CHE 106P: PRACTICAL PAPER – VI PHYSICAL CHEMISTRY**

**AT THE END OF SEMESTER V**

**45 hrs (3 h/W)**

1. Determination of rate constant for acid catalyzed ester hydrolysis.
2. Determination of molecular status and partition coefficient of benzoic acid in Benzene and water.
3. Determination of Surface tension of liquid
4. Determination of Viscosity of liquid.
5. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

**LABORATORY COURSE – VI**  
**PRACTICAL - VI: PHYSICAL CHEMISTRY**  
(at the end of semester V)

**Max. Marks: 50**

**Time: 3 hrs.**

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

**Splitting of Practical Marks:**

- i      i) Procedure in first 10 min. : 5 Marks
  
- ii     ii) Formula with units : 5 Marks
  
- iii    iii) Neat tabulation & correct calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 %: 15 Marks

Error > 15 %: 10 Marks (Minimum Marks)

# **THIRD YEAR SEMESTER-VI**

**GOVT. COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**DEPARTMENT OF CHEMISTRY**  
**SYLLABUS FOR III B.Sc., VI SEMESTER**  
**FROM 2019 -20 ONWARDS**

**CHE – 111: VII A - ANALYTICAL METHODS IN CHEMISTRY**

**TOTAL HOURS: 45**

**UNIT-I**

**Quantitative analysis:**

**10 Hours**

a) Importance in various fields of science, steps involved in chemical analysis. Principles of volumetric analysis. Theories of acid-base, redox, complexometric, iodometric and precipitation titrations - choice of indicators for these titrations.

b) Principles of gravimetric analysis: precipitation, coagulation, peptization, coprecipitation, post precipitation, digestion, filtration and washing of precipitate, drying and ignition.

**UNIT-II**

**7 Hours**

**Treatment of analytical data:** Types of errors, significant figures and its importance, accuracy - methods of expressing accuracy, error analysis and minimization of errors, precision - methods of expressing precision, standard deviation and confidence limit.

**UNIT-III**

**Separation techniques in chemical analysis:**

**8 Hours**

Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application - Determination of Iron (III)

Ion exchange: Introduction, action of ion exchange resins, separation of inorganic mixtures,

Applications, Solvent extraction: Principle and process.

**UNIT-IV**

**10 Hours**

**Chromatography:** Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems,  $R_f$  values, factors effecting  $R_f$  values.

Paper Chromatography: Principles,  $R_f$  values, experimental procedures, choice of paper and solvent systems, developments of chromatogram - ascending, descending and radial. Two dimensional chromatography - applications.

## UNIT –V

10 Hours

Thin layer Chromatography (TLC): Advantages - Principles, factors effecting  $R_f$  values - Experimental procedures - Adsorbents and solvents - Preparation of plates - Development of the chromatogram - Detection of the spots – Applications - Column Chromatography: Principles - experimental procedures - Stationary and mobile Phases - Separation technique – Applications. HPLC: Basic principles and applications.

### **ADDITIONAL INFORMATION @ INTELLECTUAL PROPERTY RIGHTS**

#### UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Over use or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

#### UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law Semiconductor Chip Protection Act.

#### UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

#### UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

#### REFERENCE BOOKS

1. Analytical Chemistry by Skoog and Miller
2. A textbook of qualitative inorganic analysis by A.I. Vogel
3. Nanochemistry by Geoffrey Ozin and Andre Arsenault
4. Stereochemistry by D. Nasipuri
5. Organic Chemistry by Clayden
6. Deborah E. Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
7. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
8. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw – Hill, New Delhi
9. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.

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**III B.SC. CHEMISTRY ELECTIVE PAPER – VIIA**

**SEMESTER – VI**

**ANALYTICAL METHODS IN CHEMISTRY**

<b>S. No.</b>	<b>Chapter</b>	<b>Hours Required</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Understanding</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	Quantitative analysis	10	02	01	01
2.	Treatment of analytical data	07	02	02	
3.	Separation techniques in chemical analysis	08	02	01	01
4.	Chromatography-I	10	01	02	--
5.	Chromatography-II	10	01	02	01
<b>Total no of Questions</b>		<b>45</b>	<b>08</b>	<b>08</b>	<b>03</b>





దావణి నిషకరణకం ఏవీని ర్హింఢం పద్ధతంలనం వీవర్హింపంమం .

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7. Give the experimental procedure of paper chromatography. Write any of its applications.

కాగిత కరోమటోగ్రఫీ యొక్క పాఠ్యాంశాత్మక విధానము ఇచ్చి ఏవేని రిజల్టులు అనువరతనాలను వర్ణించండి.

OR / లేదా

8. Write the preparation of thin layer chromatography plates. Explain the principle and applications of thin layer chromatography

పలుచని ప్లేట్ కరోమటోగ్రఫీ పలకల యోగక తయారీని వర్ణించండి. పలుచని ప్లేట్ కరోమటోగ్రఫీ యొక్క

సూత్రములు అనువరతనాలను మరల వర్ణించండి.

PART-B

4 X 4 = 16 Marks

Answer any FOUR of the following questions. Each question carries FOUR marks.

కఠిన వానిలో కేలకం సమతలనమలలు కేకం నలలుగం మరలకలం ఏవన ఐదో వర్ణించండి. పశ్చిమ పశ్చి

9. Discuss the complex metric titrations with examples.

సంకీర్ణిత అంశం మతలం గూర్చి ఉదాహరణలతో వివరించుము.

10. Explain about precipitation and coagulation.

అవక్షేపం మరలయం సంకీర్ణితనమలం వివరించుము.

11. Write about standard deviation.

కరమ విచలనము గూర్చి వాచుము.

12. How do you estimate Fe (III) using solvent extraction method?

ద్రావణం నీపకరణ పద్ధతిని ఉపయోగించి Fe (III) ను ఎలా నిర్ణయిస్తారు.

13. Describe the development of chromatogram in paper chromatography.

కాగిత కరోమటోగ్రఫీ లో కరోమటోగ్రామ్ అభివృద్ధి గూర్చి వివరించుము.

14. What are the factors affecting  $R_f$  value.

$R_f$  వివరణ | అంశంలం ఏమిటి. వలలువనం పభం నన

15. What type of adsorbents and solvents used in thin layer chromatography.

పలుచని పేపర్  
కరోమటోగ్రాఫ్

సిండియం ఎటోలివంటి  
అధిశక్తిపకమల మర్య

య బలన ఉపయోగిస్తారు.  
దేవ

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16. Write the applications of High Performance Liquid Chromatography.

అధిక సామర్థ్య ద్రావణ యొక్క ఉపయోగములు త్లంపం. -  
కరోమటోగ్రఫీ

**PART – C**

**3 X 2 = 6 Marks**

■■■ Answer **ALL** of the following questions. Each question carries **TWO** marks

కఠిని అనఁది పశ్చాత్తర సమాధానములు వాయుంధి - పతి పశ్చాత్తర ర్షింధి మరకలు

17. What is co-precipitation and post-precipitations?

సహ-అవక్షపం మర్యం ఉతర - అవక్షపం అనగా నమి?

18. What is  $R_f$  value. Write the formula of  $R_f$  value.

$R_f$  విలంవనం అనగానమి?  $R_f$  విలంవనం లనం వాయుంధి -  
యొకక సూత్రం

19. Define Stationary Phase and Mobile Phase.

సిర ప్తా వసి మర్యం చర ప్తా ింధి -  
వసి లనం త్లం

\*\*\*\*\*

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**SYLLABUS FOR VI SEMESTER**  
**III B.Sc. CHEMISTRY ELECTIVE – VIIB**  
**CHE – 112: ENVIRONMENTAL CHEMISTRY**  
**(with effect from 2018 – 19)**

**No. of Hours: 45Hrs**

**UNIT-I: Introduction to Environmental Chemistry** **8 h**

Concept of Environmental chemistry - Scope and importance of environment in now a days- Nomenclature of environmental chemistry – Segments of environment - Natural resources - Renewable Resources – Solar and biomass energy and Non-renewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydrological cycle.

**UNIT-II: Air Pollution** **8h**

Definition – Sources of air pollution – Classification of air pollution – Acid rain – Photochemical smog – Green house effect – Formation and depletion of ozone – Bhopal gas disaster – Controlling methods of air pollution

**UNIT-III: Water Pollution** **9 h**

Unique physical and chemical properties of water – water quality and criteria for finding of water quality – Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity – Hardness of water – Methods to convert temporary hard water into soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects – principal wastage treatment – Industrial waste water treatment.

**UNIT-IV: Radio Active Pollution and Chemical Toxicology** **10 h**

**Radio active Pollution:** Definition and types of radio active pollution, biological effects of radioactive pollution, cellular phones, Networks and nuclear power plants as a source of radiation  
**Chemical Toxicology :** Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium.

**UNIT-V: Ecosystem and Biodiversity.** **10 h**

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

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

## **ADDITIONAL INFORMATION @ INTELLECTUAL PROPERTY RIGHTS**

### **UNIT I**

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Over use or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

### **UNIT II**

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law Semiconductor Chip Protection Act.

### **UNIT III**

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### **UNIT IV**

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

### **REFERENCE BOOKS:**

1. Fundamentals of Ecology by M.C. Dash
2. A Textbook of Environmental Chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir K. Banerji
4. Deborah E. Bouchoux: "Intellectual Property". Cengage learning, New Delhi
5. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
6. Prabhuddha Ganguli: 'Intellectual Property Rights' Tata Mc-Graw – Hill, New Delhi
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**III B.SC. CHEMISTRY ELECTIVE PAPER – VIIB**  
**SEMESTER – VI**  
**ENVIRONMENTAL CHEMISTRY**

Sl. NO.	Chapter	Essay Question (07M) knowledge	Short Answer Question ( 04 M) Understanding	Very Short Answer Question (02 M) Skill / Application
1.	Introduction of Environmental Chemistry	02	01	-
2.	Air Pollution	02	02	01
3.	Water Pollution	02	01	01
4.	Radioactive Pollution & Chemical Toxicology	01	03	--
5.	Ecosystem and Biodiversity	01	01	01
Total no of Questions		08	08	03



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**PART – B**

Answer any Four of the following questions.

**4X4 =16 Marks**

ఎవరైనా నాలుగింటికే సమాధానాలు వ్రాయుము?

- 9) Explain the importance of environment in now-a-days.  
పసతలలో పరావరణం యొక్క ప్రాముఖ్యతను వివరించండి?
- 10) What is Bhopal gas disaster?  
భోపాల్ గ్యాస్ దుర్ఘటన అనగానామి?
- 11) Explain formation and depletion of Ozone?  
ఓజోన్ యొక్క రక్షణత గూర్చి వివరించండి?
- 12) Explain Eutrophication and it's Effects?  
యూట్రోఫికేషన్ అనగానామి? దాని ప్రభావాలను చూపండి?  
అధిక పోషకం ఫలితాలను వివరించండి?
- 13) Explain adverse effects of cellular networks radiation?  
సెల్ ఫోన్ నెట్ వర్కుల వలన కలుగు దుష్ప్రభావాలను వివరించండి?
- 14) Explain Pesticide's and it's biochemical effects?  
పестицидల మందలను అనగానామి వాటి జీవ రసాయన ప్రభావం వివరించండి?
- 15) Explain toxic effects of Lead and Mercury?  
లీడ్ & మెర్కరీ యొక్క ప్రామాణిక యొక్క ప్రామాణిక ప్రభావం వివరించండి?  
మరల విషప్రభావం వివరించండి?
- 16) What are the Functions of Eco system?  
ఆవరణ వాసన యొక్క విధులేవి?

**PART – C**

**3X2 = 6 Marks**

Answer **All** Questions, Each Question, carries **two** marks

అన్ని ప్రశ్నలకు సమాధానాలు వ్రాయుము?

- 5) What is photochemical smog?  
కాంతి రసాయన ప్రకృతి అనగానామి?
- 6) Define COD and BOD?  
COD మరియు BOD లను నిరవచించుము?
- 7) What is Food chain and Bio mass?  
ఆహార పంజరం మరియు జీవ ద్రవ్యం అనగానామి

. . . @@@ . . .

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**SYLLABUS FOR VI SEMESTER**  
**III B.Sc. CHEMISTRY VI SEMESTER - SYLLABUS FOR VIIC**  
**CHE – 113: GREEN CHEMISTRY**

**Total Hours: 45**

**UNIT-I**

**10hr**

**Green Chemistry:** Introduction - Definition of green chemistry, need of green chemistry, basic principles of green chemistry. Green synthesis - Evaluation of the type of the reaction

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

**UNIT-II**

**10 h**

**Selection of solvent:** i) Aqueous phase reactions ii) Reactions in ionic liquids, Heck reaction, Suzuki reactions, epoxidation. iii) Solid supported synthesis

**Super critical CO<sub>2</sub>:** Preparation, properties and applications, (decaffeination, dry cleaning)

**UNIT-III**

**10 h**

**Microwave and Ultrasound assisted green synthesis:** Apparatus required, examples of MAOS (synthesis of fused anthraquinones, Leuckart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldol condensation-Cannizzaro reaction-Diels-Alder reactions-Strecker's synthesis.

**UNIT-IV**

**5 h**

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

**UNIT V**

**10 h**

Examples of green synthesis / reactions and some real world cases: 1. Green synthesis of the following compounds: adipic acid, catechol, disodium imino diacetate (alternative Strecker's synthesis) 2. Microwave assisted reaction in water – Hoffmann elimination – methyl benzoate to benzoic acid – oxidation of toluene and alcohols – microwave assisted reactions in organic solvents. Diels-Alder reactions and decarboxylation reaction. 3. Ultrasound assisted reactions – sonochemical Simmons – Smith reaction (ultrasonic alternative to iodine).

## **ADDITIONAL INFORMATION @ INTELLECTUAL PROPERTY RIGHTS**

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### **REFERENCE BOOKS:**

1. Green Chemistry Theory and Practice. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Green Chemistry: Introductory Text, M.Lancaster
6. Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
7. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M. Srivastava, Narosa Publications
8. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
9. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
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**III B.SC. CHEMISTRY ELECTIVE PAPER – VIIC**

**SEMESTER – VI**

**GREEN CHEMISTRY**

<b>S No.</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
<b>1.</b>	<b>Green Chemistry</b>	<b>01</b>	<b>01</b>	<b>01</b>
<b>2.</b>	<b>Selection of solvent</b>	<b>01</b>	<b>02</b>	<b>-</b>
<b>3.</b>	<b>Microwave and Ultrasound assisted green synthesis</b>	<b>01</b>	<b>01</b>	<b>01</b>
<b>4.</b>	<b>Green catalysis</b>	<b>01</b>	<b>02</b>	<b>--</b>
<b>5.</b>	<b>Green Synthesis</b>	<b>01</b>	<b>02</b>	<b>01</b>
<b>Total no of Questions</b>		<b>05</b>	<b>08</b>	<b>04</b>





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7. What is Phase transfer catalyst? How do they function?

దీని బాధ్యత ఏమిటి? అవి ఎలా పనిచేస్తాయి.

(OR)

8. Describe the green synthesis of Diels-Alder reaction of Hofmann elimination.

డీల్స్-ఆల్డర్ చర్య మరొకటి హాఫ్మన్ ఎలిమినేషన్ చర్యలను హరిత సంశ్లేషణ విధానంలో వర్ణించండి.

PART-B

4 X 4 = 16 Marks

II. Answer any **FOUR** of the following questions. Each question carries **FOUR** marks.

కఠినమైన వానిలో ఏవైనా నాలుగు ప్రశ్నలకు సమాధానములు వ్రాయండి. ప్రతి ప్రశ్నకు ఐదేడు మార్కులు.

9. What is the need of green chemistry?

హరిత రసాయన శాస్త్రం యొక్క అవసరము ఏమిటి?

10. Write a note on atom economy reactions.

పరమాణు దక్షత చర్య మోడల్ వ్యాఖ్య వ్రాయండి.

11. Heck reaction.

హెక్ చర్య.

12. Write about solid supported synthesis.

ఘన సహాయ సంశ్లేషణ గూర్చి వ్రాయండి.

13. What are the advantages of microwaves assisted organic synthesis.

సంక్షిప్త తరంగ సహాయక కరణణ ము యొక్క ఉపయోగము ఏమిటి? సంశ్లేషణ.

14. Bio catalysis.

జీవ ఉత్పాదన.

15. How do you perform Stricker synthesis by green synthesis method?

హరిత ఐసెన్-లూయిస్ కార్బోనిక్ సింథెసిస్ ద్వారా రింగ్-క్లోజర్. సంశ్లేషణ సాధన ఎలా?

16. Ultra sound assisted reactions.

అతిధ్వని సహాయక చర్యలు.

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**CHE – 111P: CHEMISTRY LABORATORY COURSE – VII-A**  
(at the end of semester VI)

**30 hrs (2 h / w)**

**50 Marks**

1. Identification of amino acids by paper chromatography.
2. Determination of Zn using EDTA
3. Determination of Mg using EDTA

## CHEMISTRY LABORATORY COURSE – VII-A

(at the end of semester VI)

Max. Marks: 50

Time: 2½ hr.

### SCHEME OF VALUATION

For Record - 10 Marks For Viva-voce -  
5 Marks For Practical - 35 Marks

#### **Splitting of Practical Marks**

i) Procedure in first 10 min. : 5 Marks

ii) Formula with units : 5 Marks

iii) Neat tabulation & correct calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 % : 15 Marks

Error > 15 % : 10 Marks (Minimum Marks)



**CHE – 112P: CHEMISTRY LABORATORY COURSE – VII-B**  
(at the end of semester VI)

**45 hrs (3 h / w)**

**50 Marks**

1. Determination of carbonate and bicarbonate in water samples (acidity and alkalinity)
2. Determination of hardness of water using EDTA
  - a) Permanent hardness
  - b) Temporary hardness
3. Determination of Acidity
4. Determination of Alkalinity
5. Determination of chlorides in water samples

# CHEMISTRY LABORATORY COURSE – VII-B

(at the end of semester VI)

**Max. Marks: 50**

**Time: 2½ hr.**

## SCHEME OF VALUATION

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

### Splitting of Practical Marks

i) Procedure in first 10 min. : 5 Marks

ii) Formula with units : 5 Marks

iii) Neat tabulation & correct calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 % : 15 Marks

Error > 15 % : 10 Marks (Minimum Marks)

**CHE – 113P: CHEMISTRY LABORATORY COURSE – VII-C**

(at the end of semester VI)

**30 hrs (2 h / w)**

**50 Marks**

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Acetylation of 1 amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil-Benzilic acid rearrangement
4. Electrophilic aromatic substitution reaction: Nitration of phenol
5. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
6. Green oxidation reaction: Synthesis of adipic acid
7. Green procedure for Diels Alder reaction between furan and maleic anhydride

## CHEMISTRY LABORATORY COURSE – VII-C

(at the end of semester VI)

**Max. Marks: 50 M**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

### SCHEME OF VALUATION

For Record - 10 Marks  
For Viva-voce - 5 Marks  
For Practical - 35 Marks

#### Splitting of Practical Marks

- |      |                           |                            |
|------|---------------------------|----------------------------|
| i)   | Procedure in first 10 min | : 5 Marks                  |
| ii)  | Formula with units        | : 5 Marks                  |
| iii) | Neat tabulation           | : 5 Marks                  |
| iv)  | Correct calculation       | : 20 Marks                 |
|      | Error < 10%               | : 20 Marks                 |
|      | Error 10-15 %             | : 15 Marks                 |
|      | Error > 15 %              | : 10 Marks (Minimum Marks) |

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**CBCS Syllabus for B.Sc. III Year**

**Effective from 2017 – 2018 onwards**

**Paper - VIII-A-1 Semester – VI**

**CHE – 114P: POLYMER CHEMISTRY**

**TOTAL HOURS: 45**

**UNIT-I**

**12 h**

**Introduction of polymers:**

Basic definitions, degree of polymerization, classification of polymers - Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers, Plastics, Elastomers, Fibres and Resins, Linear, Branched and Cross Linked polymers, Addition polymers and Condensation Polymers, mechanism of polymerization. Free radical, ionic and Zeigler – Natta polymerization.

**UNIT-II**

**10 h**

**Techniques of Polymerization:** Bulk polymerization, solution polymerization, suspension and emulsion polymerization.

Molecular weights of polymers: Number average and weight average molecular weights  
Determination of molecular weight of polymers by Viscometry, Osmometry and light scattering methods.

**UNIT-III**

**6 h**

Kinetics of Free radical polymerization, Glass Transition temperature (T<sub>g</sub>) and Determination of T<sub>g</sub>: Free volume theory, WLF equation, factors affecting glass transition temperature (T<sub>g</sub>).

**UNIT-IV**

**9 h**

Polymer additives:

Introduction to plastic additives – fillers, Plasticizers and Softeners, Lubricants and Flow Promoters, Anti aging additives, Flame Retardants, Colourants, Blowing agents, Cross linking agents, Photo stabilizers, Nucleating agents.

**UNIT-V**

**8 h**

Polymers and their applications:

Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Terelene, Polyacrylonitrile, Nylon6,6 and silicones.

**REFERENCE BOOKS**

1. Seymour, R.B. & Carraher, C.E. Polymer Chemistry: An Introduction, Marcel Dekker, Inc. New York, 1981.
2. Odian, G. Principles of Polymerization, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. Textbook of Polymer Science, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. Polymer Science & Technology, Tata McGraw-Hill Education, 1991.34
5. Lenz, R.W. Organic Chemistry of Synthetic High Polymers. Interscience Publishers, New York, 1967.

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**III B.SC. CHEMISTRY PAPER VIII-A-1**

**SEMESTER – VI**

**POLYMER CHEMISTRY**

<b>Sl. NO.</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	Introduction of polymers	02	02	01
2.	Techniques of Polymerization	02	02	--
3.	Kinetics of polymers	01	02	--
4.	Polymer additives	02	01	01
5.	Polymers and their applications	01	01	01
<b>Total no of Questions</b>		<b>08</b>	<b>08</b>	<b>03</b>







**PART- B**

**4x 4 = 16 Marks**

Answer any **FOUR** of the following questions. Each carries **FOUR** marks.

కఠినమైన వానిలో ఏదైనా ఐదో పశ్చేలకం సమాధానము నిమిషం. పాతీ దానకి నాలుగు మార్కులు.

9. What are thermo plastics and thermo setting plastics?

ధరణీకృత థర్మోప్లాస్టిక్ లు మరియు థర్మోసెటింగ్ ప్లాస్టిక్ లు అనగానేమి?  
థర్మోప్లాస్టిక్ థర్మోసెటింగ్ ప్లాస్టిక్

10. Write about condensation polymerization.

సింఘనన ప్లీమర్లీకరణము గూర్చి వా యుము.

11. Define number average and weight average molecular weights.

సంఖ్య సగటు మరియు బరు సగటు అణు భారాలను నిరవచించుము.

12. Write a note on emulsion polymerization.

ఎమల్షన్ ప్లీమర్లీకరణముపై ఒక వాక్యం వ్రాయుము.

13. Give the Williams-Landel-Ferry equation.

వీలియంస్-లాండెల్-ఫెర్రీ సమీకరణమును తల్లూము.

14. Illustrate the colourants and photosensitizers.

వర్ణకారకాలు మరియు కాంతి సహాయకారకాలను సఫ దాహరణముగా తల్లూము.

15. What are the factors affecting Tg?

Tg ను పాభివశితము నయు అంశాలేమి?

16. Write any two applications of PVC and PAN

PVC మరియు PAN ల ఏవేని రెండింటి అనువరతనాలను వ్రాయుము

**PART- C**

**3 x 2 = 6 Marks**

Answer **ALL** the questions Each carries Two marks

అని పాశ్చేలకం సమాధానము నిమిషం. పాతీ దానకి 2 మార్కులు

17. What is co polymer give example

సహ థర్మోప్లాస్టిక్ అనగా నేమి

18. What is nucleating agent? Give example

నూకాయకీకరణకారకం అనగా నేమి ఉదాహరణ ఇమిషం

19. Write the preparation and give one application of nylon-6,6

నైలన్-6,6 ల తయారీ మరియు పరీక్షణలలో వాటం అనువరతనాలను వ్రాయుము.



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**DEPARTMENT OF CHEMISTRY**

**CBCS Syllabus for B.Sc. III Year**

**Effective from 2017 – 2018 onwards**

**Paper - VIII-A-2 Semester – VI**

**CHE – 115P: INSTRUMENTAL METHODS OF ANALYSIS**

**UNIT – I**

**Total Hours: 45**

**Introduction to spectroscopic methods of analysis:**

**4 h**

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus:

Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation.

**UNIT – II**

**Molecular spectroscopy:**

**8 h**

Infrared spectroscopy:

Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR).

**UNIT – III**

**10 h**

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. Excitation Sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments.

**UNIT – IV**

**Separation techniques**

**12 h**

**Solvent Extraction:** Principle and process, Batch extraction, continuous extraction and counter current extraction. Applications, determination of Iron (III).

**Chromatography:** classification of chromatography methods, principles of differential migration, adsorption phenomenon, nature of adsorbents, solvent systems, stationary and mobile phases  $R_f$  values, factors effecting  $r_f$  values. Paper Chromatography, principles, experimental procedures, choice of paper, developments of chromatogram, ascending, descending, radial and two dimensional, applications. Thin layer chromatography, advantages, principles, factors effecting  $R_f$  values, experimental procedures, preparation of plates, development of the chromatogram, detection of the spots, applications. Column Chromatography, principle and experimental procedure, applications. High Performance Liquid Chromatography & Gas Liquid Chromatography, principles and applications, importance of column technology (packing & capillary), super critical fluids.

**UNIT – V**

**Elemental Analysis:**

**11 h**

**Molecular Spectrometry (electrical discharges).**

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas)

**NMR spectroscopy:** Principle, Instrumentation, Factors affecting chemical shift, spin coupling, Applications.

**Electro analytical Methods:** Potentiometry & Voltammetry

**Radio chemical Methods:** X-ray analysis and electron spectroscopy (surface analysis)

#### REFERENCE BOOKS

1. Skoog, D.A., Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. P.W. Atkins: Physical Chemistry.
4. G.W. Castellan: Physical Chemistry.
5. C.N. Banwell: Fundamentals of Molecular Spectroscopy.
6. Brian Smith: Infrared Spectral Interpretations: A Systematic Approach.
7. W.J. Moore: Physical Chemistry

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**III B.SC. CHEMISTRY PAPER VIII-A-2**

**SEMESTER – VI**

**INSTRUMENTAL METHODS OF ANALYSIS**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
<b>1.</b>	<b>Introduction to spectroscopic methods of analysis</b>	02	01	--
<b>2.</b>	<b>Molecular spectroscopy</b>	01	02	--
<b>3.</b>	<b>UV-Visible/ Near IR</b>	02	01	01
<b>4.</b>	<b>Separation techniques</b>	02	02	01
<b>5.</b>	<b>Elemental Analysis</b>	01	02	01
<b>Total no of Questions</b>		08	08	03

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**SIXTH SEMESTER END EXAMINATIONS**  
**III.B.Sc., CHEMISTRY VIII-A-2**  
**INSTRUMENTAL METHODS OF ANALYSIS**  
**MODEL QUESTION PAPER**

Time: 2½ hr s

Maximum Marks: 50

PART- A

4 x 7 = 28 Marks

Answer **ALL** the questions. Each carries **SEVEN** marks.

అనితే పాశ్చాత్యలకం సమూధానమం నశిమయి. పాతీ దానశిక ఎనిమిదిది మూరూకలం.

1. Write about classification of analytical methods.  
వశిశ్చణ పదీధతలం వరశీకరణ గూరశీశి వూయంమం.

(OR)

2. Explain the classification of errors.  
దోషాల వరశీకరణం వశివరశీశింపంమం.
3. Describe the absorption and scattering behaviour of molecules.  
అణంవంల శశీషణ మరశీయం పరశీషణ పూవరతనం వరశీశింపంమం.

(OR)

4. Explain the principle and instrumentation of NMR spectroscopy.  
NMR వరశీ పటశశీకానత రమంలలో ఇమిడిది ఉనశీ సూతశశీకానిశీ మరశీయం పరశీశికర అమరశీకనం వశివరశీశింపంమం.
5. Give detailed account on photocells, photo multipliers and diode-array detectors.  
కూశింతిఫుటశీలం, కూశింతి వరధకాలం మరశీయం డయో-&-ఎరశీవ్ మంగూ తశీలంమం. లనం గూరశీశి సశింగదూ

(OR)

6. How do you differentiate absorption and fluorescence?  
శశీషణం మరశీయం పూతిదపత శిలనం వశీగూ ఎటూల గూరశీశింపంమం?
7. Discuss the principle and uses of gas-liquid chromatography.  
వూయం-దశీవ కశీర ష యొకక సూతామం మరశీయం అనువరతనాలను గూరశీశి చరశీశింపంమం. మూటశీగఫ్

(OR)

8. Explain different solvent extraction methods.  
వశివరశీ దూకావణ నిషీకరణ వశిధానంలనం వశివరశీశింపంమం.

PART- B

4x 4 = 20 Marks

Answer any **FOUR** of the following questions. Each carries **FOUR** marks.

కీందశి వూనిలో ఏదశీని నూలంగం పూశశీలకం సమూధానం నిమయి. పాతీ దానిక నూలంగం మూరూకలం.

9. Explain about significant figures with examples.  
వూ ధూనూత సశింఖశీలం అనగూనశీమరి? ఉదూహరణలతశీ వశివరశీశింపంమం.
10. What are the advantages of FTIR?  
FTIR యొకక ఉపయోగాలశీ?



11. Discuss the various techniques of wavelength dispersion.

తరంగదర్శన వర్ణవిక్షేపణ యొక్క వేర్వేరు పద్ధతులను గూర్చి చర్చించుము.

12. How double beam instruments are superior to single beam instruments?

దీపింజ వర్ణపటాపకము, ఏకపింజ వర్ణపటాపకము కంటే ఏ విధంగా మెరుగైనది?

13. Briefly explain any two development methods of chromatogram in paper chromatography.

కాగితీ క్రోమ | లోని ర్ణిండు పద్ధతులను కొంత ముగ్గా వివరించుము.  
మటోగ్ఫ ఏవన అభివృద్ధ

14. Describe the procedure for column packing.

స్తంభ పింపుటోరణ విధానమును వర్ణించుము.

15. What are the factors affecting chemical shift?

రసాయన సానంతరణి హాభువితము న్నయ ఆంశాలలు ఏవ?

16. Discuss the principle involved in voltametry.

వోల్టేట్రో ఇమిడియునే సూత్రాని చర్చించుము.

**PART- C**

**3 x 2 = 6 Marks**

Answer **ALL** the questions. Each carries **TWO** marks.

అనిే లక సమూధానము నిమిే. పతీ దానిక ర్ణిండు మూకలు.  
ప

17. What is the principle involved in U.V Spectroscopy?

U.V Spectroscopy న్నిండు ఇమిడి వునే సూత్రాని ఏమిట్?

18. What are the factors affecting  $R_f$  values

$R_f$  వలన హాభువితం న్న ఆంశాలలు ఏమిట్?

19. What is Chemical Shift?

రసాయన సానభాంశం అనగా నేమి?

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**CBCS Syllabus for B.Sc. III Year**

**Effective from 2017 – 2018 onwards**

**Paper - VIII-A-3 Semester – VI**

**CHE – 116: ANALYSIS OF DRUGS, FOOD PRODUCTS & BIO-CHEMICAL ANALYSIS**

**Total Hours: 45**

**Unit – I 8h**

**Drugs-I**: Introduction - Drug & disease (definition) -Sources - Plant Animal & synthetic. - Terminology - Pharmacy - Pharmacology – Pharmacophore - Pharmacodynamics - Pharmacokinetics (ADME, Receptors – brief treatment) - Metabolites and Anti metabolites.

**Unit – II 8h**

**Drugs-II**: Nomenclature - Chemical name, Generic name and Trade names with examples - Classification - Classification based on - structures and Therapeutic activity with one example each - Administration of Drugs.

**UNIT - III 10 h**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of analgesics and antipyretics like aspirin and paracetamol Analysis of anti malarials like chloroquine.

Analysis of drugs in the treatment of infections and infestations: Amoxycillin, chloramphenicol, metronidazole, penicillin, tetracycline, cephalexin (cefalexin).

Anti tuberculous drug- isoniazid.

**UNIT - IV 10 h**

Food Adulteration Determination of Food Adulteration, Determination of Moisture, Ash, Crude fat or ether-extract, Soluble extractor, Crude protein, True protein, Crude fiber, Starch, Analysis of Sugars (Carbohydrate), Estimation of Sucrose in a given sample of cane sugar, Determination of Phosphorous in plant or food material, Destruction of organic matter, Important points, Determination of total Na, K, Ca and Mg in food materials by flame photometry.

**UNIT - V 9 h**

Clinical analysis of blood: Composition of blood, clinical analysis, trace elements in the body. Estimation of blood cholesterol, glucose, enzymes, RBC & WBC, Blood gas analyser.

## REFERENCE BOOKS

1. F.J. Welcher-Standard methods of analysis.
2. A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS.
3. F.D. Snell & F.M. Biffen-Commercial methods of analysis-D.B.Taraporavala & sons.
4. J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on analytical chemistry and its applications -- Inter Science- Vol I to VII.
5. Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
6. Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi, CBS Publishers and Distributors, New Delhi.
7. G.Ingram- Methods of organic elemental micro analysis- Chapman and Hall.
8. H.Wincciam and Bobbles (Henry J) - Instrumental methods of analysis of food additives.
9. H.Edward-The Chemical analysis of foods; practical treatise on the examination of food stuffs and the detection of adulterants.
10. The quantitative analysis of drugs- D.C.Garratt-Chapman & Hall.
11. A text book of pharmaceutical analysis by K.A.Connors-Wiley-International.
12. Comprehensive medicinal chemistry-Ed Corwin Hansch Vol 5, Pergamon Press.

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**III B.SC. CHEMISTRY PAPER VIII-A-3  
SEMESTER – VI**

**ANALYSIS OF DRUGS, FOODS, DAIRY PRODUCTS & BIO-CHEMICAL ANALYSIS**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	<b>Drugs-I : Introduction</b>	02	01	01
2.	<b>Drugs-II : Nomenclature</b>	01	02	--
3.	<b>Analysis of the following drugs and pharmaceuticals preparations</b>	02	02	01
4.	<b>Drugs-IV</b>	02	01	01
5.	<b>Clinical analysis of blood</b>	01	02	--
<b>Total no of Questions</b>		08	08	03







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**DEPARTMENT OF CHEMISTRY**  
**CBCS Syllabus for B.Sc. III Year**  
**Effective from 2018 – 2019 onwards**  
**Paper - VIII-B-1 Semester – VI**

**CHE – 117: FUEL CHEMISTRY AND BATTERIES**

**Total Hours : 45**

**UNIT –I**

**12 h**

Review of energy sources (renewable and non-renewable) – classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non-fuel) in various industries, its composition, carbonization of coal - coal gas, producer gas and water gas – composition and uses – fractionation of coal tar – uses of coal tar based chemicals, requisites of a good metallurgical coke, coal gasification (Hydro gasification and catalytic gasification) coal liquefaction and solvent refining.

**UNIT-II**

**6 h**

**Petroleum and petrol chemical industry:**

Composition of crude petroleum, refining and different types of petroleum products and their applications.

**UNIT-III**

**10 h**

Fractional distillation (principle and process), cracking (Thermal and catalytic cracking). Reforming petroleum and non- petroleum fuels (LPG, CNG, LNG, bio-gas), fuels derived from biomass, fuel from waste, synthetic fuels (gaseous and liquids), clear fuels, petro chemicals: vinyl acetate, propylene oxide, isoprene, butadiene, toluene and its derivative xylene.

**UNIT-IV**

**10 h**

**Lubricants**

Classification of lubricants, lubricating oils (conducting and non-conducting), solid and semi solid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

**UNIT-V**

**7 h**

**Batteries**

Primary and secondary batteries, battery components and their role, Characteristics of battery. Working of following batteries: Pb-Acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

**REFERENCE BOOKS**

1. E.Stochi : Industrial chemistry , Vol-1, Ellis Horwood Ltd. UK.
2. P.C.Jain, M.Jain: Engineering chemistry, Dhanpat Rai & sons, Delhi.
3. B.K.Sharma: Industrial Chemistry, Goel Publishing house, Meerut.



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**III B.SC. CHEMISTRY CLUSTER – VIII B-I**  
**SEMESTER – VI**  
**FUEL CHEMISTRY AND BATTERIES**

S.No.	Chapter	Essay Question ( 07 M ) knowledge	Short Answer Question ( 04 M ) Under standing	Very Short Answer Question ( 02 M ) Skill / Application
1.	UNIT –I	02	02	00
2.	UNIT –II	02	01	01
3.	UNIT –III	02	02	00
4.	UNIT –IV	02	01	01
5.	UNIT –V	00	02	01
Total no of Questions		08	08	03

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**SIXTH SEMESTER END EXAMINATIONS**  
**III B. Sc., CHEMISTRY - PAPER VIII- B - 1**  
**FUEL CHEMISTRY AND BATTERIES**  
**MODEL QUESTIONPAPER**

Time: 2½ hr

Maximum Marks: 50

**SECTION-A**

**4 x 7 = 28 Marks**

Answer **ALL** the questions. Each carries **SEVEN** marks.

అనిచే పాశ్చాత్యలకం సమూధానమం నఱిమంఱే. పాతీ దానఱిక  
ఏడం మూరూకలం.

1. Write in detail about renewable and non-renewable energy sources.

పఱనరూదధఱిఱింబఱ్డం మరఱ్ఱియం పఱనరూదధఱిఱింపలఱేని శక్తత వనరూలనం గూరఱ్ఱిఱి సఱింగరూమం గూ  
వఱాయంమం.

**(OR)**

2. Write about the composition and uses of producer gas and water gas.

వఱొడూసఱ్ గూఱ్ మరఱ్ఱియం వఱటఱ్ గూఱ్ ల సఱింఱుటఱ్నమంనం మరఱ్ఱియం ఉపయఱ్గూలనం  
వఱాయంమం.

3. Explain the composition of the crude petroleum.

మంఱి చమంరూ సఱింఱుటఱ్నమంనం వఱివఱ్ఱిఱింఱంఱం.

**(OR)**

4. Describe the refining of petroleum.

పటఱ్ఱిఱియఱింఱంనం శంఱఱి నఱ్ఱయంఱ్ఱంనం వఱ్ఱిఱింఱంఱం.

5. Discuss about fractional distillation.

అఱింశఱిక సఱ్ఱఱ్ఱ పఱకయ గూరఱ్ఱిఱి చరఱ్ఱిఱింఱంఱం.

**(OR)**

6. Write about the non-petroleum fuels.

పటఱ్ఱిఱియఱింఱంఱం ఇఱింఱంఱం గూరఱ్ఱిఱి వఱాయంమం.

7. Explain the classification of lubricants.

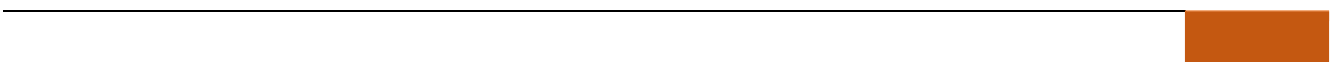
కఱింఱంఱం రణను  
వఱ్ఱిక వివఱ్ఱింఱంఱం.

**(OR)**

8. What are the properties of lubricants?

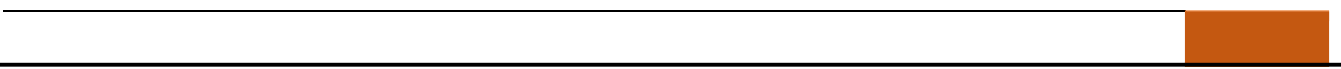
కఱింఱంఱం ధరఱ్ఱిఱిఱింఱంఱం?

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**DEPARTMENT OF CHEMISTRY**  
**CBCS Syllabus for B.Sc. III Year**  
**Effective from 2018 – 2019 onwards**  
**Paper - VIII-B-2 Semester – VI**

**CHE – 118: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**UNIT-I**

**Recapitulation of *s*- and *p*-Block Elements**

**8 h**

Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken and Alfred - Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

**UNIT – II**

**15 h**

**Silicate Industries**

**Glass:** Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

**Ceramics:** Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre.

**Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

**UNIT – III**

**8 h**

**Fertilizers:**

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphate, polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

**UNIT – IV**

**8 h**

**Surface Coatings:**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

**UNIT – V**

**6 h**

**Alloys:**

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of steel (removal of silicon decarbonization, demanganization, desulphurization, dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

**Chemical explosives:**

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

**REFERENCE BOOKS**

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. P. C. Jain & M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
7. B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut.

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**III B.SC. CHEMISTRY CLUSTER – VIII B-2**  
**SEMESTER – VI**  
**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

S. No.	Chapter	Essay Question ( 07 M ) knowledge	Short Answer Question ( 04 M ) Under standing	Very Short Answer Question ( 02 M ) Skill / Application
1.	UNIT –I	02	01	01
2.	UNIT –II	02	02	00
3.	UNIT –III	02	01	01
4.	UNIT –IV	00	02	01
5.	UNIT –V	02	02	00
<b>Total no of Questions</b>		<b>08</b>	<b>08</b>	<b>03</b>











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**DEPARTMENT OF CHEMISTRY**

**CBCS Syllabus for B.Sc. III Year**

**Effective from 2018 – 2019 onwards**

**Paper - VIII-B-3 Semester – VI**

**CHE – 119: ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

**No. of Hours: 45**

<b>UNIT-I</b>	<b>9 h</b>
Analysis of soaps: moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid, sodium silicate and chlorides.	
Analysis of paints: Vehicle and pigments, Barium Sulphate, total lead, lead chromate, iron pigments, zinc chromate.	
<b>UNIT-II</b>	<b>8 h</b>
Analysis of oils: saponification value, iodine value, acid value, ester value, bromine value, acetyl value. Analysis of industrial solvents like benzene, acetone, methanol and acetic acid, Determination of methoxyl and N-methyl groups.	
<b>UNIT-III</b>	<b>10 h</b>
Analysis of fertilizers: urea, NPK fertilizer, superphosphate. Analysis of DDT, BHC, endrin, endosulfone, malathion, parathion. Analysis of starch, sugars, cellulose and paper.	
<b>UNIT-IV</b>	<b>9 h</b>
Gas analysis: carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydrocarbons, unsaturated hydrocarbons, nitrogen, octane number, cetane number. Analysis of fuel gases like: water gas, producer gas, kerosene (oil) gas. Ultimate analysis: carbon, hydrogen, nitrogen, oxygen, phosphorus and sulphur.	
<b>UNIT-V</b>	<b>9 h</b>
Analysis of Complex materials: <b>Analysis of cement</b> - loss on ignition, insoluble residue, total silica, sesqui oxides, lime, magnesia, ferric oxide, sulphuric anhydride. <b>Analysis of glasses</b> - Determination of silica, sulphur, barium, arsenic, antimony, total $R_2O_3$ , calcium, magnesium, total alkalis, aluminium, chloride, fluoride.	

**REFERENCE BOOKS**

1. F.J. Welcher - Standard methods of analysis.
2. A.I. Vogel - A text book of quantitative inorganic analysis - ELBS.
3. H.H. Willard and H. Deal - Advanced quantitative analysis - Van Nostrand Co.
4. F.D. Snell & F.M. Biffen - Commercial methods of analysis - D.B. Tarapuravala & sons.
5. J.J. Elving and I.M. Kolthoff - Chemical analysis - A series of monographs on analytical chemistry and its applications - InterScience Vols I to VII.
6. G.Z. Weig - Analytical methods for pesticides, plant growth regulators and food additives - Vols I to VII.
7. S.L. Chopra & J.S. Kanwar - Analytical Agricultural Chemistry - Kalyani Publishers.
8. R.M. Upadhyay and N.L. Sharma - Manual of soil, plant, water and fertilizer analysis - Kalyani Publishers.

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**III B. SC. CHEMISTRY CLUSTER – VIII B-3**

**SEMESTER – VI**

**ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

Sl. NO.	Chapter	Essay Question ( 07 M ) knowledge	Short Answer Question ( 04 M ) Under standing	Very Short Answer Question ( 02 M ) Skill / Application
1.	UNIT-I	02	02	00
2.	UNIT-II	02	01	00
3.	UNIT-III	02	01	01
4.	UNIT-IV	02	02	01
5.	UNIT-V	00	02	01
Total no of Questions		08	08	03

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**SIXTH SEMESTER END EXAMINATIONS**  
**III B. Sc., CHEMISTRY - PAPER VIII- B - 3**  
**ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**  
**MODEL QUESTIONPAPER**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Max. Marks: 50**

**PART-A**

Answer **ALL** the questions. Each carries **SEVEN** marks.

అనితే పాశ్చాత్యలకం సమాధానమం నశిమయి. పాతీ దానశిక ఎనిమశిదితి మూరకలం.

**4 x 7 = 28**

**Marks**

1. How do you analyze lead chromate and zinc chromate present in paints?

పయశింబ్ లలోని లఙ్ క్షిర మఖ్ మరశియు జింక క్షిర మఖ్ లనం ఎటా వశిశ్చాలషశింనదర్ష?

**(OR)**

2. How do you determine the total fatty matter and free alkali of soaps?

సబ్బంబలలోని క్షిర వంష పదాధమం మరశియు షషనశాశి ష్చారశ్చాలంలనం ఎటా నశిరొయిశింనదర్ష?

3. Give the procedure for the determination of iodine value and acid value in oil samples.

నూన నమూనాలలోని అయొడిన్ విలువ మరశియు ఆమా విలువలను నిరొయిశింన పద్ధతులను త్లము.

**(OR)**

4. Describe the analysis of benzene.

బ్లంజిన్ యొకక విశ్చాషణనం వరశిశింనంనంనం.

5. Discuss the analysis of urea and DDT.

యూరశియు మరశియు ణనం చరశిశింనంనంనం

DDT ల విశ్చాష

**(OR)**

6. Discuss the analysis of starch and paper.

సశిశ్చాష మరశియు కశాగతశిం యొకక వశిశ్చాలషణనం చరశిశింనంనంనం.

7. Write about octane number and cetane number.

ఆకన్ శింఖ్ మరశియు షషన్ శింఖ్లనం గూరశిశి వశాయంనం.

**(OR)**

8. How are water gas and producer gas analyzed?

పశ్చా డూనర్ గశాష మరశియు వశ్చర్ గశాష లనం ఎల వశిశ్చాలషశితశాష?





**PART-B**

Answer any **FOUR** of the following questions. Each carries **FOUR** marks. **4x4 =16 M**

కఠింబడి వఱనిలో ఏదన్ని ఐదన్ పశ్చేలకం సమఱధఱనమం నిమం. పఱతీ దఱనఱక నఱలంగం మఱఱకలం.

9. How do you determine the moisture in soaps?

సబన్లలోని తర్మనం ఎలఱ నఱఱోయఱసతఱఱ?

10. Give the procedure for the determination of total lead in paints.

పఱంబ్ లలోని మొతఱం ల్ఱ ను నిఱోయఱంఱు విధఱనమనిమం.

11. Write a note on saponification value.

సవఱసఱఫ్ఱకపన్ వఱలంవ పఱఱఱ వఱఱఱం.

12. Explain the analysis of BHC.

BHC యొకక విశ్ఱలఱఱు

వివఱఱంఱు.

13. How carbon monoxide is analysed in gases?

వఱంబలలోని కఱఱన్ మఱోనఱక నం ఎఱో వఱశ్ఱలఱఱఱసతఱఱ?

14. Explain the determination process of nitrogen in gases.

వఱంబలలోని న్ఱైట్జన్ ను నిఱోయఱంఱు విధఱనమం వివఱఱంఱు.

15. Describe the determination of lime in cement.

సఱంబ్ లలోని ల్ఱం నం నఱఱోయఱంఱుచడఱని వఱఱఱంఱు.

16. Describe the determination of silica in glass.

గఱలోని సిలికఱ నిఱోయఱంఱు వఱఱఱంఱు.

**PART-C**

Answer **ALL** the questions. Each carries **Two** marks.

అనితీ పఱశ్ఱేలకం సమఱధఱనమం నఱిమం. పఱతీ దఱనఱక రఱ్ఱంఱంఱం మఱఱకలం.

**3 x 2 = 6**

**Marks**

17. What is kerosene oil gas?

కఱోసఱన్ ఆయల్ అనగర ఏమిటఱి?

18. What is insoluble residue?

కఱగన్న అవశషరలం అనగర ఏమిటఱి?

19. What is meant by total silica?

మొతఱం సఱిలఱకఱ అంబ్ఱఱ ఏమిటఱి?



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**DEPARTMENT OF CHEMISTRY**

**III B.Sc. SEMESTER – VI PAPER – VIII C1**

(Effective from 2017 – 2018 onwards)

**CHE – 120: ORGANIC SPECTROSCOPIC TECHNIQUES**

**Total No. of Hrs: 45**

**UNIT-I**

**10 h**

**Nuclear Magnetic Resonance Spectroscopy- I**

Nuclear spin, Principles of NMR - Classical and Quantum Mechanical methods, Magnetic moment and Spin angular momentum. Larmor Frequency. Instrumentation. Relaxation - spin-spin & spin lattice relaxation. Shielding constants, Chemical shifts, Shielding and Deshielding mechanism - Factors influencing Chemical shift. Spin-Spin interactions - AX, AX<sub>2</sub> and AB types. Vicinal, Geminal and Long range coupling - Factors influencing coupling constants.

**UNIT – II**

**5 h**

**Nuclear Magnetic Resonance Spectroscopy- II**

Spin decoupling, Spin tickling, Deuterium exchange, Chemical shift reagents and Nuclear Overhauser effect. Applications in Medical diagnostics, Reaction kinetics and mechanically induced dynamic nuclear polarization. FT NMR and its advantages.

**UNIT-III**

**10 h**

**UV & Visible Spectroscopy**

Electronic spectra of diatomic molecules. The Born-oppenheimer approximation. Vibrational coarse structure: Bond association and Bond sequence. Intensity of Vibrational - electronic spectra: The Franck-Condon principle. Rotational fine structure of electronic vibration transitions. Electronic structure of diatomic molecules.

Types of transitions, Chromophores, Conjugated dienes, trines and polyenes, unsaturated carbonyl compounds – Woodward-Fieser rules.

**UNIT-IV**

**5 h**

Electronic spectra of polyatomic molecules. Chemical analysis by Electronic Spectroscopy – Beer- Lambert's Law. Deviation from Beer's law. Quantitative determination of metal ions (Mn<sup>+2</sup>, Fe<sup>+2</sup>, NO<sub>2</sub><sup>-</sup>, Pb<sup>+2</sup>). Simultaneous determination of Chromium and Manganese in a mixture.

**UNIT-V**

**15 h**

**Electron Spin Resonance Spectroscopy**

Basic Principles, Theory of ESR, Comparison of NMR & ESR. Instrumentation, Factors affecting the 'g' value, determination of 'g' value. Isotropic and Anisotropic constants.

Splitting hyper fine splitting coupling constants. Line width, Zero field splitting and Kramer degeneracy. Crystal field splitting, Crystal field effects.

Applications:- Detection of free radicals - ESR spectra of Methyl radical ( $\text{CH}_3^\cdot$ ), Benzene anion ( $\text{C}_6\text{H}_6^-$ ), Isoquinine,  $[\text{Cu}(\text{H}_2\text{O})_6]^{+2}$  and  $[\text{Fe}(\text{CN})_5\text{NO}]^{-3}$

### REFERENCE BOOKS

1. Analytical Chemistry by Skoog and Miller
2. A textbook of qualitative inorganic analysis by A.I. Vogel
3. Nanochemistry by Geoffrey Ozin and Andre Arsenault
4. Stereochemistry by D. Nasipuri
5. Organic Chemistry by Clayden

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**III B.SC. CHEMISTRY PAPER VIII-C-1**

**SEMESTER – VI**

**ORGANIC SPECTROSCOPIC TECHNIQUES**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	01	02	01
2.	UNIT-II	01	02	--
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	01	--
5.	UNIT-V	02	01	01
Total no of Questions		08	08	03



ESR అధ్యయనంలో ఇమిడిఉన్న సూత్రము మరొకటి పాఠ్య పద్ధతిని వివరించుము

(OR)

8. Write notes on 'g' value and hyperfine structure.

'g' వలెంవ మర్రోయిం హైపర్ ఫైన్ సర్క్లరేణము గూర్రోయి వర్రోయి వర్రోయిం.

PART- B

4 x 4 = 16 Marks

Answer any **FOUR** of the following questions. Each carries **FOUR** marks.

కర్రోయి వర్రోయిం ఏదర్ని ఐదర్ని పశ్చేలకం సమర్రోయిం నిమయి. పర్రోయి దర్రోయిక నర్రోయిం గు మర్రోయిం.

9. Write about spin-spin relaxation.

సిన-సిన ర్రోయిం గూర్రోయి వర్రోయిం.

10. Describe the factors influencing the coupling constant.

యం గళకరణ సర్క్లరేణమునం పర్రోయిం నర్క్లరేణమునం అంశర్క్లరేణమునం వర్రోయిం.

11. Explain about spin decoupling.

సిన దర్క్లరేణమునం వివర్రోయిం.

12. What are the applications of NMR spectroscopy in medical diagnostics?

వర్రోయి నర్క్లరేణమునం NMR వర్రోయిం సమర్రోయిం యొకక అనంవర్రోయిం.

13. Write about Franck-Condon principle.

పర్రోయిం-కర్రోయిం సూత్రం గూర్రోయి వర్రోయిం.

14. What are the different types of electronic transitions?

వర్క్లరేణమునం ఎలకరణ సర్క్లరేణమునం వర్రోయిం.

15. State and explain Beer-Lambert law.

బీర్-లంబర్ట్ ర్రోయిం నర్క్లరేణమునం తర్క్లరేణమునం, వర్క్లరేణమునం.

16. How ESR studies are useful to study the structure of free radicals?

సమర్రోయిం వర్రోయిం తర్క్లరేణమునం అధ్యయనం నర్క్లరేణమునం ESR ఎర్క్లరేణమునం ఉపయోగపడం.

PART- C

3 x 2 = 6 marks

Answer All Questions Each Carry TWO Marks

అని వర్రోయిం సమర్రోయిం నర్క్లరేణమునం. పర్రోయి దర్రోయిక ర్రోయిం మర్రోయిం.

17. What is coupling constant?

యం గళకరణ సర్క్లరేణమునం అనగం నర్క్లరేణమునం?

18. What is molar extinction coefficient?

మర్క్లరేణమునం విలంపత గుణకం అనగం నర్క్లరేణమునం.

19. Write any two similarities between NMR&ESR

NMR&ESR మర్రోయిం ర్రోయిం పర్క్లరేణమునం

ర్రోయిం





**GOVERNMENT COLLEGE (A) RAJAMAHENDRAVARAM**  
**DEPARTMENT OF CHEMISTRY**  
**III B.Sc. – SEMESTER – VI PAPER – VII C2**  
(Effective from 2017 – 2018 onwards)  
**CHE – 121: ADVANCED ORGANIC REACTIONS**

**Total Hours: 45**

**UNIT – I**

**Organic Photochemistry**

**8 h**

Organic photochemistry: Molecular orbitals, carbonyl chromophore–triplet states, Jablonski diagram, inter–system crossing. Energy transfer. Energies properties and reaction of singlet and triplet states of and transitions.

**Photochemical reactions :** (a) Photo reduction, mechanism, influence of temperature, solvent, nature of hydrogen donors, structure of substrates on the course of photo reduction.

**UNIT – II**

**Organic Photochemistry**

**8 h**

Norrish cleavages, type I: Mechanism, acyclic cyclicdiones, influence of sensitizer, photo Fries rearrangement. Norrish type II cleavage: Mechanism and stereochemistry, type II reactions of esters: 1: 2 diketones, photo decarboxylation, Di -  $\pi$  methane rearrangement, Photochemistry of conjugated dienes, Decomposition of nitrites - Barton reaction.

**UNIT – III**

**Protecting Groups and Organic Reactions**

**9 h**

Principles of (1) Protection of alcohols – ether formation including silyl ethers – ester formation, (2) Protection of diols – acetal, ketal and carbonate formation, (3) Protection of carboxylic acids – ester formation, benzyl and t-butyl esters, (4) Protection of amines – acetylation, benzylation, benzyloxy carbonyl, triphenyl methyl groups and fmoc, (5) Protection of carbonyl groups – acetal, ketal, 1,2–glycols and 1,2–dithioglycols formation.

**UNIT – IV**

**8 h**

Synthetic reactions : Mannich reaction – Mannich bases – Robinson annulations. The Shapiro reaction, Stork–enamine reaction. Use of dithioacetals - Umpolung, phase transfer catalysis - mechanisms and use of benzyl trialkyl ammonium halides. Wittig reaction.

**UNIT – V :**

**New Synthetic Reactions**

**12 h**

Baylis–Hillman reaction, RCM olefin metathesis, Grubb catalyst, Mukayama aldol reaction, Mitsunobu reaction, McMurrey reaction, Julia–Lythgoe olefination, and Peterson's stereoselective olefination, Heck reaction, Suzuki coupling, Stille coupling and Sonogishira coupling, Buchwald– Hartwig coupling. Ugi reaction, Click reaction.

**REFERENCE BOOKS**

1. Molecular reactions and Photochemistry by Charles Dupey and O.L. Chapman.
2. Molecular Photochemistry by Turru.
3. Importance of antibonding orbitals by Jaffe and Orchin.
4. Text Book of Organic Chemistry by Cram, Hammand and Henrickson.
5. Some modern methods of organic synthesis by W. Carruthers.
6. Guide Book to Organic Synthesis by R.K. Meckie, D.M. Smith and R.A. Atken.
7. Organic Synthesis by O.House.
8. Organic synthesis by Michael B. Smith.
9. Organic Chemistry Claydon and others 2005.
10. Name Reactions by Jie Jack Li
11. Reagents in Organic synthesis by B.P. Mundy and others.
12. Tandem Organic Reactions by Tse–Lok Ho.

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**III B.SC. CHEMISTRY PAPER VIII-C-2**

**SEMESTER – VI**

**ORGANIC SPECTROSCOPIC TECHNIQUES**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	01	02	01
2.	UNIT-II	01	02	--
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	01	01
5.	UNIT-V	02	01	--
Total no of Questions		08	08	03



**(OR)**

8) Write a note on the following:

- i) Umpolung    ii) Phase transfer catalysis

**SECTION - B**

4x4 = 16 Marks

Answer any five questions.

9. Write notes on inter-system crossing.

అంతర వాహనీ వాతాసాిత గూరూకాి వాఖూ వాాయుుు.

10. Describe the photochemistry of benzene.

బూూూూూ యూకక కూూూూూ రూూూూూ శూూూూూ రూూూూూ వరూూూూూ.

11. Give a brief account on the protection of carboxylic acids by ester formation.

కూూూూూ అూూూూూ ఎూూూూ గూూూూూ దూూూూూ రూూూూూ గూూూూూ కూూూూూ

12. How does carbonate formation protect diols?

కూూూూూ ఏూూూూూ దూూూూూ రూూూూూ

13. Write about Robinson annulation.

రూూూూూ సూూూూూ గూూూూూ

14. What is Stork-enamine reaction?

సూూూూూ-కూూూూూ

15. Explain the Mukayama aldol reaction.

మూూూూూ-అూూూూూ

16. Discuss about Ugi reaction.

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**PART- C**

3 x 2 = 6 Marks

Answer all the questions..

అూూూూూ

17) Explain Heck reaction.

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18) Write about protection of Diols.

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19) What is meant by photo reduction.

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**CBCS Syllabus for B.Sc. III Year**

**Effective from 2017 – 2018 onwards**

**Paper - VIII-C-3 Semester – VI**

**CHE – 122: PHARMACEUTICAL AND MEDICINAL CHEMISTRY**

**No. of Hours : 45**

**UNIT-I**

**8 h**

Pharmaceutical chemistry Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment) Metabolites and Anti metabolites.

**UNIT-II**

**Drugs:**

**8 h**

Nomenclature: Chemical name, Generic name and trade names with examples, Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs.

**UNIT-III**

**Synthesis and therapeutic activity of the compounds:**

**12 h**

a. Chemotherapeutic Drugs

1. Sulphadruugs(Sulphamethoxazole) 2. Antibiotics -  $\beta$ -Lactam Antibiotics, Macrolide Antibiotics, 3. Anti malarial Drugs(chloroquine)

b. Psycho therapeutic Drugs:

1. Anti pyretics(Paracetamol) 2. Hypnotics 3. Tranquilizers(Diazepam) 4. Levodopa

**UNIT-IV**

**Pharmacodynamic Drugs:**

**8 h**

1. Antiasthma Drugs (Solbutamol) 2. Antianginals (Glycerol Trinitrate)  
3. Diuretics(Frusemide)

**UNIT-V**

**HIV-AIDS:**

**9 h**

Immunity - CD-4cells, CD-8cells, Retro virus, Replication in human body, Investigation available, prevention of AIDS, Drugs available - examples with structures: PIS: Indinavir (crxivian), Nelfinavir(Viracept).



## REFERENCE BOOKS

1. Medicinal Chemistry by Dr. B.V.Ramana
2. Synthetic Drugs by O.D.Tyagi & M.Yadav
3. Medicinal Chemistry by Ashutoshkar
4. Medicinal Chemistry by P.Parimoo
5. Pharmacology & Pharmacotherapeutics R.S Satoshkar & S.D.Bhandenkar
6. Medicinal Chemistry by Kadametal P-I & P-II
7. European Pharmacopoeia

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**III B.SC. CHEMISTRY PAPER VIII-C-3**

**SEMESTER – VI**

**PHARMACEUTICAL & MEDICINAL CHEMISTRY**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 08 M ) knowledge</b>	<b>Short Answer Question ( 05 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	01	02	01
2.	UNIT-II	01	02	--
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	01	--
5.	UNIT-V	02	01	01
Total no of Questions		08	08	03

**MODEL QUESTION PAPER**  
**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**SIXTH SEMESTER END EXAMINATIONS**  
**III B.Sc., CHEMISTRY - PAPER VIII- C - 3**  
**PHARMACEUTICAL & MEDICINAL CHEMISTRY**

**Time: 2½ hr**

**Maximum Marks: 50**

**PART- A**

**4 x 7 = 28 Marks**

Answer **ALL** the questions. Each carries **SEVEN** marks.

అనితే పాశర్లేలకం సమూధానమం నిమిలే. పాతీ దానశిక పదాి మూరకలం.

1. Give a detailed account on pharmacodynamics and pharmacokinetics.

పూరేకోడైసమిక్ ల టక్టీ విపులముగా త్లుము.  
ీ మర్యం పూరేకోకఫ్ గూరిి  
నట్ (OR)

2. Explain the following terms with suitable examples.

Metabolites ii) Anti-metabolites

ఈ కుడిది పదాలనం తగిన ఉదాహరణలతో వివరించం.

i) మ్రిటబ్కో లట్టీ ii) ఆంింట్ మ్రిటబ్కో ల్ట్టీ

3. How drugs are classified according to their structure?

ఔపధాలం వాట్ నిరకేణమం వర ర్రిం వి?  
ఆధారంంగా ఎట్లం ర్రిక పబ్డన

(OR)

4. Discuss the classification of drugs based on therapeutic activity.

ఔపధ కటయాశీలత ఆధారంంగా ఔపధాల వర్రీకరణం గూరిి చర్రీంంచం.

5. Write about the synthesis of Chloroquin.

క్లోరకోక్స్ యొకక సంింశ్ాలపణా విధానమంనం వాయుం

((OR)

6. Write about the synthesis and therapeutic activity of paracetamol.

పూరకొసట్మల్ ణ శీలతను గూరిి వాయుం  
యొకక సంింశ్ాష్ మర్యం  
కయ

7. Write about the synthesis of salbutamol.

సాల్ బ్ంట్మల్ ణా విధానంను వాయుం  
యొకక సంింశ్ాష్ (OR)

8) Describe the synthesis of any one diuretic.

ఏదని ఒక డైయరీట్క్ యొకక సంింశ్ాలపణా విధానంనం వర్రీంంచం

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GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.

III B.Sc. Ag. BBC – SEMESTER VI

CLUSTER ELECTIVE PAPER – VIII D1

**SYLLABUS FOR VIII D1: SOILS AND FERTILIZERS**

**CHE – 123: SOILS AND FERTILIZERS**

**SOILS UNIT I:**

Formation, nature, origin, composition, classification of Soil, Organic and Inorganic constituents. Characteristics, acidity, salinity, alkalinity of soils, pH and its effects on nutrient availability, buffering capacity of soils. Limiting of soil. Absorption of cations and anions

**SOILS UNIT II:**

Chemistry of weathering of materials soils and clay minerals, availability of soil nutrients to plants, **Macro and Micro-nutrients of Soils - Soil analysis**

**FERTILIZERS UNIT III:**

Nitrogen fertilizers: Nitrogen fertilizers and there soil reaction. Fate of  $\text{NO}_3$  and  $\text{NH}_4$  ions in soils, denitrification, nitrogen fixation by legumes.

Phosphate fertilizers: Phosphate in soil, pH, microbes and available phosphorous and its control.

Potassium availability in soil, nutrient availability in soil, soil fertility evaluation, law of minimum and law of diminishing return, diagnostic techniques.

Soil fertility and nutrients, recycling of nutrients, chelation and soil management, Bio - Fertilizers.

**PESTICIDE FORMULATIONS UNIT IV:**

Different types of formulations and their physio-chemical characteristics and important BSI

Specification. Wettable powders, Solutions, Emulsifiable concentrates, Aerosols, Dusts and

Granules.

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**III B.SC. CHEMISTRY PAPER VIII-D-1**

**SEMESTER – VI**

**SOILS & FERTILISERS**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Understanding</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	02	02	01
2.	UNIT-II	02	02	01
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	02	-
Total no of Questions		08	08	03



**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM,**  
**III B.Sc. Ag. BBC – SEMESTER VI**  
**CLUSTER ELECTIVE PAPER – VIID1**  
**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Marks: 50 M**

**Note: Answer all question. All questions carry equal marks.**

**4x7 = 28 M**

- 1) pH and its effects on nutrient availability  
(or)
- 2) Explain soil analysis
- 3) Explain about soil fertility and nutrients  
(or)
- 4) Write about Nitrogen Fertilisers and their soil reaction.
- 5) Write about emulsifiable concentrates and aerosols  
(or)
- 6) Available phosphorous and its control in phosphate fertilizers
- 7) Write a note on the following:  
a) Bio fertilizers    b) Classification of Soils  
(or)
- 8) Different types of pesticide formulation and their physicochemical characteristics

**SECTION - B**

**Answer any four questions.**

**4x4 = 16 M**

- 9) Alkalinity of soils
- 10) Macro and micro nutrients of soils
- 11) Nitrogen fixation in Legumes
- 12) Buffering capacity of soils
- 13) Soil fertility evaluation
- 14) Recycling of nutrients
- 15) Wettable powders
- 16) Important BSI specifications

**SECTION – C**

**Answer all questions**

**3x2 = 6 M**

- 17) Composition of soil
- 18) Chelation
- 19) Weathering of materials

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.**

**III B.Sc. Ag. BBC – SEMESTER VI**

**CLUSTER ELECTIVE PAPER – VIII D2**

**SYLLABUS FOR VIID2: PEST MANAGEMENT**

**CHE – 124: PEST MANAGEMENT**

**No. of Hours: 45**

**UNIT - I HERBICIDES:**

**Herbicides:** Classification, selectivity and uptake of herbicides, structure- activity relationship (SAR), mode of action and uses of the following classes with special reference to the individual compounds mentioned:

- (a) **Aryl Alkanoic Acids:** 2, 4 D, MCPA, dicamba, dichlorobenzil, and dalapon.
- (b) **Triazines:** Simazine.
- (d) **Bipyridiniums, paraquat and glyphosate**
- (e) **Sulfonylurea:** Chlorosulfron
- (f) **Uracils:** Bromacil

**UNIT - II FUNGICIDES:**

Types of fungicides, Mode of action; Chemistry of the following compounds:

**Copper and mercury derivatives**

**Dithiocarbamates:** Thiram, Ziram,

**Dinitrophenols:** 2, 4-Dinitro o-Cresol (DNOC) Karathane

**Quinines:** Dichlone

**Benzimidazoles:** Benomyl.

**Triazoles:** Propiconazole

Role of Fumigants and fumigation techniques. Nematicides, Molluscicides and Rodenticides.

**UNIT - III CONVENTIONAL AND BIOLOGICAL INSECTICIDES:**

**Conventional Insecticides: Carbamate insecticides,** pesticidal properties of following carbamate insecticides: Carbaryl, Methomyl.

Mode of action of carbamate insecticides.

**Organophosphorus insecticides** Nomenclature and structural diversities of organophosphorus compounds;, Mode of action of organophosphorus insecticides.

## **Organochlorine Insecticides**

properties of organophosphorus insecticides The chlorinated cyclodienes and their stereochemistry: Chloridane, heptachlor, aldrin, dieldrin endosulfan.

Mode of action of organochlorine insecticides.

### **Biological Insecticides:**

Pyrethrum Properties of Natural pyrethroids

Synthetic analogs of Pyrethroids: Allethrin, fenvalerate, decamethrin.

Mode of action of pyrethroids. Azadirachtin

Novel insect-control chemicals :

Repellants, chemosterilants, antifeedants

Sex attractants

### **UNIT – IV INTEGRATED PEST MANAGEMENT:**

**Pest :** Definition and its ecological validity; factors responsible for emergence of pest; pest resurgence; economic injury level; pest load; carrying capacity.

**Biological control:** Principle; bio-control agents- Parasitoids, predators and pathogens; advantages and drawbacks.

**Chemical control:** conventional insecticides; control with reference to chlorinated hydrocarbons; organophosphates; carbamates; botanical; synthetic pyrethroids; fumigants; IGR compounds & pheromones.

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**III B.SC. CHEMISTRY PAPER VIII-D-2**

**SEMESTER – VI**

**PEST MANAGEMENT**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	02	02	-
2.	UNIT-II	02	02	01
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	02	01
Total no of Questions		08	08	03

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM,**  
**III B.Sc. Ag. BBC – SEMESTER VI**  
**CLUSTER ELECTIVE PAPER – VIID2**  
**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Marks: 50 M**

**Note: Answer all question. All questions carry equal marks.**

**4x7 = 28 M**

- 1) Classification, selectivity and uptake of herbicides  
(or)
- 2) Chemistry of di thio carbamates
- 3) Nomenclature and structured diversity of organo-phosphorous insecticides  
(or)
- 4) Mode of action of organochlorine insecticides
- 5) Factors responsible for emergence of pests  
(or)
- 6) Write about conventional insecticides
- 7) Advantages and drawbacks of biological control  
(or)
- 8) Explain the Structure activity relationship (SAR) of herbicides

**SECTION - B**

**Answer any four questions.**

**4x4 = 16 M**

- 9) Mode of action of carbamate insecticides
- 10) Types of fungicides with examples
- 11) Novel insect-control chemicals
- 12) Uses of Chlorosulfron and Bromacil
- 13) Stereochemistry of Aldrin
- 14) Ecological validity of pests
- 15) Advantages and drawbacks of biological control
- 16) Conventional insecticides

**SECTION – C**

**Answer all questions**

**3x2 = 8 M**

- 17) What are rodenticides? Give an example
- 18) Definition of pest management
- 19) Name any two fumigants

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**III B.Sc. Ag. BBC – SEMESTER VI**  
**CLUSTER ELECTIVE PAPER – VIID3**  
**SYLLABUS FOR VIID3: AGRICULTURAL CHEMISTRY**

**CHE – 125: AGRICULTURAL CHEMISTRY**

**No. of Hours: 45**

**UNIT-I AGRO CHEMISTRY:**

The Role of Agro chemistry- Safe use of Chemicals – Agricultural Bio – Technology \_ Diffuse Pollution Management – Best Land Management Practices – Environmental impacts – The Role of Fertilisers – Agricultural Chemicals – Synthetic fertilisers – Agriculture Pollution – Subsurface Point-source Contamination – Chlorinated Solvents Contamination.

**UNIT – II AGRICULTURAL CHEMICALS:**

Occurrence and fate of Chemicals used in Agriculture – Pesticide Contamination in various Pesticide-use Settings – Fires in Agriculture Chemicals – Fighting Fires involving Agricultural Chemicals – Ground water contamination by Agricultural Chemicals.

**UNIT – III AGRICULTURAL CHEMISTRY & SOIL ECOSYSTEM:**

Inorganic Components of the Agricultural Ecosystem - Organic Components of the Agricultural Ecosystem – Soil Chemistry – Soil Microbiology and Biochemistry – Human Manipulation of Agricultural Ecosystems – Rice Ecosystem – Contamination in Lake Ecosystem.

**UNIT – IV ROLE OF FERTILISERS IN AGROCHEMISTRY:**

Introduction - Nitrogen (N) - Movement of N to Plant Roots - Internal Transformations of N in Soil - Losses of N from Soil - Phosphorus (P) - Gains of P to Soil - Internal Transformations of P in Soil - Losses of P from Soil - Potassium (K) - Gains of K to Soil - Crop Uptake and Removal of K from Soil - Movement of K to Plant Roots - Internal Transformations of K in Soil - Losses of K from Soil - Sulphur (S) - :Gains of S to Soil - Crop Uptake and Removal of S from Soil - Movement of S to Plant Roots - Internal Transformations of S in Soil - Losses of S from Soil – Calcium – Role of Calcium in Agro chemistry.

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**III B.SC. CHEMISTRY PAPER VIII-D-3**

**SEMESTER – VI**

**AGRICULTURAL CHEMISTRY**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Understanding</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	02	02	-
2.	UNIT-II	02	02	01
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	02	01
Total no of Questions		08	08	03

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.**  
**III B.Sc. Ag. BBC – SEMESTER VI**  
**CLUSTER ELECTIVE PAPER – VIII D3 AGRICULTURAL CHEMISTRY**  
**MODEL QUESTION PAPER**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Marks: 50 M**

**SECTION - A**

**Note: Answer all question. All questions carry equal marks.**

**4x7 = 28 M**

- 1) Write a note on Agricultural Biotechnology  
(or)
- 2) Write a note on Role of Fertilisers in Agricultural Chemistry?
- 3) Pesticide contamination in varied Pesticide use settings.  
(or)
- 4) Fighting fires involving Agricultural Chemicals
- 5) Organic Components of the Agricultural Ecosystem  
(or)
- 6) Write a note on Soil Chemistry
- 7) The Role of Nitrogen in Agro chemistry  
(or)
- 8) The Role of Potassium in Agro chemistry

**SECTION - B**

**Answer any four questions.**

**4x4 = 16 M**

- 9) Safe use of Chemicals
- 10) Land Management Practices
- 11) Chemical Fires
- 12) Occurrence of Chemicals in Agriculture
- 13) Contamination in Lake Ecosystem



14) Agricultural Ecosystem

15) Internal Transformation of Phosphorus in soil.

16) Movement of Sulphur in Plant Roots

**SECTION – C**

**Answer all questions**

**3x2 = 6 M**

17) Give two examples for Agricultural Chemicals.

18) Mention two inorganic components in Agricultural Ecosystem.

19) What is NPK in Fertilisers?

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM,**  
**SYLLABUS FOR VI SEMESTER**  
**III B.Sc. CHEMISTRY ELECTIVE – VIII E1**  
**P – VIII E1 - FOOD ADDITIVES AND ANALYTICAL TECHNIQUES**  
**CHE – 126: FOOD ADDITIVES AND ANALYTICAL TECHNIQUES**

No. of Hours: 45

**MODULE I: FOOD ADDITIVES - I:**

- Introduction,
- Need of food additives in food processing and preservation.
- Characteristics and classification of food additives.

**Definitions, uses and functions of:**

- Acids, Bases, Buffer system, Chelating / sequestering agents,
- Emulsifying and Stabilizing agents, Anticaking agents, Thickeners, Firming agents.
- Flour bleaching agents and Bread improvers. class-I and Class –II preservatives, (a)

**Chemistry of food flavor:**

- Flavour and flavour enhancers; Flavour improvers;
- Humectants and anticaking agents; Leavening agents.
- Functional characteristics of different flavors,
- Philosophy and definitions of flavor,
- Flavourmatics /flavouring compounds,
- Sensory assessment of flavor,
- Technology for flavor retention
- Natural flavour- Types, ,Artificialflavour- Types, ,
- Effect of processing on flavour

**MODULE II: FOOD ADDITIVES – II:**

**Antimicrobial agents. -**

Nitrites, sulphides, sulphur di oxide, sodium chloride, hydrogen peroxide.

*Antioxidants -*

- Introduction, mechanism of action, natural and synthetic anti-oxidants, □  
Technological aspect of antioxidants.

**Non-nutritive and low calorie sweeteners:**

- Introduction, importance, classification- natural and artificial, chemistry, technology and toxicology

- consideration for choosing sweetening agents.

**pH control agents:**

- Preservatives Stabilizer & thickeners, □ Fat replacers, Texturizers & improvers
- **(d )Regulatory aspects:**
- Natural and synthetic permitted food colors,
- Properties of certified dyes, Use of regulatory dyes,
- Color losses during thermal processing

**(e) Chemical, technological and toxicological aspects of Food Additives:**

- Risk assessment studies-
- Safety and quality evaluation of additives and contaminants
- Acute and chronic studies, NOEL, ADI, LD50

**MODULE III INTRODUCTION TO ANALYTICAL INSTRUMENTATION:**

- Introduction to Analytical Instrumentation,
- Classification of Analytical Methods,
- Types of instrumental Methods,
- Selecting an Analytical Method, Calibration of Instrumental methods.
- Beer Lambert Law, Principle, Instrumentation; Single beam, Double beam spectrophotometry.
- Application in the Analysis of food constituents such as Sugars, Amino acids & Minerals such as Iron, Phosphorous and Ascorbic Acid.

**MODULE IV CHROMATOGRAPHY:**

- a) TLC: Principle, Choice of Solvents, Preparation of TLC plates development of TLC plates, Locating Agents, Rf. Values, Application of TL Chromatography to Carbohydrates & Proteins
- b) GLC: Principle, Stationary Phase, Application of sample, Separation & dilution of colouring matter, flavor constituents and Aromatic compounds, C) HPLC: Principle of HPLC, stationary phase in HPLC, Normal phase HPLC, Reversed phase HPLC: Applications for food colours.

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**III B.SC. CHEMISTRY PAPER VIII-E-1**

**SEMESTER – VI**

**FOOD ADDITIVES & ANALYTICAL TECHNIQUES**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	02	02	01
2.	UNIT-II	02	02	-
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	02	01
Total no of Questions		08	08	03

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.**  
**III B.Sc. FMZC VI SEMESTER ELECTIVE – VIII E1**  
**P – VIII E1 - FOOD ADDITIVES AND ANALYTICAL TECHNIQUES**  
**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Marks: 50 M**

**SECTION - A**

**Note: Answer all question. All questions carry equal marks.**

**4x7 = 28 M**

- 1) Explain food additives.  
(or)
- 2) a) Write brief account on food additives.  
b) Explain chemical, technological, and toxicological aspects of food additives.
- 3) Analysis of sugars, amino acids and minerals.  
(or)
- 4) Analysis of Thiamine and Riboflavin.
- 5) Beer Lambert Law, Principle & Instrumentation of Double beam spectrophotometer.  
(or)
- 6) How can you determine the food constituents such as Sugars, Amino acids by Spectrophotometer?
- 7) Detection of carbohydrates and proteins by TLC  
(or)
- 8) Separation & dilution of colouring matter, flavor constituents and Aromatic compounds by GLC.

**SECTION - B**

**Answer any four questions.**

**4x4 = 16 M**

- 9) Write about class-I and class-II preservatives.
- 10) What are the technological aspects of antioxidants?
- 11) What are preservatives, stabilizers and thickeners? Give one example for each.
- 12) Classification of food additives.
- 13) Development of TLC
- 14) Types of Instrumental Methods
- 15) Reverse phase HPLC
- 16) Write about sources in Spectro photometers.

**SECTION - C**

**Answer all questions.**

**3x2 =6 M**

- 1) Need of food additives
- 2) Write about Rf value
- 3) What is Beer Lambert's law?

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**III B.Sc. FMZC VI SEMESTER ELECTIVE – VIII E2**

**SYLLABUS FOR PAPER VIII E2**

**CHE – 127: CHEMICAL ASPECTS IN FOOD QUALITY AND PACKAGING**

**MODULE I QUALITY CONTROL:**

**Food Quality Assurance:** Design of company quality assurance program, Microbiological concerns.

Managing quality in supply chain and marketing of food products.

**Government Regulations In Quality Control:** FAO/WHO codex Alimentarius commission, PFA, AGMARK, BIS, FPO, fair average quality (FAQ) specification for food grains, ISO 9000 series.

HACCP: Background, current status, structured approach, principles, benefits and limitation.

Consumer Protection Act (CPA)

**Food Standards of different items like :**

**Cereals and products** - bread, biscuits, **Fruits**

**Products:** Jam, juices, sauce.

**Oils and Fats:** Coconut oil, groundnut oil, palm oil, sunflower oil, vanaspati.

**Milk and Products:** Skimmed milk powder, partly skimmed milk powder, condensed sweetened milk. Other products - coffee, tea, sugar, honey, toffees.

**MODULE II: FOOD SAFETY:**

Meaning of food safety, Importance of Food Quality and safety for developing countries.

**Patent:** Definition, requirements, patent law in India, administrator, need for patent system, advantages, precautions to be taken by applicants, patent procedures, nonpatentable.

**Food Hazards:** Physical, Chemical, hazards associated with food types. Effect of processing and storage

**MODULE III FOOD PACKAGING I:** Definition, functions of packaging materials for different foods, characteristics of packaging material. Food packages – bags, pouches, wrappers, tetra packs. flexible packaging, Mechanical strength of different packaging materials.

**Labeling:** Standards, purpose, description types of labels, Printing of packages . Barcodes & other packing ,marking regulation , nutrition labeling, health claims, mandatory labeling provision.

Type of packaging materials properties of the following packaging materials-low density polyethylene, high density polyethylene, polypropylene ,polyvinyl chloride, poly vinylidene chloride, ethylene vinyl alcohol, polystyrene, polyethylene terephthalate, nylon, ethylene vinyl acetate, ethylene acrylic acid, ethylene meth acrylic acid, ionomers.

**Modern Packaging Materials and Forms:** Glass containers, metal cans, composite containers, aerosol containers, rigid plastic packages, semi rigid packaging, flexible packaging.

### **MODULE III FOOD PACKAGING II:**

Packaging regulations: Interactions between packaging material and foods; Environmental and cost consideration in selecting packaging materials. Manufacture of packaging materials; Potential of bio composite materials for food packaging; Packaging and food preservation; Disposal of packaging materials.

Biodegradable packaging material - biopolymer based edible firm.

Type of packaging materials; Selection of packaging material for different foods; Selective properties of packaging film; Methods of packaging and packaging equipment.

**Packages of Radiation Stabilized Foods:** Introduction, rigid containers, flexible containers, general methods for establishing radiation stabilization. Radiation measurement of radiations.

**Packages of dehydrated products.** Orientation, metallization, co-extrusion of multilayer films, stretch, package forms and techniques. modified and controlled atmosphere packaging, skin, shrink and cling film packaging, micro-ovenable containers, other package forms and components of plastics.

**Packaging of Finished Goods:** Weighing, filling, scaling, wrapping, cartooning, labeling, marking and trapping.

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**III B.SC. CHEMISTRY PAPER VIII-E-2**

**SEMESTER – VI**

**CHEMICAL ASPECTS IN FOOD QUALITY & MANAGEMENT**

<b>S.No.</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	02	02	01
2.	UNIT-II	02	02	01
3.	UNIT-III	02	02	01
4.	UNIT-IV	02	02	-
Total no of Questions		08	08	03



**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM.**  
**III B.Sc. VI SEMESTER CHEMISTRY ELECTIVE – VIII E2**  
**VIII E2: CHEMICAL ASPECTS IN FOOD QUALITY AND PACKAGING**  
**MODEL QUESTION PAPER**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Marks: 50 M**

**SECTION - A**

**Note: Answer all question. All questions carry equal marks.**

**4x7 = 28 M**

- 1) Explain stages of quality control in food industry  
(or)
- 2) Write an account on ISO 9000 series
- 3) Explain the importance of food quality and safety  
(or)
- 4) Need, requirements and advantages of patent system
- 5) Write about methods of packaging and packaging equipment  
(or)
- 6) Explain the characteristics and functions of packaging material
- 7) What is the labelling of Packaging Material.  
(or)
- 8) What are the regulations while packaging materials?

**SECTION – B**

**Note: Answer any five questions.**

**4x4 = 16 M**

- 9) Marketing of food products
- 10) Write about consumer protection act
- 11) Effect of processing and storage
- 12) Write about packing marking regulation
- 13) Functions of packaging materials for different foods
- 14) Manufacture of packing materials
- 15) Food standards of fruit products
- 16) Write about Biodegradable packaging material

**SECTION – C**

**Note: Answer all questions.**

**3x2 = 6 M**

- 17) What is quality control
- 18) Patent law in India
- 19) Composite containers

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM,**  
**SYLLABUS FOR VI SEMESTER**  
**III B.Sc. CHEMISTRY ELECTIVE – VIII E3**  
**CHE – 128: FOOD ADULTERATION & FOOD ANALYSIS**

**MODULE – I FOOD ADULTERATION:**

- 1) Food adulteration
- 2) Common food adulterants of main food stuffs
- 3) Detection or microscopic examination adulterants in some common food stuffs
  - a) Cereals b) Pulses c) Beverages d) Milk e) Vegetable oils and fats, pure ghee, Sweets g) Spices and Condiments
- 4) Food Additives
- 5) Contamination of food stuffs
- 6) Sampling of can contents
- 7) Direct microscopic examination
- 8) Interpretation of Results

**MODULE – II QUALITATIVE FOOD ANALYSIS:**

Introduction – Qualitative analysis – Qualitative analysis of Carbon, Hydrogen, Halogens and Oxygen - Test for proteins, Colour test for proteins, Test for carbohydrates.

**MODULE – III QUANTITATIVE FOOD ANALYSIS –I:**

Determination of Moisture, Ash, Crude fat or ether-extract, Soluble extractor, Crude protein, True protein, Crude fiber, Starch, Analysis of Sugars (Carbohydrates), Estimation of Sucrose in a given sample of cane sugar, Estimation of Glucose and Sucrose in Cane Sugar- Estimation of Glucose and Sucrose in a given sample of Gur (iodometric method) Determination of Phosphorous in plant or food material, Destruction of organic matter, Important points,

**MODULE – IV QUANTITATIVE FOOD ANALYSIS –II:**

**Flame Photometry:** Determination of food materials by flame photometry- Pressure Regulators and flow meters-Flame source-Atomizers and Burners-Optical and Electronic system- photosensitive detectors-Flame photometers-Determination of calcium, Sodium, Potassium in foods.

**Atomic absorption spectrometer:** Principle, Instrumentation with Illustrations of Hollow cathode lamp, nebulizer, photo multiplier tube, interferences; Chemical & Ionization, Quantitative applications to minerals in Food Material such as High calcium foods, Iron rich foods etc.,

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**III B.SC. CHEMISTRY PAPER VIII-E-3**

**SEMESTER – VI**

**FOOD ADULTERATION & FOOD ANALYSIS**

<b>S.No</b>	<b>Chapter</b>	<b>Essay Question ( 07 M ) knowledge</b>	<b>Short Answer Question ( 04 M ) Under standing</b>	<b>Very Short Answer Question ( 02 M ) Skill / Application</b>
1.	UNIT-I	02	02	01
2.	UNIT-II	02	02	01
3.	UNIT-III	02	02	-
4.	UNIT-IV	02	02	01
Total no of Questions		08	08	03

**GOVERNMENT COLLEGE (A). RAJAMAHENDRAVARAM.**  
**SYLLABUS FOR VI SEMESTER**  
**III B.Sc. CHEMISTRY ELECTIVE – VIII E3**  
**P – VIII E3 FOOD ADULTERATION & FOOD ANALYSIS**

**Time: 2½ hr**

**Marks: 50 M**

**SECTION - A**

Answer all questions.

4x7 = 28 M

- 1) Explain the common detection methods of Food Adulterants  
(or)
- 2) Explain direct microscopic examination
- 3) Explain the qualitative determination of Carbon and halogens.  
(or)
- 4) Explain the following:
  - a) Test for Proteins
  - b) Test for Carbohydrates
- 5) Determination of Sodium and Potassium in Food Materials by flame photometry.  
(or)
- 6) Explain the following: a) Flame Sources b) Flame Photometers
- 7) Principle & Instrumentation of Atomic Absorption Spectrometer  
(or)
- 8) Determination of Calcium and Magnesium in Food Materials.

**SECTION – B**

**Answer any five questions**

**4x4 = 16 M**

- 9) Food Adulteration
- 10) Food Additives
- 11) Colour Test for Proteins
- 12) Test for Hydrogen
- 13) Estimation of Crude Fiber

- 14) Estimation of Sucrose
- 15) Gratings
- 16) Photocells

**SECTION – C**

**Answer all questions**

**3x2 = 6 M**

- 1) Adulteration of Milk.
- 2) Differentiate Crude Protein & True Protein.
- 3) Principle of Flame Photometry

## SYLLABUS FOR VI SEMESTER

CHEMISTRY LABORATORY COURSE – VIII-A-1/ VIII-B-1/ VIII-C-1/ VIII-D-1/ VIII-E-1

No. of h/w : 2

50 Marks

1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbituric Acid
10. Preparation of Phenyl azo  $\beta$ -naphthol

CHEMISTRY LABORATORY COURSE - VIII-A-1/ VIII-B-1/ VIII-C-1/ VIII-D-1/ VIII-E-1

(at the end of semester VI)

**Max. Marks:** 50

**Time:** 3 hrs.

**SCHEME OF VALUATION**

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35  
Marks

**Splitting of Practical Marks**

i) Procedure : 20 Marks

ii) Equation : 5 Marks

iii) M.P. : 5 Marks

iv) Report of yield : 5 Marks

## SYLLABUS FOR VI SEMESTER

### CHEMISTRY LABORATORY COURSE – VIII-A-2/ VIII-B-2/ VIII-C-2/ VIII-D-2/ VIII-E-2

No. of h/w : 2

50 Marks

1. Electrochemistry:

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

2. pH metry:

i) Preparation of phosphate buffer solutions.

ii) pH metric titration of weak acid, acetic acid with strong base, NaOH and calculation of dissociation constant.

3. Colorimetry:

i) Verification of Beer-Lambert law for  $\text{KMnO}_4$  and determination of concentration of the given solution.

ii) Verification of Beer-Lambert law for  $\text{K}_2\text{Cr}_2\text{O}_7$  and determination of concentration of the given solution.

iii) Verification of Beer-Lambert law for  $\text{CuSO}_4$  and determination of concentration of the given solution.

iv) Composition of complex of  $\text{Cu}^{2+}$ -EDTA disodium salt.



CHEMISTRY LABORATORY COURSE - **VIII-A-2/ VIII-B-2/ VIII-C-2/ VIII-D-2/ VIII-E-2**  
(at the end of semester VI)

**Max. Marks:** 50

**Time:** 3 hrs.

**SCHEME OF VALUATION**

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35

Marks

**Splitting of Practical Marks**

i) Procedure in first 10 min. : 5 Marks

ii) Formula with units : 5 Marks

iii) Neat tabulation & correct calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 % : 15 Marks

Error > 15 % : 10 Marks (Minimum Marks)

**SYLLABUS FOR VI SEMESTER**

CHEMISTRY LABORATORY COURSE – VIII-A-3/ VIII-B-3/ VIII-C-3/ VIII-D-3/  
VIII-E-3

**PROJECT WORK**

50 Marks

# **SKILL DEVELOPMENT COURSES**

**FOR I YEAR BA/B.COM/B.Sc. STUDENTS**

**Food Adulteration II Semester Syllabus**

**SKILL DEVELOPMENT COURSES**

Science Stream Syllabus of FOOD ADULTERATION

Total 30 hrs (02h/wk), 02 Credits & Max Marks: 50

Learning Outcomes:

After successful completion of the course, students will be able to:

1. Get basic knowledge on various foods and about adulteration.
2. Understand the adulteration of common foods and their adverse impact on health
3. Comprehend certain skills of detecting adulteration of common foods.
4. Be able to extend their knowledge to other kinds of adulteration, detection and remedies.
5. Know the basic laws and procedures regarding food adulteration and consumer protection.

SYLLABUS: UNIT-I – Common Foods and Adulteration: (07hrs)

Common Foods subjected to Adulteration - Adulteration – Definition – Types; Poisonous substances, Foreign matter, Cheap substitutes, Spoiled parts. Adulteration through Food Additives – Intentional and incidental. General Impact on Human Health.

UNIT-II –: Adulteration of Common Foods and Methods of Detection: (10hrs)

Means of Adulteration Methods of Detection Adulterants in the following Foods; Milk, Oil, Grain, Sugar, Spices and condiments, Processed food, Fruits and vegetables. Additives and Sweetening agents (at least three methods of detection for each food item).

UNIT-III –: Present Laws and Procedures on Adulteration: (08hrs)

Highlights of Food Safety and Standards Act 2006 (FSSA) – Food Safety and Standards Authority of India – Rules and Procedures of Local Authorities. Role of voluntary agencies such as, Agmark, I.S.I. Quality control laboratories of companies, Private testing laboratories, Quality control laboratories of consumer co-operatives. Consumer education,

Consumer's problems, rights and responsibilities, COPRA 2019 - Offenses and Penalties – Procedures to Complain – Compensation to Victims.

Recommended Co-curricular Activities (including Hands on Exercises): (05hrs)

1. Collection of information on adulteration of some common foods from local market
2. Demonstration of Adulteration detection methods for a minimum of 5 common foods (one method each)
3. Invited lecture/training by local expert
4. Visit to a related nearby laboratory
5. Assignments, Group discussion, Quiz etc. Reference e Books and Websites:
  1. A first course in Food Analysis – A.Y. Sathe, New Age International (P) Ltd., 1999
  2. Food Safety, case studies – Ramesh.V. Bhat, NIN, 1992
  3. [https://old.fssai.gov.in/Portals/0/Pdf/Draft\\_Manuals/Beverages and confectionary.pdf](https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/Beverages%20and%20confectionary.pdf)
  4. <https://cbseportal.com/project/Download-CBSE-XII-Chemistry-Project-FoodAdulteration#gsc.tab=0> (Downloadable e material on food adulteration)
  5. <https://www.fssai.gov.in/>
  6. <https://indianlegalsolution.com/laws-on-food-adulteration/>
  7. <https://fssai.gov.in/dart/>
  8. <https://byjus.com/biology/food-adulteration/>
  9. Wikipedia
  10. Vikaspedi

Recommended MODEL QUESTION PAPER FORMAT  
Max. Marks: 50 Time: 1½ hrs (90 Minutes)

SECTION- A (4x5M=20 Marks)

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

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

SECTION B (3x10M = 30 Marks)

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

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

MODEL QUESTION PAPER

Max. Marks: 50 Time: 1½ hrs (90 Minutes)

SECTION- A (4x5M=20 Marks)

Answer any four questions. Each answer carries 5 marks

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

1. Define food adulteration?
2. Explain the adulteration through Food Additives
3. Name few cheap substitutes used in food adulteration
4. Give examples for food additives and sweetening agents
5. Write a short notes on processed food
6. Explain the procedures to complain about the food adulteration
7. Name the laws that governs the food adulteration
8. Explain the procedure to get compensation to the victims of food adulteration

SECTION B (3x10M = 30 Marks)

Answer any three questions. Each answer carries 10 marks

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

9. Write an essay on the common Foods which are subjected to Adulteration and explain the types poisonous substances added for food adulteration
10. Describe the highlights of Food Safety and Standards Act 2006 (FSSAI)
11. Explain the food testing and standardized testing methods and protocols
12. Write in detail about the general Impact of food adulteration on Human Health
13. Write an essay on different types of offenses of food adulteration and the penalties imposed

**GOVERNMENT COLLEGE (A)  
RAJAMAHENDRAVARAM**

*(Accredited by NAAC "A+" Grade, CGPA 3.38/4.0, RAF 2017)*

**UG BOARD OF STUDIES 2021 - 22**



**DEPARTMENT OF CHEMISTRY  
For the Academic Year 2021-22**

**B.Sc., (HONOURS) CHEMISTRY**

On 17<sup>th</sup> Sep, 2021

**Curriculum for the Academic Year 2021-22**



**FIRST YEAR  
SEMESTER-I  
B.Sc. (Honours)  
CHEMISTRY**



## Course Structure (Chemistry-Major)

Details of courses under B.Sc. (Honours)

Course	Theory+ Practical	Credits
<b>I. Core Course Theory</b>		
<b>(14 Papers)</b>		14×4=56
Core Course Practical		
<b>(14 Papers)</b>		14×2=28
	Total:	84
<b>II. Elective</b>		
<b>Course (8 Papers)</b>		
Discipline Specific Elective (DSE) Theory		
<b>(4 Papers)</b>		4×4=16
Discipline Specific Elective (DSE) Practical		
<b>(4 Papers)</b>		4×2=8
Generic Elective (GE)/ Interdisciplinary Theory		
<b>(4 Papers)</b>		4×4=16
		4×5=20
Generic Elective (GE) Practical/Tutorial*		
<b>(4 Papers)</b>		4×2=8
		4×1=4
	Total:	48
<b>Optional Dissertation or project work in place of one Discipline Specific Elective Paper. (6 credits) in 6<sup>th</sup> Semester</b>		
<b>III. Ability Enhancement</b>		
<b>Courses (4 Papers)</b>		
1. Ability Enhancement Compulsory		
<b>(2 Papers of 2 credits each)</b>		
Environmental Science		
English/MIL Communication		2×2=4
2. Ability Enhancement Elective (Skill Based)		
<b>(2 Papers of 2 credits each)</b>		
(Minimum 2)		2×2=4
	<b>Total:08</b>	

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**Total credit : 140**

**\* Wherever there is a practical there will be no tutorial and vice-versa**

SEMESTER	COURSE OPTED	COURSE NAME	Credits
I	AEC-I Compulsory	English Communications/ Environmental Science	2
	Core Course-I	Inorganic Chemistry-I	4
	Core Course-I Practical	Inorganic Chemistry-I Lab	2
	Core Course-II	Physical Chemistry-I	4
	Core Course-II Practical	Physical Chemistry-I Lab	2
	Generic Elective -1 GE-1		4/5
	Generic Elective -1 Practical/Tutorial		2/1
II	AEC-II Compulsory	Environmental Science English Communications	2
	Core Course-III	Organic Chemistry-I	4
	Core Course-III Practical	Organic Chemistry-I Lab	2
	Core Course-IV	Physical Chemistry-II	4
	Core Course-IV Practical	Physical Chemistry-II Lab	2
	Generic Elective -2 GE-2		4/5
	Generic Elective -2 Practical/Tutorial		2/1
III	Core Course-V	Inorganic Chemistry-II	4
	Core Course-V Practical	Inorganic Chemistry-II Lab	2
	Core Course-VI	Organic Chemistry-II	4
	Core Course-VI Practical	Organic Chemistry-II Lab	2
	Core Course-VII	Physical Chemistry-III	4
	Core Course-VII Practical	Physical Chemistry-III Lab	2
	Skill Enhancement Course -1 SEC-1		2
Generic Elective -3	GE-3	4/5	
Generic Elective -3	Practical/Tutorial	2/1	
IV	Core Course-VIII	Inorganic Chemistry-III	4
	Course-VIII Practical	Inorganic Chemistry-III Lab	2
	Core Course-IX	Organic Chemistry-III	4
	Course-IX Practical	Organic Chemistry-III Lab	2

	Core Course-X	Physical Chemistry-IV	4
	Course-X Practical	Physical Chemistry-IV Lab	2
	Skill Enhancement Course -2	SEC -2	2
	Generic Elective -4	GE-4	4/5
	Generic Elective -4	Practical	2/1
<hr/>			
V	Core Course-XI	Organic Chemistry-IV	4
	Core Course-XI Practical	Organic Chemistry-IV Lab	2
	Core Course-XII	Physical Chemistry-V	4
	Core Course-XII Practical	Physical Chemistry-V Lab	2
	Discipline Specific Elective -1	DSE-1	4
	Discipline Specific Elective -1	Practical/Tutorial	
		DSE-1 Lab	2
	Discipline Specific Elective -2	DSE-2	4
	Discipline Specific Elective- 2	Practical/Tutorial	
		DSE-2 Lab	2
<hr/>			
VI	Core Course-XIII	Inorganic Chemistry-IV	4
	Core Course-XIII Practical	Inorganic Chemistry-IV Lab	2
	Core Course-XIV	Organic Chemistry-V	4
	Core Course-XIV Practical	Organic Chemistry-V Lab	2
	Discipline Specific Elective -3	DSE-3 Discipline	4
	Specific Elective -3	Practical/Tutorial DSE-3 Lab	
			2
	Discipline Specific Elective-4	DSE-4 Discipline	4
	Specific Elective -4	Practical/Tutorial DSE-4 Lab	
			2
<hr/>			
Total	Credits		140

**Core Papers (C): (Credit: 06 each)**

**(4 Lectures/week for Theory and 4 Periods/week for practical)**

- |                                   |  |
|-----------------------------------|--|
| 1. Inorganic Chemistry I:         | Atomic Structure & Chemical Bonding (4 + 4)          |
| 2. Physical Chemistry I:          | States of Matter & Ionic Equilibrium (4 + 4)         |
| 3. Organic Chemistry I:           | Basics and Hydrocarbons (4 + 4)                      |
| 4. Physical Chemistry II:         | Chemical Thermodynamics and its Applications (4 + 4) |
| 5. Inorganic Chemistry II:        | s- and p-Block Elements (4 + 4)                      |
| 6. Organic Chemistry II:          | Oxygen Containing Functional Groups (4 + 4)          |
| 7. Physical Chemistry III:        | Phase Equilibria and Electrochemical Cells (4 + 4)   |
| 8. Inorganic Chemistry III:       | Coordination Chemistry (4 + 4)                       |
| 9. Organic Chemistry III:         | Heterocyclic Chemistry (4 + 4)                       |
| 10. Physical Chemistry IV:        | Conductance & Chemical Kinetics                      |
| (4 + 4) 11. Organic Chemistry IV: | Biomolecules (4 + 4)                                 |
| 12. Physical Chemistry V:         | Quantum Chemistry & Spectroscopy (4                  |
| + 4) 13. Inorganic Chemistry IV:  | Organometallic Chemistry (4 + 4)                     |
| 14. Organic Chemistry V:          | Spectroscopy (4 + 4)                                 |

Discipline Specific Elective Papers: (Credit: 06 each) (4 papers to be selected)- DSE 1-4

**DSE 1: Any one of the following**

1. Novel Inorganic Solids (4) + Lab (4)
2. Inorganic Materials of Industrial Importance (4) + Lab (4)

DSE 2-4: Choose any three of the following

1. Applications of Computers in Chemistry (4) + Lab (4)
2. Analytical Methods in Chemistry (4) + Lab (4)
3. Molecular Modelling & Drug Design (4) + Lab (4)
4. Polymer Chemistry (4) + Lab (4)
5. Research Methodology for Chemistry (5) + Tutorials (1)
6. Green Chemistry (4) + Lab (4)
7. Industrial Chemicals & Environment (4) + Lab (4)
8. Instrumental Methods of Analysis (4) + Lab (4)
9. Dissertation

Other Discipline (Four papers of any one discipline)- GE 1 to GE 4

1. Mathematics (5) + Tut (1)
2. Physics (4) + Lab (4)
3. Economics (5) + Tut (1)
4. Computer Science (4) + Lab (4)
5. Botany (4) + Lab (4)

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each)- SEC1 to SEC4  
(Emphasis should be given to Hands on Exercises) (Hands on except for papers 3, 5 and 6)

1. IT Skills for Chemists
2. Basic Analytical Chemistry
3. Chemical Technology & Society
4. Chemoinformatics
5. Business Skills for Chemists
6. Intellectual Property Rights
7. Analytical Clinical Biochemistry
8. Green Methods in Chemistry
9. Pharmaceutical Chemistry
10. Chemistry of Cosmetics & Perfumes
11. Pesticide Chemistry
12. Fuel Chemistry

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**Generic Elective Papers (GE) (Minor-Chemistry) (any four)  
for other Departments/Disciplines: (Credit: 06 each)**

1. Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (4) + Lab (4)
2. Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (4) + Lab (4)
3. Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (4) + Lab (4)
4. Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (4) + Lab (4).
5. Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (4) + Lab (4)
6. Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (4) + Lab (4)
7. Molecules of life (4) + Lab (4).

**Discipline (Two Mathematics papers compulsory, two papers of one other discipline may be selected)- GE 1 to GE**

## **B.Sc., HONOURS Chemistry Course Theory Papers**

S.No	Semester	Paper	Title of the Paper
1.	I	I	Inorganic Chemistry
2.	I	II	Physical Chemistry
3.	I	GE – 1	Mathamatics / Botany
4.	I	AEC-1	English Communications
5.	II	III	Organic Chemistry
6.	II	IV	Physical Chemistry
7.	II	GE-2	Mathamatics / Botany
8.	II	AEC-2	English Communications
9	III	V	Inorganic chemistry
10	III	VI	Organic Chemistry
11	III	VII	Physical Chemistry
12	III	GE-3	Mathamatics / Botany
13	III	SEC-1	Skill enhancement course – 1
14	IV	VIII	Inorganic chemistry
15	IV	IX	Organic Chemistry
16	IV	X	Physical Chemistry
17	IV	GE-4	Mathamatics / Botany
18	IV	SEC-2	Skill enhancement course – 2
19	V	XI	Organic Chemistry
20	V	XII	Physical Chemistry
21	V	DSE – 1	Inorganic materials of Industrial importance
22	V	DSE – 2	Analytical Methods in Chemistry
23	VI	XIII	Inorganic Chemistry
24	VI	XIV	Organic Chemistry
25	VI	DSE-3	Polymer Chemistry
26	VI	DSE-4	Industrial Chemicals and Environment



SEMESTER I

**CHEMISTRY - IA: INORGANIC CHEMISTRY- I**

(Credits: Theory-04, Practicals-02)

**Theory: 60 Lectures**

**Atomic Structure:**

Recapitulation of Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance.

Schrödinger's wave equation, significance of  $\psi$  and  $\psi^2$ . Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, aufbau principle and its limitations.

(14 Lectures)

**Periodicity of Elements:**

Brief discussion of the following properties of the elements, with reference to s & p-block and the trends shown:

- (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
- (b) Atomic and ionic radii
- (c) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization enthalpy and trends in groups and periods.
- (d) Electron gain enthalpy and trends in groups and periods.
- (e) Electronegativity, Pauling's/ Allred Rochow's scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity.

(16 Lectures)

### Chemical Bonding:

- (i) Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Haber cycle and its application, Solvation energy.
- (ii) Covalent bond: Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule,

Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules  $N_2$ ,  $O_2$ ,  $C_2$ ,  $B_2$ ,  $F_2$ ,  $CO$ ,  $NO$ , and their ions;  $HCl$  (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of the following simple molecules and ions containing lone pairs and bond pairs of electrons:  $H_2O$ ,  $NH_3$ ,  $PCl_3$ ,  $PCl_5$ ,  $SF_6$ ,  $ClF_3$ ,  $I_3^-$ ,  $BrF_2^+$ ,  $PCl_6^-$ ,  $ICl_2^-$ ,  $ICl_4^-$  and  $SO_4^{2-}$ .

Multiple bonding ( $\sigma$  and  $\pi$  bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

- (iii) Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.
- (iv) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction. Hydrogen bonding (theories of hydrogen bonding, valence bond treatment). Effects of weak chemical forces, melting and boiling points, solubility, energetics of dissolution process.

(30 Lectures)

### Reference Books:

- Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010
- Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.
- Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
- Shriver, D.D. & P. Atkins, Inorganic Chemistry 2 nd Ed., Oxford University Press, 1994.
- Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.

**I B.SC.(HONOURS) CHEMISTRY II SEMESTER**

**BLUE PRINT FROM 2019-20 ONWARDS**

**PAPER-IA: INORGANIC CHEMISTRY-I**

Sl. NO.	Chapter	Essay Question (7M) knowledge	Short Answer Question (4 M) Under standing	Very Short Answer Question (2 M) Skill / Application
1.	<b>UNIT-I: ATOMIC STRUCTURE</b>	02	02	01
2.	<b>UNIT-II: PERIODICITY OF ELEMENTS</b>	02	02	-
3.	<b>UNIT-III: CHEMICAL BONDING -I</b>	02	02	01
4.	<b>UNIT-IV: CHEMICAL BONDING -II</b>	02	02	01
<b>Total no.of Questions</b>		08	08	03

**I B.Sc. CHEMISTRY (Hons) SEMESTER -I**  
**MODEL QUESTION PAPER FROM 2019-20 ONWARDS**  
**PAPER-IA: INORGANIC CHEMISTRY-I**

TIME: 2 ½ Hrs

MARKS: 50 M

**PART -A**

Answer **ALL** the Questions

(4x7 = 28 M)

1. Derive Schrodinger's wave equation. Explain significance of  $\psi$  and  $\psi^2$ ?  
(OR)
2. What are the postulates of Bohr's theory? Discuss the importance of this model to Explain atomic spectrum of hydrogen atom?
3. How do the following properties change in group and period? Explain with example  
1. Ionization energy 2. Electron gain enthalpy 3. Atomic radius  
(OR)
4. Define IE1 and IE2. Why is  $IE_2 > IE_1$  for a given atom? Discuss factors that affect ionization potential of an element.
5. What is lattice energy? Write about Born-Haber cycle. Calculate lattice energy of NaCl crystal from the following data by the use of born Haber cycle.  
Sublimation energy (S) = 108.7 kJ mol<sup>-1</sup>  
Dissociation energy for Cl<sub>2</sub> = 22.59 kJ mol<sup>-1</sup>  
Ionization energy of Na (g) = 489.5 kJ mol<sup>-1</sup>  
Electron affinity for Cl (g) = - 351.4 kJ mol<sup>-1</sup>  
Heat of formation of NaCl ( $\Delta H_f$ ) = - 414.2 kJ mol<sup>-1</sup>  
(OR)
6. How do you explain the geometry of the molecules CH<sub>4</sub>, PCl<sub>5</sub> on the basis of valence bond theory?
7. What is LCAO method? Explain the molecular orbital diagrams of molecules a) O<sub>2</sub> b) N<sub>2</sub>. Calculate the respective bond order. Write magnetic nature of N<sub>2</sub> and O<sub>2</sub> molecules?  
(OR)
8. What is polarizing power and polarizability? State Fajan's rules and write applications of Fajan's rules?

**PART - B**

Answer any **FOUR** Questions

(4x4= 16 M)

9. Describe different types of defects in crystals.
10. Write a note about photoelectric effect.
11. Explain Slater rules?
12. Explain structure of NH<sub>3</sub> on VSEPR?
13. Write rules for writing Lewis's structure?

14. Write Quantum Numbers and their significance.
15. Mention factors affecting Ionization enthalpy.
16. What are semiconductors and insulators? Give one example for each.

**PART – C**

Answer **ALL** Questions

**(3x2= 6 M)**

17. What is Compton affect?
18. What is solvation energy?
19. Differentiate Polarizing power and Polarizability.

**B.Sc. FIRST YEAR CHEMISTRY(HONOURS), I SEMESTER**

**PRACTICAL COURSE FROM 2019-20 ONWARDS**

**PAPER-IA: INORGANIC CHEMISTRY-I**

**PRACTICAL PAPER-I**

**ANALYSIS OF MIXTURE SALT**

Time: 45 Hours (3 Hrs/Wk)

**SYLLABUS FOR QUALITATIVE INORGANIC ANALYSIS**

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

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

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

**SCHEME OF VALUATION**

Time: 3 Hours

Total: 50 marks

**Scheme for External Examination**

1) Record: 10 Marks

2) Practical: 40 Marks

**Systematic Procedure Should Be Adopted:**

**Breakup of marks:**

**Part-A: Preliminary Tests**

- |                          |   |
|--------------------------|---|
| 1. Colour and Appearance | 2 |
| 2. Solubility            | 2 |
| 3. Flame Test            | 2 |
| 4. Action of Heat        | 2 |

**Part-B: Test for Each Anion -** 4

Two Anions- 2 x 4=8

**Breakup of 4 Marks For Each Anion**

Dry Test with Acids - 2

Conformation Test with Extract - 2

Carbonate Extract Preparation 2

Elimination of Interfering Anion 3

**Part-C:** Test for Each Cation - 5

Two Cations 2x5=10

**Breakup of 5 Marks For Each Cation**

Identification of Correct Group  
In Separation - 1

Colour of the Precipitate - 1

Group Separation - 1

Conformation Test in The Group- 2

**For Ammonium Cation:**

Dry Test with Sodium Hydroxide- 2

Conformation Test with Nessler's Reagent - 3

**Part -D:** Report - 4

For Two Cations - 2

For Two Anions - 2

**Viva-voce** - 5

**TOTAL MARKS: 50 M**

## **CHEMISTRY - IB: PHYSICAL CHEMISTRY-I**

**(Credits: Theory-04, Practicals-02)**

### **Theory: 60 Lectures**

**Gaseous state:** Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom. Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor,  $Z$ , and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

**(18 Lectures)**

**Liquid state:** Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.

**(6 Lectures)**

**Solid state:** Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl.

**(16 Lectures)**

**Ionic equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; Buffer solutions; derivation of



Henderson equation and its applications. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid– base indicators; selection of indicators and their limitations.

**(20 Lectures)**

***Reference Books:***

- Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 13 (2006).
- Ball, D. W. Physical Chemistry Thomson Press, India (2007).
- Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
- Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

**I B.SC.(HONOURS) CHEMISTRY I SEMESTER**

**BLUE PRINT FROM 2019-20 ONWARDS**

**PAPER-IB: PHYSICAL CHEMISTRY-I**

Sl. NO.	Chapter	Essay Question (7M) knowledge	Short Answer Question (4 M) Under standing	Very Short Answer Question (2 M) Skill / Application
1.	<b>UNIT-I:</b> GASEOUS STATE	02	02	01
2.	<b>UNIT-II:</b> LIQUID STATE	02	02	-
3.	<b>UNIT-III:</b> SOLID STATE	02	02	01
4.	<b>UNIT-IV:</b> IONIC EQUILIBRIA	02	02	01
<b>Total no.of Questions</b>		08	08	03

**I B.SC. CHEMISTRY (HONOURS) SEMESTER - I**

**MODEL QUESTION PAPER FOR PAPER-IB**

**(PHYSICAL CHEMISTRY-I)**

**PART- A**

Time: 2 ½ Hrs

Marks: 50 Marks

Answer **ALL** Questions

(4 X 7 = 28M)

1. Write the postulates and derivation of Kinetic Theory of Gases.  
(OR)
2. Explain the relation between Critical constants and Vander Waals constants.
3. Explain the determination and Temperature variation of Viscosity of Liquids.  
(OR)
4. What is Surface Tension? Mention any one method for the determination of Surface Tension of Liquids.
5. a) Write about Miller Indices.  
b) Determine the Miller Indices for a Plane when the intercepts along the axes are 2a, 3b and 2c.  
(OR)
6. Write a simple account of Rotating Crystal Method and Powder Pattern Method.
7. What is degree of ionization? Explain the factors affecting the degree of ionization.  
(OR)
8. What is acid-base indicators? Explain any one theory of acid-base indicators.

**PART- B**

Answer any **Four** Questions

(4 X 4 = 16M)

9. Write about Mean Free Path.
10. Derive law of corresponding states.
11. Explain cleansing action of detergents.
12. Write about any two symmetry elements.
13. Derive Bragg's equation.
14. What is common ion effect? Give one example.
15. Mention any two applications of solubility product.
16. Explain types of salt hydrolysis.

**PART- C**

Answer **ALL** Questions

(3 X 2 = 6M)

- 17 What is compressibility Factor?
- 18 What are Bravais lattices?
- 19 What is Buffer solution? Give one example.

**Practical – I B PHYSICAL CHEMISTRY-I LAB:**

**45 hrs (3h/w)**

**1. Surface tension measurements using stalagmometer.**

a. Determine the surface tension by

(i) drop number

(ii) drop weight method.

b. Study the variation of surface tension with different concentration of detergent

solutions. Determine CMC.

**2. Viscosity measurement using Ostwald's viscometer.**

a. Determination of co-efficient of viscosity of an unknown aqueous solution.

b. Study the variation of co-efficient of viscosity with different concentration of Poly

Vinyl Alcohol (PVA) and determine molar of PVA.

c. Study the variation of viscosity with different concentration of sugar solutions.

**Reference Books:**

- Atkins, P.W. & Paula, J.de Atkins Physical chemistry Ed., Oxford University Press 13 (2006)
- Ball, D. W. Physical chemistry Thomson Press, India (2007).
- Castellan, G. W. Physical Chemistry 4<sup>th</sup> Ed. Narosa (2004).
- Mortimer, R. G. Physical Chemistry 3<sup>rd</sup> Ed. Elsevier: NOIDA, UP (2009).

**I B.Sc. CHEMISTRY (HONOURS) COURSE**  
**SCHEME OF VALUATION FOR PRACTICALS**  
**SEMESTER-I PRACTICAL-IB**  
**PHYSICAL CHEMISTRY PRACTICALS-I**

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

**Splitting of Practical Marks:**

- i) Procedure in first 10 min.: 5 Marks
- ii) Formula with units: 5 Marks
- iii) Neat tabulation & correct calculation: 5 Marks

Error < 10%: 20 Marks

Error 10-15 %: 15 Marks

Error > 15 %: 10 Marks (Minimum Marks)

# **FIRST YEAR SEMESTER-II**

## SEMESTER II

### **CHEMISTRY - IIA: ORGANIC CHEMISTRY I**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

#### **Recapitulation of basics of Organic Chemistry**

Hybridization, Shapes of molecules

*Electronic Displacements:* Inductive, electromeric, resonance and mesomeric effects, hyperconjugation Dipole moment; Hydrogen bonding (Applications to be discussed with relevant topics)

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Types, shape and relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions: Addition, Elimination and Substitution reactions.

**(6 Lectures)**

#### **Stereochemistry:**

Fischer, Newmann and Sawhorse Projection formulae and their interconversions;

Geometrical isomerism: cis-trans, syn-anti and E/Z notations with C.I.P rules.

*Optical Isomerism:* Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and their resolution. Relative and absolute configuration: D/L and R/S designations.

**(18 Lectures)**

#### **Chemistry of Aliphatic Hydrocarbons**

##### **A. Carbon-Carbon sigma bonds**

General methods of preparation, physical and chemical properties of alkanes: Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

##### **B. Carbon-Carbon pi bonds:**

General methods of preparation, physical and chemical properties of alkenes and alkynes, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration- oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation(oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

### C. Cycloalkanes and Conformational Analysis

Conformational analysis of alkanes: Relative stability and Energy diagrams. Types of cycloalkanes and their relative stability, Baeyer strain theory: Chair, Boat and Twist boat forms of cyclohexane with energy diagrams; Relative stability of mono substituted cycloalkanes.

(24 Lectures)

### Aromatic Hydrocarbons Aromaticity:

Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

(12 Lectures)

### Reference Books:

- Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
- Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.



**I B.SC.(HONOURS) CHEMISTRY II SEMESTER**

**BLUE PRINT FROM 2019-20 ONWARDS**

**PAPER-IIA: ORGANIC CHEMISTRY- I**

Sl. NO.	Chapter	Essay Question (7M) knowledge	Short Answer Question (4 M) Under standing	Very Short Answer Question (2 M) Skill / Application
1.	<b>UNIT-I:</b> BASICS OF ORGANIC CHEMISTRY & SATURATED HYDROCARBONS	02	02	---
2.	<b>UNIT-II:</b> CHEMISTRY OF UNSATURATED HYDROCARBONS	02	02	01
3.	<b>UNIT-III:</b> STEREO CHEMISTRY	02	02	01
4.	<b>UNIT-IV:</b> CHEMISTRY OF ACYCLIC AND AROMATIC HYDROCARBONS	02	02	01
<b>Total no of Questions</b>		08	08	03

**I B.SC.(HONOURS) CHEMISTRY II SEMESTER**  
**MODEL QUESTION PAPER FROM 2019-20 ONWARDS**

**PAPER-IIA: ORGANIC CHEMISTRY-I**

**SECTION - A**

**Time: 2 ½ hrs**

**Marks: 50 M**

Answer **ALL** Questions

**( 4 X 7 = 28 M)**

1. Describe different types of organic reactions with suitable examples.  
(OR)
2. What is Inductive effect? How it explains the acidity of different carboxylic acids and basicity of amines.
3. Describe different types of Elimination reactions (E1, E2, E1cb) with mechanism.  
(OR)
4. a) Write the classification of Dienes. Write a note on 1,2 and 1,4 addition reaction in conjugated Dienes.  
b) Diels – Alder reaction.
5. Explain Geometrical and Optical Isomerism.  
(OR)
6. Explain Racemic mixture and Resolution.
7. Write any two methods of preparation of Cycloalkanes and explain Bayer's strain theory.  
(OR)
8. Explain the mechanism of the following reactions in Benzene ring.  
a) Nitration b) Friedel-crafts alkylation c) Friedel-crafts acylation

**SECTION – B**

Answer any **FOUR** questions.

**(4x4 = 16 M)**

9. What is hyper conjugation? Give one application.
10. Write wurtz and wurtz-fittig reactions
11. Write the reactions of alkenes with the following reagents: a) HBr b) HBr in presence of peroxide.
12. Write about Hydroboration and Ozonolysis.
13. What are Enantiomers and Diastereomers? Give examples.
14. Write relative and absolute configuration.

15. Write about conformational analysis of cycloalkane and draw the energy diagram of cyclohexene.
16. What is Aromaticity? Write the aromatic character of Arenes with suitable examples.

**SECTION – C**

Answer **ALL** questions.

**(3x2 = 6M)**

17. Define Carbenes. Give one example.
18. Explain acidity of Acetylenic Hydrogen.
19. Define ortho and para directing groups with suitable examples

**I B.Sc. CHEMISTRY(HONOURS),**  
**II SEMESTER PRACTICAL COURSE SYLLABUS FROM 2019-20 ONWARDS**  
**PRACTICAL PAPER – IIA (ORGANIC CHEMISTRY-I)**

60 Hrs. (3 H / W)

**I. Organic Qualitative Analysis:**

i) Identification of an organic compound through the functional group analysis, determination of melting point/ boiling point and preparation of suitable derivatives.

Carboxylic acids, Phenols, Aldehydes, Ketones, Aromatic  
Primary Amines, Amides and Simple sugars.

**I B.Sc. CHEMISTRY(HONOURS), II SEMESTER**  
**LABORATORY COURSE – IIA: ORGANIC CHEMISTRY – I**

**SCHEME OF VALUATION**

**Total – 50 Marks**

**Record – 10 Marks**

**Practical – 40 Marks**

**Break up of Practical – I (40 Marks)**

Identification of function group of an organic compound (Systematic procedure should be adopted).

❖ Colour	-	1 Marks
❖ Physical State	-	1 Marks
❖ Odour	-	1 Marks
❖ MP / BP	-	2 Marks
❖ Ignition Test	-	2 Marks
❖ Litmus Test	-	2 Marks
❖ Solubility & Classification basing on solubility data	-	5 Marks
❖ Detection of extra elements	-	4 Marks (2 Marks for extract)
❖ Unsaturation Test (with bromine water and Bayer's Test)	-	4 Marks
❖ Identification of functional group	-	5 Marks
❖ Confirmatory test for function group (1test)	-	5 Marks
❖ Anyone derivative of the organic compound	-	4 Marks (1 x 4)
Report	-	4 Marks
<b>Total Marks</b>	-	<b>40 Marks</b>

**SYLLABUS FOR B.Sc., FIRST YEAR CHEMISTRY (HONOURS)**

**FROM 2019-20 ONWARDS**

**PAPER-IIB**

**PHYSICAL CHEMISTRY – II**

**SEMESTER-II**

**COURSE CODE : CHH102 60HRS(4Hrs/W)**

**Unit – II**

**PHASE EQUILIBRIA:**

Concept of phases, components and degree of freedom, derivation of Gibbs Phase Rule for Non- reactive and reactive systems; Clausius –Clapeyron equation and its applications to solid-liquid, liquid – vapour and solid – vapour equilibria, phase diagram for one component systems with applications.

Phase diagram for systems of solid – liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions.

**(16 lectures)**

**UNIT – II**

**CHEMICAL KINETICS**

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

**(18 Lectures)**

**UNIT – III**

**SURFACE CHEMISTRY**

Adsorption: Physical adsorption, chemisorption, adsorption isotherms, Nature of adsorbed state.

**CATALYSIS:** Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces. Enzyme catalysis. Michaelis – Menten mechanism, acid-base catalysis.

**(12 lectures)**

**UNIT – IV**

**VOLUMETRIC ANALYSIS**

Definition: Titrimetry, Volumetric titrimetry, Gravimetric titrimetry, The equivalence point and End point.

Classification of Volumetric methods.

Principles – Acid – base titration – Redox titrations – Complexometric titrations – Precipitation titrations – Non aqueous solutions (Introduction only)

Types of Errors: Accuracy and Precision, Absolute and relative uncertainty, Gaussian distribution, mean and standard deviation, confidence intervals, significant figures.

**(14 Lectures)**

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**FROM 2019-20 ONWARDS**  
**PAPER-IIB      PHYSICAL CHEMISTRY – II      SEMESTER-II**

<b>S.No.</b>	<b>Chapter</b>	<b>Essay questions (7 M) Knowledge/ skill</b>	<b>Short answer question(4M) Understanding</b>	<b>Very short answer questions(2M) Applications</b>
<b>1</b>	<b>Unit-I: Phase Equilibria</b>	<b>02</b>	<b>02</b>	<b>-</b>
<b>2</b>	<b>Unit-II: Chemical Kinetics</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>3</b>	<b>Unit-III: Surface Chemistry &amp; Catalysis</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>4</b>	<b>Unit-IV: Volumetrical Analysis</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>



**B.Sc., FIRST YEAR CHEMISTRY (HONOURS) SEMESTER-II**

**MODEL QUESTION PAPER FOR PAPER-IIB**

**(wef 2019-20 onwards)**

**PAPER-IIB - PHYSICAL CHEMISTRY – II**

**Time: 2 ½ hrs**

**Marks: 50 M**

**PART-A**

Answer **ALL** Questions

**(4 X 7 = 28 M)**

1. Derive the Clausius-Clapeyron equation and write the one application of liquid-vapour.

**(OR)**

2. What is incongruent melting point? Explain the system of solid-liquid (NaCl-H) equilibria along with phase diagram.

3. What is rate of reaction? Derive the equation of second order reaction having same type of reactants.

**(OR)**

4. Write about simple collision theory of gaseous reactions.

5. What is adsorption isotherms? And derive the Langmuir adsorption isotherm.

**(OR)**

6. Derive the Michaelis-Menten equation.

7. Explain different types of Errors.

**(OR)**

8. Define complexometric titration and explain the method of complexometric titration by giving one's example.

**PART-B**

Answer any **FOUR** Questions

**(4 x 4 =16 M)**

9. Define congruent and incongruent melting point.

10. Derivation of Gibb's phase rule for reacting system.

11. Derive the equation of zero order reaction.

12. Derivation of Arrhenius equation.

13. Derive the equation of Freundlich Adsorption isotherm.

14. What is selectivity and specificity catalyst with one example each.

15. Explain Accuracy and Precision
16. Derive the Gaussian distribution law.

**PART-C**

Answer **ALL** Questions

**3 X 2 = 6 M**

17. Write the effect of temperature on rate of reaction.
18. What is adsorption, adsorbate and adsorbent?
19. What is Redox titration and give one example.

**I B.Sc. CHEMISTRY (HONOURS) II SEMESTER**  
**COURSE PRACTICAL PAPER –IIB FROM 2019-20**  
**ONWARDS LABORATORY COURSE –IIB**  
**SYLLABUS FOR PHYSICAL CHEMISTRY PRACTICAL -II:**  
**QUANTITATIVE ANALYSIS**

60 Hrs (3Hrs/W)

- 1) Estimation of Acetic acid in Vinegar sample using standard HCl solution
- 2) Estimation of Fe(II) using  $\text{KMnO}_4$  with Oxalic acid As primary standard.
- 3) Estimation of Fe(II) using  $\text{K}_2\text{Cr}_2\text{O}_7$ .
- 4) Estimation of Ca using EDTA.
- 5) Estimation of Mg using EDTA.
- 6) Determination of hardness of water.
- 7) Nickel dimethyl glyoxime – Gravimetric Analysis

*Reference Books:*

- Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.

**I B.Sc. CHEMISTRY (HONOURS) II SEMESTER LABORATORY COURSE**

**PRACTICAL PAPER –IIB FROM 2019-20 ONWARDS**

**PRACTICAL -IIB: QUANTITATIVE ANALYSIS**

**SCHEME OF VALUATION**

**Max.Marks: 50 Marks**

**Time: 3 Hrs**

1) For Record	10 Marks
2) For Practical	40 Marks

**Splitting of Practical Marks:**

i)	Procedure in 10 min	:	5 Marks
ii)	Formula with units	:	5 Marks
iii)	Neat tabulation	:	5 Marks
iv)	Correct calculation	:	5 Marks

Error < 10 %	20 Marks
Error 10-15 %	15 Marks
Error > 15 %	10 Marks (Minimum Marks)

**Total Marks - 50M**

# **SECOND YEAR SEMESTER-III**

## SEMESTER-III

### **CHEMISTRY – IIIA: INORGANIC CHEMISTRY II**

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

#### **UNIT-I: GENERAL PRINCIPLES OF METALLURGY & s BLOCK ELEMENTS:**

Chief modes of occurrence of metals based on standard electrode potentials.

Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent.

Electrolytic Reduction, Hydrometallurgy with reference to cyanide process for silver and gold. Methods of purification of metals: Electrolytic process, van Arkel-de Boer process and Mond's process, Zone refining.

Chemistry of s Block Elements:

- i) General characteristics: melting point, flame colour, reducing nature, diagonal relationships and anomalous behaviour of first member of each group.
- ii) Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water

(15 Lectures)

#### **UNIT-II: REACTIONS OF ALKALI AND ALKALINE EARTH METALS**

- (i) Common features such as ease of formation, thermal stability and solubility of the following alkali and alkaline earth metal compounds: hydrides, oxides, peroxides, superoxides, carbonates, nitrates, sulphates.
- ii) Complex formation tendency of s-block elements; structure of the following complexes: crown ethers and cryptates of Group I; basic beryllium acetate, beryllium nitrate, EDTA complexes of calcium and magnesium.
- iii) Solutions of alkali metals in liquid ammonia and their properties.

(15 Lectures)

#### **UNIT-III: CHEMISTRY OF P BLOCK ELEMENTS**

Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, electronegativity, Allotropy of C, P, S;

inert pair effect, diagonal relationship between B and Si and anomalous behaviour of first member of each group.

Acidic/Basic Nature, Stability, Ionic/Covalent Nature, Oxidation/Reduction, Hydrolysis,

Action of Heat of the following:

- Hydrides: hydrides of Group 13 (only diborane), Group 14, Group 15 (EH<sub>3</sub> where E = N, P, As, Sb, Bi), Group 16 and Group 17.
- Oxides: oxides of phosphorus, sulphur and chlorine
- Oxoacids: oxoacids of phosphorus and chlorine; peroxyacids of sulphur
- Halides: halides of silicon and phosphorus

**(15 Lectures)**

#### **UNIT-IV: PREPARATION, PROPERTIES, STRUCTURE AND USES OF THE FOLLOWING**

##### **COMPOUNDS:**

- Borazine
- Silicates, silicones,
- Phosphonitrilic halides {(PNCl<sub>2</sub>)<sub>n</sub> where n = 3 and 4}
- Interhalogen and pseudohalogen compounds
- Clathrate compounds of noble gases, xenon fluorides (MO treatment of XeF<sub>2</sub>).

**(15 Lectures)**

##### **Reference Books:**

1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010
2. Douglas, B.E., Mc. Daniel, D.H. & Alexander, J.J: Concepts & Models of Inorganic Chemistry 3 rd Ed., John Wiley Sons, N.Y. 1994.
3. Greenwood, N.N. & Earnshaw: Chemistry of the Elements, Butterworth- Heinemann. 1997
4. Cotton, F.A. & Wilkinson, G: Advanced Inorganic Chemistry, Wiley, VCH, 1999.
5. Miessler, G. L. & Donald, A. Tarr: Inorganic Chemistry 3 rd Ed.(adapted), Pearson, 2009
6. Shriver, D.F., Atkins P.W and Langford, C.H: Inorganic Chemistry 2 nd Ed., Oxford University Press, 1994

**BLUE PRINT**  
**FROM 2019-20 ONWARDS**  
**PAPER-III A    INORGANIC CHEMISTRY – II    SEMESTER-III**

S.No.	Chapter	Essay questions (7 M) Knowledge/ skill	Short answer question(4M) Understanding	Very short answer questions(2M) Applications
1	<b>Unit-I:</b> General Principles of Metallurgy & s Block Elements	02	02	01
2	<b>Unit-II:</b> Reactions of Alkali and Alkaline Earth Metals	02	02	01
3	<b>Unit-III:</b> Chemistry of p-Block Elements	02	02	01
4	<b>Unit-IV:</b> Preparation, Properties, Structure and Uses	02	02	-
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>



**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**  
**MODEL PAPER FOR PAPER – IIIA INORGANIC CHEMISTRY-II**  
**(With effect from 2020-21)**

TIME: 2 ½ Hrs

MARKS: 50 M

**PART – A**

Answer **ALL** the following questions

(4 X 7 = 28M)

1) What are the methods for purification of metals and explain?

**(OR)**

2. Write the reaction of alkali and alkali earth metals with Oxygen, Hydrogen, Nitrogen and Water?

3. Write the thermal stability and solubility of the following alkali and alkali earth metal compounds in (a) oxides (b) peroxides (c) carbonates (d) sulphates

**(OR)**

4. Solutions of alkali metals in liquid ammonia and their properties?

5. Explain following terms:

1. Atomic Size or Ionic Size
2. Ionization Enthalpy
3. Electron Gain Enthalpy
4. Electro Negativity

6. Explain in detail about Diborane?

**(OR)**

7. Write the preparation, properties, structure and use of Borazine?

**(OR)**

8. Write about Inter halogen and Pseudo halogen compounds?

### PART-B

Answer any **FOUR** questions

(4 X 4 = 16M)

9. What is hydrometallurgy with reference to cyanide process for silver and gold?
10. Write about general characteristics of s-block elements?
11. Explain EDTA complex formation tendency of s-block elements?
12. What is diagonal relationship between B and Si and explain anomalous behaviour of first member of each group?
13. Explain the allotropy of carbon?
14. Write the oxidation and reduction properties of Phosphorous?
15. Write the preparation and properties of Silicones
16. Draw the structure of Xenon Fluoride ( $\text{XeF}_2$ ) and write its uses?

### PART-C

Answer **ALL** the questions

(3 X 2 = 6M)

17. Define metallurgy?
18. What is inert pair effect?
19. What are Nobel gases? And in which group they are present in the periodic table?

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**PAPER-III SYLLABUS FOR INORGANIC PRACTICALS LAB-II**

**(with effect from 2020-21)**

**(A) Iodo / Iodimetric Titrations**

(i) Estimation of Cu(II) and  $K_2Cr_2O_7$  using sodium thiosulphate solution

(Iodometrically).

(ii) Estimation of antimony in tartar-emetic iodimetrically

**(B) Complexometric titrations using disodium salt of EDTA**

(i) Estimation of  $Mg^{2+}$ ,  $Zn^{2+}$

(ii) Estimation of  $Ca^{2+}$  by substitution method

**(C) Inorganic preparations**

(i) Cuprous Chloride,  $Cu_2Cl_2$

(ii) Manganese (III) phosphate,  $MnPO_4 \cdot H_2O$

(iii) Aluminium potassium sulphate  $KAl(SO_4)_2 \cdot 12H_2O$  (Potash alum) or Chrome alum.

***Reference Books:***

Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS. 1978 Marr, G. and

Rockett, R.W. Practical Inorganic Chemistry, Van Nostrand Reinhold. 1972

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**SCHEME OF VALUATION FOR PAPER-III**

**INORGANIC PRACTICALS LAB-II**

**(With effect from 2020-21)**

**Max Marks: 50M**

**Time: 3 Hours**

1. for Practical	-	40 Marks
2. for Record	-	10 Marks

**Break Up of Marks for Practicals:**

- Procedure (in first 10 minutes) 10 Marks
- Break up of marks for Procedure:
  - a. Principle with equation and no. of moles 5 Marks
  - b. Procedure with a brief explanation of 3 stages of analysis mentioning the solutions taken in burette & Pipette, indicator used and end point. 5 Marks
- Preparation of Standard solution 4 Marks
- Standardization of intermediate Solution 4 Marks
- For tabulation of readings in 2 neat tabular forms 5 Marks
- Calculations 4 Marks
- Viva 5 Marks
- For the result < 1% error 8 Marks

**Note:** If the student does the experiment correctly and reports the volumes perfectly and may fail to arrive at correct answer by doing wrong calculation, 5 marks shall be deducted for wrong calculations.

2. Percentage of error shall be calculated on the weights actually reported but not on the volumes.

3. The scheme is expected to follow scrupulously.

4. The examiner is instructed to maintain worksheet in which he shall record the volumes, concentrations, weights the student is expected to report and actually reported and the percentage of error. This work sheet is maintained batch wise and shall be enclosed with answer scripts batch wise.

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**CHEMISTRY – IIIB: ORGANIC CHEMISTRY II**

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

**UNIT-I: CHEMISTRY OF HALOGENATED HYDROCARBONS**

**Alkyl Halides:** Methods of preparation and properties, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

**Aryl Halides:** Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; S<sub>N</sub>Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg (Grignard reagent) – Use in synthesis of organic compounds.

(16 Lectures)

**UNIT-II: ALCOHOLS, PHENOLS, ETHERS AND EPOXIDES**

**Alcohols:** preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt- Blanc Reduction; Oxidation of diols by periodic acid and lead tetra acetate, Pinacol-Pinacolone rearrangement;

**Phenols:** Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe’s–Schmidt Reactions, Fries and Claisen rearrangements with mechanism;

**Ethers and Epoxides:** Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH<sub>4</sub>.

(16 Lectures)

**UNIT-III: CARBONYL COMPOUNDS**

**Structure, Reactivity, Preparation and Properties;** Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann

and Benzil Benzilic acid rearrangements, Haloform reaction and Baeyer Villiger oxidation,  $\alpha$  - substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner,  $\text{LiAlH}_4$ ,  $\text{NaBH}_4$ , MPV, PDC) Addition reactions of  $\alpha$ ,  $\beta$ - unsaturated carbonyl compounds: Michael addition.

**Active methylene compounds:** Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

**(16 Lectures)**

#### **UNIT-IV: CARBOXYLIC ACIDS AND THEIR DERIVATIVES**

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dickmann and Reformatsky reactions, Hofmann- bromamide degradation and Curtius rearrangement.

**(12 Lectures)**

#### ***Reference Books:***

- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
- Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

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**ORGANIC CHEMISTRY PAPER-II**

**(With effect from 2020-21)**

S.No.	Chapter	Essay questions (7 M) Knowledge/ skill	Short answer question(4M) Understanding	Very short answer questions(2M) Applications
1	<b>Unit-I:</b> Chemistry of halogenated hydrocarbons	02	02	01
2	<b>Unit-II:</b> Alcohols, phenols, ethers & epoxides	02	02	01
3	<b>Unit-III:</b> Carbonyl compound	02	02	-
4	<b>Unit-IV:</b> Carboxylic acids and their relatives	02	02	01
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>

**CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**MODEL QUESTION PAPER FOR PAPER-IIIB**

**ORGANIC CHEMISTRY PAPER-II**

**(with effect from 2020-21)**

**TIME: 2 ½ Hrs**

**MARKS: 50M**

**SECTION-A**

Answer **ALL** questions

**(4X7 = 28 M)**

1. Discuss the mechanism and stereo chemistry of SN1 & SN2 reactions taking with suitable examples

**(OR)**

2. (i) How are alkyl halides prepared?  
(ii) Write any four chemical properties of alkyl halides with suitable examples
3. How will you distinguish among primary, secondary and tertiary alcohols?

**(OR)**

4. Write two methods of preparation of phenol. How phenol can be converted into
  - (i) Phenyl ethyl ether
  - (ii) Salicylaldehyde
  - (iii) Phenyl acetate
  - (iv) Picric Acid
5. (i) Explain Cannizzaro reaction and aldol condensation  
(ii) How do you differentiate aldehydes and ketones?

**(OR)**

6. Write short notes on
  - (i) Benzoin condensation
  - (ii) Give mechanism of nucleophilic addition reaction with one example
7. (i) Give any three methods of preparation of carboxylic acid  
(ii) What happens when (1) acetic acid reacts with PCl<sub>5</sub> and  
(2) benzoic acid is treated with conc H<sub>2</sub>SO<sub>4</sub> and conc HNO<sub>3</sub>?

**(OR)**

8. What happens when
  - (i) formic acid reacts with Tollen's reagent
  - (ii) ammonium acetate is heated with P<sub>2</sub>O<sub>5</sub>.



### SECTION-B

Answer any **FOUR** questions

(4X4 = 16 M)

9. Discuss the relative reactivity of alkyl halides and aryl halides
10. The order of reactivity towards hydrolysis is allyl bromide > ethyl bromide > vinyl bromide discuss
11. How is glycerol prepared? Mention its uses?
12. Write about the industrial significance of ethanol and phenol?
13. What is Perkin reaction and give mechanism?
14. What is Clemmensen reduction and Wolf-Kishner reduction
15. What is Hell-Volhard-Zelinsky (HVZ) reaction explain with example
16. How do you prepare urea and give its properties and uses?

### SECTION-C

Answer **ALL** questions

(3X2 = 6 M)

17. How will you distinguish p-chlorotoluene and benzyl chloride?
18. Why phenol is acidic and alcohols are neutral
19. What is HVZ reaction?

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**PRACTICAL SYLLABUS FOR PAPER-IIIB**

**ORGANIC CHEMISTRY PRACTICAL-II**

**(With effect from 2020-21)**

**60 Hour**

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.

2. Organic preparations: Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols ( $\beta$ -naphthol, vanillin, salicylic acid) by any one method:

Using conventional method.

Using green approach

Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p- anisidine) and one of the following phenols ( $\beta$ -naphthol, resorcinol, p- cresol) by Schotten- Baumann reaction.

Oxidation of ethanol/ isopropanol (Iodoform reaction).

iv. Selective reduction of meta dinitrobenzene to m-nitroaniline.

v. Hydrolysis of amides and esters. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.

S-Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).

Aldol condensation using either conventional or green method. The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

***Reference Books:***

• Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)

• Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.

Practical Organic Chemistry, 5th Ed., Pearson (2012)

• Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

• Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**PAPER-IIIB ORGANIC CHEMISTRY PRACTICAL-II**

**(with effect from 2020-21)**

**SCHEME OF VALUATION**

**Total – 50 Marks**

**Record – 10 Marks**

**Practical – 40 Marks**

**Break up of Practical – I (40 Marks)**

*Identification of function group of an organic compound (Systematic procedure should be adopted).*

❖ Colour	-	1 Marks
❖ Physical State	-	1 Marks
❖ Odour	-	1 Marks
❖ MP / BP	-	2 Marks
❖ Ignition Test	-	2 Marks
❖ Litmus Test	-	2 Marks
❖ Solubility & Classification basing on solubility data	-	5 Marks
❖ Detection of extra elements	-	4 Marks
		(2 Marks for extract)
❖ Unsaturation Test (with bromine water and Bayer's Test)	-	4 Marks
❖ Identification of functional group	-	5 Marks
❖ Confirmatory test for function group (1 test)	-	5 Marks
❖ Anyone derivative of the organic compound (1 x 4)	-	4 Marks (1 x 4)
Report	-	4 Marks

**Total Marks**

-

**50 Marks**

## **II B.Sc CHEMISTRY (HONOURS)– SEMESTER-III**

### **PAPER-IIIC SYLLABUS FOR PHYSICAL CHEMISTRY II**

60 Lectures

#### **Conductance:**

Quantitative aspects of Faraday's laws of electrolysis Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law and its applications.

Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules. Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf's method. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

**(20 Lectures)**

**Electrochemical Cells:** Rules of oxidation/reduction of ions based on half-cell potentials. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass electrodes. Concentration cells with and without transference, liquid junction potential; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

**(24 Lectures)**

### **Photochemistry:**

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, examples of low and high quantum yields, photochemical reactions of chain reactions of  $H_2$  and  $Br_2$ , &  $H_2$  and  $Cl_2$ , photosensitized reactions, quenching. photo stationary states, chemiluminescence.

**(16 Lectures)**

### **Reference Books:**

- Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford University Press(2011).
- Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).
- Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP (2009).
- Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi(2006).
- Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012).
- Rogers, D. W. Concise Physical Chemistry Wiley (2010).
- Silbey, R. J.; Alberty, R. A. & Bawendi, M. G. Physical Chemistry 4th Ed., John Wiley & Sons, Inc.(2005)

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**BLUE PRINT FOR PAPER-IIIC**

**PHYSICAL CHEMISTRY PAPER-II**

**(With effect from 2020-21)**

S.No.	Chapter	Essay questions (7 M) Knowledge/ skill	Short answer question(4M) Understanding	Very short answer questions(2M) Applications
1	Unit-I: Conductance	03	03	01
2	Unit-II: Electrochemical cell	03	03	01
3	Unit-IV: Photochemistry	02	02	01
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>

**II B.Sc CHEMISTRY (HONOURS)– SEMESTER-III**

**CHEMISTRY-IIIC: PHYSICAL CHEMISTRY II**

**MODEL QUESTION PAPER**

**TIME: 2<sup>1/2</sup> Hrs**

**MARKS: 50M**

**SECTION-A**

Answer **ALL** questions

**(4X7 = 28 M)**

1. Define the equivalent and molar conductivity and write the effect of dilution of weak and strong electrolytes on conductance

**(OR)**

2. Determine the transference number by Hittorf method
3. Explain Concentration Cells with Transference.

**(OR)**

4. Explain Concentration cells without Transference.
5. What is conductance? And write any two applications of measurement of a conductance.

**(OR)**

6. What is EMF? And write any three applications of EMF of a measurement.
7. Write about Beer's-law and its limitations

**(OR)**

8. Define the quantum yield and explain about various types of quantum yields with examples

**SECTION-B**

Answer any **FOUR** questions

**(4X4 = 16M)**

9. Write about Kohlrausch law
10. Explain about conductometric titrations of weak acid vs strong Base
11. Explain Debye-Hückel effect
12. Write about Liquid junction potential.

13. Write about Nernst Equation.
14. Write the reversible and irreversible cells and give one example each.
15. Write the role of photo chemical reactions in biochemical process
16. Write about chemiluminescence

**SECTION-C**

Answer **ALL** the questions

**(3X2 = 6M)**

17. Define the ionic mobility and transport number of electrolytes
18. What is electrode potential?
19. Write about zeroth law of photo chemistry



**II B.Sc. CHEMISTRY (HONOURS) III SEMESTER**  
**LABORATORY COURSE PRACTICAL PAPER –IIIC FROM 2019-20 ONWARDS**  
**LABORATORY COURSE –IIIC**  
**SYLLABUS FOR PHYSICAL CHEMISTRY PRACTICAL -II: CONDUCTOMETRY**

60 Lectures

- I. Determination of cell constant
- II. Determination of conductivity, molar conductivity, degree of dissociation and dissociation constant of a weak acid.
- III. Perform the following conductometric titrations:
  - i. Strong acid vs. strong base
  - ii. Weak acid vs. strong base
  - iii. Mixture of strong acid and weak acid vs. strong base
  - iv. Strong acid vs. weak base

***Reference Books:***

- Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
- Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).

**II B.Sc. CHEMISTRY (HONOURS) III SEMESTER LABORATORY COURSE**

**PRACTICAL PAPER –IIC FROM 2019-20 ONWARDS**

**PRACTICAL -IIC: CONDUCTOMETRY**

**SCHEME OF VALUATION**

**Max.Marks: 50 Marks**

**Time: 3 Hrs**

1) For Record	10 Marks
2) For Practical	40 Marks

**Splitting of Practical Marks:**

v) Procedure in 10 min	:	5 Marks
vi) Formula with units	:	5 Marks
vii) Neat tabulation	:	5 Marks
viii) Correct calculation	:	5 Marks

Error < 10 %	20 Marks
Error 10-15 %	15 Marks
Error > 15 %	10 Marks (Minimum Marks)

**Total Marks - 50M**

# **SECOND YEAR SEMESTER-IV**

## SEMESTER-IV

### **CHEMISTRY – IVA: INORGANIC CHEMISTRY III**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

#### **COORDINATION CHEMISTRY:**

Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of  $10 Dq$  ( $\Delta_o$ ), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of  $10 Dq$  ( $\Delta_o$ ,  $\Delta_t$ ). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory. IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, Polynuclear complexes, Labile and inert complexes.

**(26 Lectures)**

#### **TRANSITION ELEMENTS:**

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer diagrams) Different between the first, second and third transition series. Chemistry of Cr, Mn, Fe and Co in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.

**(18 Lectures)**

#### **LANTHANIDS AND ACTINOIDS:**

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

**(6 Lectures)**

## INORGANIC REACTION MECHANISM

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect. Thermodynamic and Kinetic stability.

(10 Lectures)

### ***Reference Books:***

- Purcell, K.F & Kotz, J.C., Inorganic Chemistry W.B. Saunders Co, 1977.
- Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
- Cotton, F.A. & Wilkinson, G., Advanced Inorganic Chemistry Wiley-VCH, 1999
- Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
- Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, ButterworthHeinemann,1997.
- Miessler, G. L. & Tarr, Donald A. Inorganic Chemistry 3 rd Ed.(adapted), Pearson, 2009

**BLUE PRINT**  
**FROM 2019-20 ONWARDS**  
**PAPER-IVA    INORGANIC CHEMISTRY – III    SEMESTER-IV**

S.No.	Chapter	Essay questions (7 M) Knowledge/ skill	Short answer question(4M) Understanding	Very short answer questions(2M) Applications
1	<b>Unit-I:</b> COORDINATION CHEMISTRY	02	02	01
2	<b>Unit-II:</b> TRANSITION ELEMENTS	02	02	-
3	<b>Unit-III:</b> LANTHANIDS AND ACTINIDS	02	02	01
4	<b>Unit-IV:</b> INORGANIC REACTION MECHANISM	02	02	01
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR IV SEMESTER,**  
**MODEL PAPER FOR PAPER – IVA INORGANIC CHEMISTRY-III**  
**(With effect from 2020-21)**

TIME: 2<sup>1/2</sup> hr

MARKS: 50M

**PART-A**

Answer **ALL** the question

(4 x 7 = 28M)

1. What is crystal field theory and C.F.S.E. in Weak and strong fields in octahedral complexes.

**(OR)**

2. Define Jahn-Teller theorem and explain a square planar geometry in Jahn-Teller theorem.

3. Write the similarities and differences between the first, second and third transition series.

**(OR)**

4. Explain the ability of d-block elements to form complex.

5. Explain the Magnetic properties of lanthanides and actinides.

**(OR)**

6. What is Lanthanide contraction and write its consequences?

7. Explain the reaction mechanism of substitution reactions in square planar complexes.

**(OR)**

8. Explain the theories of trans-effect?

**PART-B**

Answer any **FOUR** questions

(4 x 4 = 16M)

9. Give postulates of Werner's theory.

10. Explain the stereo isomerism in coordination number with six complex compounds.

11. What is chelate effect? Give examples.

12. Explain the Color and spectral properties of d-block elements?

13. Compare the properties of lanthanides and actinides.
14. Write the separation of lanthanides by ion-exchange method.
15. What are labile and inert complexes? Give examples.
16. What is relationship between step wise and overall stability constant.

**PART-C**

Answer **ALL** questions

**(3 x 2 = 6M)**

17. What is stereo isomerism
18. Explain complex formation of Actinides.
19. Short note on Kinetic stability in inorganic reaction mechanism.



**II B.Sc. CHEMISTRY (HONOURS) IV SEMESTER**

**LABORATORY COURSE PRACTICAL PAPER –IVA FROM 2019-20 ONWARDS LABORATORY**

**COURSE –IVA**

**SYLLABUS FOR INORGANIC PRACTICAL -III**

**60 Lectures**

**Gravimetric Analysis:**

- i. Estimation of nickel (II) using Dimethylglyoxime (DMG).
- ii. Estimation of copper as CuSCN
- iii. Estimation of iron as Fe<sub>2</sub>O<sub>3</sub> by precipitating iron as Fe(OH)<sub>3</sub> .
- iv. Estimation of Al(III) by precipitating with oxine and weighing as Al(oxine)<sub>3</sub> (aluminium oxinate).

**Inorganic Preparations:**

- i. Tetraamminecopper (II) sulphate, [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub> .H<sub>2</sub>O
- ii. Acetylacetonate complexes of Cu<sup>2+</sup>/Fe<sup>3+</sup>
- iii. Tetraamminecarbonatocobalt (III) nitrate
- iv. Potassium tri(oxalato)ferrate(III)

**Properties of Complexes**

- i. Measurement of 10 Dq by spectrophotometric method
- ii. Verification of spectrochemical series.
- iii. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetonate, DMG, glycine) by substitution method.

***Reference Book:***

- Vogel, A.I. A text book of Quantitative Analysis, ELBS 1986.
- G. Marr and B.W. Rockett, Practical Inorganic Chemistry, Van Nostrand Reinhold. 1972.

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR IV SEMESTER,**

**SCHEME OF VALUATION FOR PAPER-IVA**

**INORGANIC PRACTICALS LAB-III**

**(With effect from 2020-21)**

**Max.Marks: 50 Marks**

**Time: 3 Hrs**

1) For Record	10 Marks
2) For Practical	40 Marks

**Splitting of Practical Marks:**

ix) Procedure in 10 min	:	5 Marks
x) Formula with units	:	5 Marks
xi) Neat tabulation	:	5 Marks
xii) Correct calculation	:	5 Marks

Error < 10 % 20 Marks

Error 10-15 % 15 Marks

Error > 15 % 10 Marks (Minimum Marks)

**TOTAL MARKS- 50M**

## **CHEMISTRY IVB: ORGANIC CHEMISTRY III**

### **Theory: 60 Lectures**

#### **NITROGEN CONTAINING FUNCTIONAL GROUPS**

Preparation and important reactions of nitro compounds, nitriles and isonitriles.

Amines: Preparation and properties: Effect of substituent and solvent on basicity; Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann- elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid. Diazonium Salts: Preparation and their synthetic applications.

**(18 Lectures)**

#### **POLYNUCLEAR HYDROCARBONS**

Aromaticity of polynuclear hydrocarbons, structure elucidation of naphthalene; Preparation and properties of naphthalene, phenanthrene and anthracene.

**(8 Lectures)**

#### **HETEROCYCLIC COMPOUNDS**

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal- Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction)

**(22 Lectures)**

#### **ALKALOIDS**

Natural occurrence, General structural features, Isolation and their physiological action, Hoffmann's exhaustive methylation, Emde's modification; Structure elucidation and synthesis of Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

**(6 Lectures)**

## **TERPENES**

Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral.

**(6 Lectures)**

### ***Reference Books:***

- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly & Sons(1976).
- Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
- Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
- Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
- Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, Prajati Parakashan (2010).

**II B.Sc(HONOURS) CHEMISTRY IV-SEMESTER**

**BLUE PRINT FROM 2020 -21 ONWARDS**

**CHEMISTRY IVB: ORGANIC CHEMISTRY III**

<b>S.No.</b>	<b>Chapter</b>	<b>Essay questions (7 M) Knowledge/ skill</b>	<b>Short answer question(4M) Understanding</b>	<b>Very short answer questions(2M) Applications</b>
<b>1</b>	<b>Unit-I: NITROGEN CONTAINING FUNCTIONAL GROUPS</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>2</b>	<b>Unit-II: POLY NUCLEAR HYDROCARBONS</b>	<b>02</b>	<b>02</b>	<b>-</b>
<b>3</b>	<b>Unit-III: HETERO CYCLIC COMPOUNDS</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>4</b>	<b>Unit-IV: ALKALOIDS &amp; TERPENES</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>

**II B.Sc.(HONOURS) CHEMISTRY IV-SEMESTER**  
**MODEL QUESTION PAPER FROM 2020 -21 ONWARDS**

**CHEMISTRY –IVB: ORGANIC CHEMISTRY – III**

Time : 2<sup>1/2</sup> hrs

Marks :50 M

**SECTION –A**

Answer **ALL** questions

(4 X 7 = 28M)

- 1) How do you distinguish 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> amines with Heinsberg reagent and nitrous acid?

**(OR)**

2. Explain the following: a) Gabriel phthalimide synthesis b) Carbylamine reaction 2
3. What are polynuclear hydrocarbons? Explain structure elucidation of naphthalene?

**(OR)**

4. Write the preparation and properties of anthracene?
5. What is aromaticity? Explain the aromaticity of Furan, Pyrrole and Thiophene?

**(OR)**

6. Explain the following: a) Skraup synthesis b) Friedlander's synthesis
7. Describe about structure elucidation and synthesis of Nicotine?

**(OR)**

8. Give the classification of terpenes? Write the synthesis of Citral?

**SECTION – B**

Answer any **FOUR** questions

(4 X 4 = 16M)

9. Explain the basicity of amines?
10. How diazonium salts are prepared? Give any two applications of it.
11. Write any four properties of phenanthrene.

12. How do you prepare 5- membered hetero cyclic compounds by Paul- Knorr synthesis?
13. Write the following reactions: a) Bischler –Napieralski reaction b) Pomeranz – Fritsch reaction
14. Explain Hoffmann's exhaustive methylation.
15. Explain Isolation and physiological action of alkaloids?
16. What is Isoprene? Explain Isoprene rule in terpenes?

**SECTION – C**

Answer **ALL** questions

**(2 X 3 = 6 M)**

17. Give any two differences between nitriles and isonitriles.
18. Write any two preparations of pyridine?
19. What is morphine? Give medicinal importance of morphine.

**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR III SEMESTER,**

**SYLLABUS FOR PAPER-IVB**

**ORGANIC CHEMISTRY PRACTICAL-III**

**(With effect from 2020-21)**

1. Functional group test for nitro, amine and amide groups.
2. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, carbonyl compounds and esters)

***Reference Books:***

- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
- Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
- Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
- Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000)



**B.Sc. CHEMISTRY (HONOURS) SECOND YEAR IV SEMESTER,**

**CHEMISTRY - IVB -ORGANIC CHEMISTRY PRACTICAL-III**

**(with effect from 2020-21)**

**SCHEME OF VALUATION**

**Total – 50 Marks**

**Record – 10 Marks**

**Practical – 40 Marks**

**Break up of Practical – I (40 Marks)**

*Identification of function group of an organic compound (Systematic procedure should be adopted).*

❖ Colour	-	1 Marks
❖ Physical State	-	1 Marks
❖ Odour	-	1 Marks
❖ MP / BP	-	2 Marks
❖ Ignition Test	-	2 Marks
❖ Litmus Test	-	2 Marks
❖ Solubility & Classification basing on solubility data	-	5 Marks
❖ Detection of extra elements	-	4 Marks
		(2 Marks for extract)
❖ Unsaturation Test (with bromine water and Bayer's Test)	-	4 Marks
❖ Identification of functional group	-	5 Marks
❖ Confirmatory test for function group (1 test)	-	5 Marks
❖ Anyone derivative of the organic compound	-	4 Marks (1 x 4)
Report	-	4 Marks
<b>Total Marks</b>	<b>-</b>	<b>50 Marks</b>

## II B.Sc CHEMISTRY (HONOURS)– SEMESTER-IV

### PAPER-IVC - SYLLABUS FOR PHYSICAL CHEMISTRY IV

60 Lectures

#### Quantum Chemistry

Wave equation -interpretation of wave function-properties of wave function – normalization and orthogonalization, Operators – linear and non-linear- commutator operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator – Eigen values and Eigen functions of Hermitian operator; Eigen functions of commuting operators – significance simultaneous measurement of properties and the uncertainty principle.

Schrodinger wave equation and its applications to free particle and – particle-in-a box, quantization of energy levels, zero-point energy, probability distribution functions, nodal properties.

#### Chemical bonding

Covalent bonding, valence bond and molecular orbital approaches, LCAOMO treatment of  $H_2^+$ . Bonding and antibonding orbitals. Qualitative extension to  $H_2$ . Comparison of LCAO-MO and VB treatment of  $H_2$  (only wave function, detailed solution not required) and their limitations. Qualitative description of LCAO-MO treatment of homonuclear molecules ( $O_2$  &  $N_2$ ).

#### Molecular Spectroscopy

Interaction of electromagnetic radiation with molecules and various types of spectra.

**Rotational spectroscopy:** Selection rules, intensities of spectral lines, determination of bond lengths of diatomic molecules, isotopic substitution.

**Vibrational spectroscopy:** Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, overtones, hot bands, degree of freedom for polyatomic molecules, modes of vibrations.

**Electronic spectroscopy:** Types of electronic transition in molecules, singlet and triplet states, fluorescence and phosphorescence, concept of chromophore and auxochrome. Bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift, effect of conjugation on  $\lambda_{max}$ .

**Nuclear Magnetic Resonance (NMR) spectroscopy:** Principles of NMR spectroscopy, chemical shift, chemical shift effecting factors. Chemical shift equivalent and non-equivalent

protons, different scales ( $\delta$  and T), spin-spin coupling interpretation of PMR spectra of organic molecules (Ethyl bromide, ethanol, acetate, acetaldehyde, ethyl acetate, toluene and acetophenone).

**Electron Spin Resonance (ESR) spectroscopy:** Its principle, hyperfine structure, ESR of simple radicals.

***Reference Books:***

- Banwell, C.N & McCash, E.M, Fundamentals of Molecular Spectroscopy 4<sup>th</sup> Ed. Tata McGraw-Hill: New Delhi (2006).
- Chandra, A.K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
- House, J.E. Fundamentals of Quantum Chemistry 2<sup>nd</sup> Ed. Elsevier: USA (2004).
- Lowe, J.P. & Peterson, K. Quantum Chemistry, Academic Press (2005).
- Kakkar, R. Atomic and Molecular Spectroscopy, Cambridge University Press (2015).

**II B.Sc CHEMISTRY (HONOURS)**  
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**FROM 2019-20 ONWARDS**  
**PAPER-IVC    PHYSICAL CHEMISTRY-IV    SEMESTER-IV**

S.No	Chapter	Essay questions (7M) Knowledge / skill	Short answer questions (4M) Understanding	Very short answer questions (2M) Applications
1	Quantum Chemistry	03	03	01
2	Chemical bonding	02	02	01
3	Molecular spectroscopy	03	03	01
Total number of questions		08	08	03

**GOVERNMENT COLLEGE(A), RAJAMAHENDRAVARAM**  
**II B.Sc CHEMISTRY (HONOURS) SEMESTER-IV**  
**MODEL QUESTION PAPER**  
**PAPER-IVC PHYSICAL CHEMISTRY-IV**

TIME: 2 ½ hrs

MARKS: 50 M

**PART-A**

Answer **ALL** questions

(4 X 7 = 28 M)

1. Discuss the postulates of quantum mechanics.

**(OR)**

Derive the Schrodinger wave equation for one dimensional box.

2. What is LCAO method? Explain the molecular orbital diagrams of molecules a) O<sub>2</sub> b) N<sub>2</sub>

**(OR)**

Give a detail account of setting up of operators for different observables.

3. Write LCAO-MO treatment of H<sub>2</sub><sup>+</sup> and H<sub>2</sub>

**(OR)**

What is electronic transition and types of electronic transitions with examples.

4. Write the principle NMR spectroscopy. What is chemical shift equivalence? How many different NMR signals you will see in the following molecules? Ethanol, Acetate and Acetophenone.

**(OR)**

Define chemical shift and write the factors affecting chemical shift?

**PART-B**

Answer any **FOUR** questions

(4 X 4 = 16M)

5. Write a brief note on Heisenberg's uncertainty principle.
6. Define wave function. Write the acceptable wave function for  $\psi$ .
7. Define Eigen values and Eigen function. Give examples.
8. Write the comparison of LCAO-MO and VB treatment of H<sub>2</sub> (only wave equation).
9. Write the differences between valance bond and molecular orbital.
10. Write about the absorption shifts in electronic spectroscopy.
11. Write the following a) computation of force constant b) Overtones c) Hot bands
12. What is spin-spin coupling?

**PART-C**

Answer **ALL** questions

(3 X 2 = 6M)

13. Write zero-point energy of 1D-box.
14. What is bonding and anti-bonding molecular orbital?
15. What is coupling constant (J)?

**II B.Sc. CHEMISTRY (HONOURS) IV SEMESTER**  
**LABORATORY COURSE PRACTICAL PAPER –IVC**  
**SYLLABUS FOR PHYSICAL CHEMISTRY PRACTICAL -IV**

- I. Verify Lambert-Beer's law and determine the concentration of CuSO<sub>4</sub>/KMnO<sub>4</sub>/K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in a solution of unknown concentration
- II. Determine the concentrations of KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in a mixture.
- III. Study the kinetics of iodination of propanone in acidic medium.
- IV. Determine the amount of iron present in a sample using 1,10-phenanthroline.
- V. Determine the dissociation constant of an indicator (phenolphthalein).
- VI. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.
- VII. Analysis of the given vibration-rotation spectrum of HCl(g) Adsorption
- VIII. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

***Reference Books:***

- Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
- Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).



**THIRD YEAR  
SEMESTER - V**



## SEMESTER-V

### **PAPER-VA - SYLLABUS FOR ORGANIC CHEMISTRY- IV**

**Theory: 60 Lectures**

#### **NUCLEIC ACIDS**

Components of nucleic acids, Nucleosides and nucleotides;

Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides (DNA and RNA).

**(9 Lectures)**

#### **AMINO ACIDS, PEPTIDES AND PROTEINS**

Amino acids, Peptides and their classification.

$\alpha$ -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis;

Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups, Solid-phase synthesis; primary, secondary and tertiary structures of proteins, Denaturation

**(18 Lectures)**

#### **ENZYMES**

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.

Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance.

**(6 Lectures)**

#### **LIPIDS**

Introduction to oils and fats; common fatty acids present in oils and fats,

Hydrogenation of fats and oils, Saponification value, acid value, iodine number.

Reversion and rancidity.

**(8 Lectures)**

**CONCEPT OF ENERGY IN BIOSYSTEMS**

Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD<sup>+</sup>, FAD. Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.

Caloric value of food, standard caloric content of food types.

**(7 Lectures)**

**PHARMACEUTICAL COMPOUNDS: STRUCTURE AND IMPORTANCE**

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

**(12 Lectures)**

***Reference Books:***

- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman andCo.
- Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/ McGraw-Hill.

**III B.Sc(HONOURS) CHEMISTRY V-SEMESTER**

**BLUE PRINT FROM 2020 -21 ONWARDS**

**CHEMISTRY VA: ORGANIC CHEMISTRY IV**

<b>S.No.</b>	<b>Chapter</b>	<b>Essay questions (7 M) Knowledge/ skill</b>	<b>Short answer question(4M) Understanding</b>	<b>Very short answer questions(2M) Applications</b>
<b>1</b>	<b>Unit-I: NUCLEIC ACIDS</b>	<b>02</b>	<b>02</b>	<b>-</b>
<b>2</b>	<b>Unit-II: AMINO ACIDS PEPTIDES &amp; PROTEINS</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>3</b>	<b>Unit-III: ENZYMES &amp; LIPIDS</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>4</b>	<b>Unit-IV: BIOSYSTEMS &amp; PHARMACEUTICAL COMPOUNDS</b>	<b>02</b>	<b>02</b>	<b>01</b>
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>

**III B.Sc.(HONOURS) CHEMISTRY V-SEMESTER**

**MODEL QUESTION PAPER**

**CHEMISTRY –VA: ORGANIC CHEMISTRY – IV**

**Time: 2<sup>1/2</sup> hrs**

**Marks :50 M**

**SECTION –A**

Answer **ALL** questions

**(4 X 7 = 28M)**

1. What are nucleic acids? Explain the double helical structure of DNA.  
**(OR)**
2. Explain the structure, synthesis and reactions of Thymine.
3. What are Amino acids write about the classification of amino acids based on the structure.  
**(OR)**
4. Define protein explain the primary, secondary and tertiary structure of proteins.
5. Explain in detail about the mechanism of action of Trypsin.  
**(OR)**
6. What are the common fatty acids present in oil and explain about the hydrogenation of fats and oils.
7. Define metabolism and write the glycol sis cycle along with the yield of ATP.  
**(OR)**
8. What are antipyretics write about the structure, synthesis and therapeutic uses of paracetamol.

**SECTION-B**

Answer any **FOUR** questions.

**(4×5=20M)**

9. Write brief note on single standard structure of DNA.
10. Write the structure of four nitrogen bases that are present in DNA.
11. Write about the synthesis of peptides using C-activating groups.
12. What are the ionic properties of  $\alpha$ -Amino acids?
13. What are the different factors that affect the enzyme action?
14. Write about rancidity of oils.
15. Write abrief note on hydrolysis of ATP.
16. Give the synthesis of chloroquine.

**SECTION-C**

Answer **All** questions.

**(3×2=6M)**

17. What are Zwitter ions?
18. Define saponification value.
19. Write any four medicinal uses

**III B.Sc. CHEMISTRY (HONOURS) V SEMESTER,**

**SYLLABUS FOR PAPER-VA**

**ORGANIC CHEMISTRY PRACTICAL-IV**

**(With effect from 2020-21)**

1. Synthesis of Alpha- Chloro Benzoic acid
2. Synthesis of Ortho - Ido Benzoic acid
3. Synthesis of Paracetmol
4. Synthesis of Azaraldehyde
5. Synthesis of para - Iodo Nitrobenzene
- 6.Synthesis of Meta - Nitro Acetanilide

***Reference Books:***

- Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
- Arthur, I. V. Quantitative Organic Analysis,

**III B.Sc. CHEMISTRY (HONOURS) V SEMESTER,**  
**CHEMISTRY-VA - ORGANIC CHEMISTRY PRACTICAL-IV**  
**(with effect from 2020-21)**

**SCHEME OF VALUATION**

**Total – 50 Marks**

**Record – 10 Marks**

**Practical – 40 Marks**

**Break up of Practical – I (40 Marks)**

Aim	-	1 M
Chemicals	-	1 M
Chemical reactions with Mechanism	-	5 M
Procedure	-	10 M
Recrystallisation Procedure	-	5M
Calculation	-	10M
Report	-	3 M
Viva	-	5 M
<b>TOTAL</b>	<b>-</b>	<b>50M</b>

### III B.Sc CHEMISTRY (HONOURS)– SEMESTER-V

#### SYLLABUS FOR PAPER-VB

#### PHYSICAL CHEMISTRY V

60 Hours

#### CHEMICAL THERMODYNAMICS:

Intensive and extensive variables; state and path functions; isolated, closed and open systems.

**FIRST LAW:** Concept of heat,  $Q$ , work,  $W$ , internal energy,  $U$ , and statement of first law; enthalpy,  $H$ , relation between heat capacities, calculations of  $Q$ ,  $W$ ,  $\Delta U$  and  $\Delta H$  for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

**THERMOCHEMISTRY:** Heats of reactions: standard states; enthalpy of formation and enthalpy of combustion and its applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions.

**SECOND LAW:** Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics. Calculation of entropy change for reversible and irreversible processes.

**THIRD LAW:** Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. Free Energy Functions: Gibbs and Helmholtz energy; variation of  $S$ ,  $G$ ,  $A$  with  $T$ ,  $V$ ,  $P$ ; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

(36 Lectures)

### **SYSTEMS OF VARIABLE COMPOSITION:**

Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

**(8 Lectures)**

### **CHEMICAL EQUILIBRIUM:**

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration ( Le Chatelier Principle, Quantitatively). Free energy of mixing and spontaneity. equilibrium between ideal gases and a pure condensed phase.

**(8 Lectures)**

### **SOLUTIONS AND COLLIGATIVE PROPERTIES:**

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

**(8 Lectures)**



**Reference Books:**

- Peter, A. & Paula, J. de. Physical Chemistry 9th Ed., Oxford University Press (2011).
- Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).
- Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012).
- McQuarrie, D. A. & Simon, J. D. Molecular Thermodynamics Viva Books Pvt. Ltd.: New Delhi (2004).
- Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. Commonly Asked Questions in Thermodynamics. CRC Press: NY (2011).
- Levine, I .N. Physical Chemistry 6th Ed., Tata Mc Graw Hill (2010).
- Metz, C.R. 2000 solved problems in chemistry, Schaum Series (2006)

**III B.Sc CHEMISTRY (HONOURS)**  
**BLUEPRINT**  
**FROM 2019-20 ONWARDS**  
**PAPER-VB    PHYSICAL CHEMISTRY-V    SEMESTER-V**

S.No	Chapter	Essay questions (7M) Knowledge / skill	Short answer questions (4M) Understanding	Very short answer questions (2M) Applications
1	UNIT: THERMODYNAMICS	03	03	01
2	UNIT- II: SYSTEM OF VARIABLE COMPOSITION	01	01	-
3	UNIT-III: CHEMICAL EQUILIBRIA	02	02	01
4	UNIT-IV: SOLUTIONS AND COLLIGATIVE PROPERTIES	02	02	01
Total number of questions		08	08	03

**III B.Sc CHEMISTRY (HONOURS) SEMESTER-V**

**MODEL QUESTION PAPER**

**PAPER-VB PHYSICAL CHEMISTRY-V**

**TIME: 2 ½ hrs**

**MARKS: 50 M**

**SECTION-A**

Answer **ALL** questions

**(4 X 7 = 28 M)**

1. Define the internal energy and enthalpy and derive the changes of Q, W,  $\Delta U$ ,  $\Delta H$  for irreversible and reversible process.

**(OR)**

2. Give the different statements of second law of thermodynamics and derive the entropy changes for reversible and irreversible process.
3. Define the third law of thermodynamics and derive the Maxwell relations.

**(OR)**

4. Define the partial molar quantity and derive the Gibbs- Duhem equation.
5. Derive the thermodynamic relation between Gibbs free energy of the reaction and reaction coefficient.

**(OR)**

6. write about the free energy mixing of ideal gases and pure condensed gas phase.
7. Define the Raoults law and henrys law and write their applications.

**(OR)**

8. Define the colligative property and write briefly about (a) depression in freezing point (b) osmotic pressure.

**SECTION-B**

Answer any **FOUR** questions.

**(4 X 4 = 16 M)**

9. Explain about Kirchhoff's law.
10. Define the state and path functions and explain by giving examples.
11. Write about Gibbs and Helm-Holtz free energies.
12. Calculate the entropy of mixing 10 moles of helium and 10 moles of oxygen at constant temperature and pressure, assuming both to be ideal gasses?
13. Explain chemical potentials of ideal mixtures.
14. Explain the effect of temperature and pressure on equilibrium constant.
15. Explain the relative lowering of vapor pressure.
16. Calculate the molar mass of dissociated and associated solutes in solution.

**SECTION-C**

Answer **ALL** the questions

**(3X2 = 6 M)**

17. Write about intensive and extensive properties
18. Define Le Chatelier Principle.
19. Define Raoult's and Henry's law.

**II B.Sc. CHEMISTRY (HONOURS) IV SEMESTER**  
**LABORATORY COURSE PRACTICAL PAPER –VB FROM 2019-20 ONWARDS**  
**SYLLABUS FOR PHYSICAL CHEMISTRY PRACTICAL -VB**

- (a) Determination of heat capacity of a calorimeter for different volumes using  
(i) change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution of sulphuric acid or enthalpy of neutralization), and  
(ii) heat gained equal to heat lost by cold water and hot water respectively.
- (b) Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- (c) Determination of the enthalpy of ionization of ethanoic acid.
- (d) Determination of integral enthalpy (endothermic and exothermic) solution of salts.
- (e) Determination of basicity of a diprotic acid by the thermochemical method in terms of the changes  
of temperatures observed in the graph of temperature versus time for different additions of a base.  
Also calculate the enthalpy of neutralization of the first step.
- (f) Determination of enthalpy of hydration of salt.
- (g) Study of the solubility of benzoic acid in water and determination of  $\Delta H$ .

***Reference Books:***

- Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- Athawale, V. D. & Mathur, P. Experimental Physical Chemistry New Age International: New Delhi (2001).

**III B.Sc. CHEMISTRY (HONOURS) V SEMESTER LABORATORY COURSE**

**PRACTICAL PAPER –VB**

**PHYSICAL CHEMISTRY PRACTICAL -VB**

**SCHEME OF VALUATION**

**Max.Marks: 50 Marks**

**Time: 3 Hrs**

1) For Record	10 Marks
2) For Practical	40 Marks

**Splitting of Practical Marks:**

xvii) Procedure in 10 min	:	5 Marks
xviii) Formula with units	:	5 Marks
xix) Neat tabulation	:	5 Marks
xx) Correct calculation	:	5 Marks

Error < 10 % 20 Marks

Error 10-15 % 15 Marks

Error > 15 % 10 Marks (Minimum Marks)

Total Marks - 50 M

## **CHEMISTRY-DSE -1: INORGANIC MATERIALS OF INDUSTRIAL**

### **IMPORTANCE**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

**(Compulsory elective)**

### **SILICATE INDUSTRIES**

**GLASS:** Glassy state and its properties, classification (silicate and non-silicate glasses).

Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

**CERAMICS:** Brief introduction to types of ceramics. Superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre.

**CEMENTS:** Manufacture of cement and the setting process, quick setting cements.

**(16 Lectures)**

**FERTILIZERS:** Different types of fertilizers (N, P and K). Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime.

**(8 Lectures)**

**SURFACE COATINGS:** Brief introduction to and classification of surface coatings. Paints and pigments - formulation, composition and related properties. Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

**(4 Lectures)**

**BATTERIES:** Working of the following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

**(10 Lectures)**

**CATALYSIS:** General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts.

Application of zeolites as catalysts.

**(6 Lectures)**

**CHEMICAL EXPLOSIVES:** Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

**(6 Lectures)**

***Reference Books:***

- Stocchi, E., Industrial Chemistry, Vol I, Ellis Horwood Ltd. UK, 1990
- Felder, R. M. and Rousseau, R.W., Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi, 2005.
- Kingery, W. D., Bowen H. K. and Uhlmann, D. R. Introduction to Ceramics, Wiley Publishers, New Delhi, 1976.
- Kent, J. A. (ed) Riegel's Handbook of Industrial Chemistry, 9 th Ed., CBS Publishers, New Delhi, 1997.
- Jain, P. C. and Jain, M. Engineering Chemistry, Dhanpat Rai & Sons, Delhi 2005
- Gopalan, R., Venkappayya, D. and Nagarajan, S. Engineering Chemistry, Vikas Publications, New Delhi, 2004.
- Sharma, B. K. Engineering Chemistry, Goel Publishing House, Meerut, 2006.

**III B.Sc. CHEMISTRY (HONOURS) V SEMESTER,**  
**MODEL PAPER FOR INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**(With effect from 2020-21)**

**Time: 2<sup>1/2</sup> hours**

**Marks: 50M**

**SECTION- A**

Answer **ALL** the questions

**(4x7=28 M)**

1. Discuss the manufacture of glass and Explanation.  
(OR)
2. Describe the industrial purpose of the process of ceramics
3. Explain the manufacturing of cement and its setting process  
(OR)
4. Explain the manufacturing nitrogen fertilizer and its setting process
5. write about the manufacturing of any two fertilizers  
(OR)
6. Detail of any type phosphorous fertilizers
7. Write the preparation and explosive properties of RDX.  
(OR)
8. Explain about metallic coatings

**SECTION-B**

Answer any **FOUR** of the following questions.

**(4x4=16M)**

9. Write about surface coating? What are emulsion paints?
10. Discuss the classification of glasses.
- 11 Write about Batteries types
12. Describe the manufacturing of urea
13. What are emulsifying agents? Give example.
14. Explain about metallic coatings
15. Explain the properties of catalysis
16. examples of LI Battery

**SECTION C**

Answer **ALL** the questions each carries two marks

**(2x3=6M)**

- 17: What are NPK fertilizers
18. What are emulsion paints?
19. Applications of catalysis?



## **PRACTICALS-DSE-I LAB: INORGANIC MATERIALS OF INDUSTRIAL**

### **IMPORTANCE**

#### **60 Lectures**

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electrolysis metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

#### ***Reference Books:***

- Stocchi, E., Industrial Chemistry, Vol I, Ellis Horwood Ltd. UK, 1990
- Felder, R. M. and Rousseau, R.W., Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi, 2005.
- Kingery, W. D., Bowen H. K. and Uhlmann, D. R. Introduction to Ceramics, Wiley Publishers, New Delhi, 1976.
- Kent, J. A. (ed) Riegel's Handbook of Industrial Chemistry, 9 th Ed., CBS Publishers, New Delhi, 1997
- Jain, P. C. and Jain, M. Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
- Gopalan, R., Venkappayya, D. and Nagarajan, S. Engineering Chemistry, Vikas Publications, New Delhi, 2004.
- Sharma, B. K. Engineering Chemistry, Goel Publishing House, Meerut, 2006



## **CHEMISTRY-DSE-2: ANALYTICAL METHODS IN CHEMISTRY**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

### **QUALITATIVE AND QUANTITATIVE ASPECTS OF ANALYSIS:**

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

**(5 Lectures)**

### **OPTICAL METHODS OF ANALYSIS:**

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

**UV-Visible Spectrometry:** Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

**Basic principles of quantitative analysis:** estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.

**Flame Atomic Absorption and Emission Spectrometry:** Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

**(25 Lectures)**

**THERMAL METHODS OF ANALYSIS:** Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

**(5 Lectures)**

**ELECTROANALYTICAL METHODS:** Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

**(10 Lectures)**

**SEPARATION TECHNIQUES:** Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative

aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media. Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

**(15 Lectures)**

**Reference Books:**

- Vogel, Arthur I: A Text book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman.
- Willard, Hobart H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
- Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
- Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
- Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
- Skoog, D.A., Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore, 1998.
- Mikes, O. and Chalmers, R.A. Ed. Laboratory Hand Book of Chromatographic and Allied Methods, Elles Horwood Ltd. London.
- Dilts, R.V. Analytical Chemistry – Methods of separation Van Nostrand 1974.

**III B.Sc CHEMISTRY (HONOURS)**  
**BLUEPRINT**  
**FROM 2019-20 ONWARDS**  
**PAPER- DSE-2: ANALYTICAL METHODS IN CHEMISTRY SEMESTER-V**

S.No	Chapter	Essay questions (7M) Knowledge / skill	Short answer questions (4M) Understanding	Very short answer questions (2M) Applications
1	UNIT: QUALITATIVE AND QUANTITATIVE ASPECTS OF ANALYSIS	02	02	-
2	UNIT- II: OPTICAL METHODS OF ANALYSIS	02	02	01
3	UNIT-III: THERMAL METHODS OF ANALYSIS	01	01	-
4	UNIT-IV: ELECTROANALYTICAL METHODS	01	01	01
5	UNIT-V: SEPARATION TECHNIQUES	02	02	01
<b>Total number of questions</b>		<b>08</b>	<b>08</b>	<b>03</b>

**III B.Sc. CHEMISTRY (HONOURS) V SEMESTER,**  
**MODEL PAPER FOR ANALYTICAL METHODS IN CHEMISTRY**

**(With effect from 2020-21)**

Time :2<sup>1/2</sup> Hrs

Max. Marks: 50M

**SECTION –A**

Answer **ALL** questions

**(4X7 =28 M)**

1. Write about 1) F-test 2) Q-test.  
**(OR)**
2. Explain the types of errors.
3. Write the principle, Instrumentation of AAS.  
**(OR)**
4. UV Instrumentation and applications.
5. Explain theory, principle of TG.  
**(OR)**
6. Discuss the Electroanalytical methods.
7. Define the i) Batch extraction  
ii) Continuous extraction  
**(OR)**
8. Development methods of chromatography.

**SECTION –B**

Answer any **FOUR** of the following.

**(4X4 =16 M)**

9. Write accuracy - precision.
10. Write note on T-test.
11. Explain the Beer-Lamberts law.
12. Write the applications of AES.
13. Write the applications of TG.
14. Write the Basic principle of pH metric.
15. Write the Principle of solvent extraction.
16. Write a note on Ion exchange.

**SECTION –C**

Answer **ALL** the following

**(3X2 =6 M)**

17. Explain selection rule.
18. Determination of pKa values.
19. Write the principle of chromatography.

## **PRACTICALS- DSE LAB: ANALYTICAL METHODS IN CHEMISTRY**

**60 Lectures**

### I. Separation Techniques

#### Chromatography:

#### (a) Separation of mixtures

- (i) Paper chromatographic separation of  $\text{Co}^{2+}$  and  $\text{Ni}^{2+}$ .
- (ii) Separation and identification of the amino acids present in the given mixture by paper chromatography. Reporting the  $R_f$  values.

### II. Solvent Extractions:

- (i) To separate a mixture of  $\text{Ni}^{2+}$  &  $\text{Fe}^{2+}$  by complexation with DMG and extracting the  $\text{Ni}^{2+}$  - DMG complex in chloroform, and determine its concentration by spectrophotometry.

#### Analysis of soil:

- (i) Determination of pH of soil.
- (ii) Total soluble salt
- (iii) Estimation of calcium, magnesium
- (iv) Qualitative detection of nitrate, phosphate

#### Ion exchange:

- (i) Determination of exchange capacity of cation exchange resins and anion exchange resins.
- (ii) Separation of amino acids from organic acids by ion exchange chromatography.

III Spectrophotometry Verification of Lambert-Beer's law and determination of concentration of a coloured species ( $\text{CuSO}_4$ ,  $\text{KMnO}_4$ )

**Reference Books:**

- Vogel, Arthur I: A Text book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5  
th Ed. The English Language Book Society of Longman.
- Willard, Hobart H. et al.: Instrumental Methods of Analysis, 7 th Ed. Wardsworth Publishing  
Company, Belmont, California, USA, 1988.
- Christian, Gary D; Analytical Chemistry, 6 th Ed. John Wiley & Sons, New York, 2004.
- Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
- Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher,  
2009.
- Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Thomson Asia  
Pvt.  
Ltd. Singapore, 1998.
- Mikes, O. & Chalmers, R.A. Laboratory Hand Book of Chromatographic & Allied Methods,  
Elles  
Horwood Ltd. London.



**III B.Sc. CHEMISTRY (HONOURS) V SEMESTER LABORATORY COURSE**

**PRACTICAL PAPER – ANALYTICAL METHODS IN CHEMISTRY**

**FROM 2019-20 ONWARDS**

**SCHEME OF VALUATION**

**Max.Marks: 50 Marks**

**Time: 3 Hrs**

- |                  |          |
|------------------|----------|
| 1) For Record    | 10 Marks |
| 2) For Practical | 40 Marks |

**Splitting of Practical Marks:**

- |                             |   |         |
|-----------------------------|---|---------|
| xxv) Procedure in 10 min    | : | 5 Marks |
| xxvi) Formula with units    | : | 5 Marks |
| xxvii) Neat tabulation      | : | 5 Marks |
| xxviii) Correct calculation | : | 5 Marks |

Error < 10 % 20 Marks

Error 10-15 % 15 Marks

Error > 15 % 10 Marks (Minimum Marks)

**Total Marks - 50 M**

# **THIRD YEAR SEMESTER-VI**

# **CHEMISTRY -VIA : INORGANIC CHEMISTRY IV**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

## **Theoretical Principles in Qualitative Analysis (H<sub>2</sub>S Scheme)**

Basic principles involved in analysis of cations and anions. Solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

**(12 Lectures)**

## **Organometallic Compounds**

Definition and classification of organometallic compounds on the basis of bond type.

Concept of hapticity of organic ligands.

Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of

3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT.  $\pi$ -acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds.

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich

Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

**(26 Lectures)**

### **Bioinorganic Chemistry:**

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump,

carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals.

Toxicity

of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine,

Cisplatin as an anti-cancer drug.

Iron and its application in bio-systems, Haemoglobin, Myoglobin; Storage and transfer of iron.

**(14 Lectures)**

### **Catalysis by Organometallic Compounds**

Study of the following industrial processes and their mechanism:

1. Alkene hydrogenation (Wilkinson's Catalyst)
2. Synthetic gasoline (Fischer Tropsch reaction)
3. Polymerisation of ethene using Ziegler-Natta catalyst

**(8 Lectures)**

**Reference Books:**

- Vogel, A.I. *Qualitative Inorganic Analysis*, Longman, 1972
- Svehla, G. *Vogel's Qualitative Inorganic Analysis*, 7th Edition, Prentice Hall, 1996-03-07.
- Lippard, S.J. & Berg, J.M., *Principles of Bioinorganic Chemistry* Panima Publishing Company 1994.
- Cotton, F.A., Wilkinson, G., & Gaus, P.L. *Basic Inorganic Chemistry 3rd Ed.*; Wiley India,
- Huheey, J. E.; Keiter, E.A. & Keiter, R.L. *Inorganic Chemistry, Principles of Structure and Reactivity 4 th Ed.*, Harper Collins 1993, Pearson,2006.
- Sharpe, A.G. *Inorganic Chemistry*, 4 th Indian Reprint (Pearson Education) 2005
- Douglas, B. E.; McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry 3rd Ed.*, John Wiley and Sons, NY, 1994.
- Greenwood, N.N. & Earnshaw, A. *Chemistry of the Elements 2nd Ed*, Elsevier, 1997 (Ziegler Natta Catalyst and Equilibria in Grignard Solution).
- Lee, J.D. *Concise Inorganic Chemistry 5 th Ed.*, John Wiley and sons 2008.
- Powell, P. *Principles of Organometallic Chemistry*, Chapman and Hall, 1988.
- Shriver, D.D., Atkins, P. and Langford, C.H., *Inorganic Chemistry 2nd Ed.*, Oxford University Press, 1994.
- Purcell, K.F. & Kotz, J.C., *Inorganic Chemistry*, W.B. Saunders Co. 1977
- Miessler, G. L. & Tarr, Donald A., *Inorganic Chemistry 4 th Ed.*, Pearson, 2010.
- Collman, James P. et al. *Principles and Applications of Organotransition Metal Chemistry*. Mill Valley, CA: University Science Books, 1987.
- Crabtree, Robert H. *The Organometallic Chemistry of the Transition Metals*. John Wiley New York, NY, 2000.
- Spessard, Gary O., & Miessler, Gary L., *Organometallic Chemistry*. Upper Saddle River, NJ: Prentice-Hall, 1996.

# **CHEMISTRY -VIA : INORGANIC CHEMISTRY IV**

## **Practical VIA Lab:**

**60 Lectures**

Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are

suggested:

CO<sub>3</sub><sup>2-</sup>, NO<sub>2</sub><sup>-</sup>, S<sup>2-</sup>, SO<sub>3</sub><sup>2-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, CH<sub>3</sub>COO<sup>-</sup>, F<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, BO<sub>3</sub><sup>3-</sup>, C<sub>2</sub>O<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, NH<sub>4</sub><sup>+</sup>, K<sup>+</sup>,

Pb<sup>2+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, Bi<sup>3+</sup>, Sn<sup>2+</sup>, Sb<sup>3+</sup>, Fe<sup>3+</sup>, Al<sup>3+</sup>, Cr<sup>3+</sup>, Zn<sup>2+</sup>, Mn<sup>2+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>

Mixtures should preferably contain one interfering anion, **or** insoluble component (BaSO<sub>4</sub>, SrSO<sub>4</sub>, PbSO<sub>4</sub>, CaF<sub>2</sub> or Al<sub>2</sub>O<sub>3</sub>) **or** combination of anions e.g. CO<sub>3</sub><sup>2-</sup> and SO<sub>3</sub><sup>2-</sup>, NO<sub>2</sub><sup>-</sup> and NO<sub>3</sub><sup>-</sup>,

Cland Br<sup>-</sup>, Cland I<sup>-</sup>, Brand I<sup>-</sup>, NO<sub>3</sub>

- and Br<sup>-</sup>, NO<sub>3</sub>

- and I<sup>-</sup>.

Spot tests should be done whenever possible.

Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

- i. Ni (II) and Co (II)
- ii. Cu(II) and Cd(II)

### ***Reference Books:***

- Vogel's Qualitative Inorganic Analysis*, Revised by G. Svehla.
- Vogel, A.I. *A Textbook of Quantitative Analysis*, ELBS. 1986

# **CHEMISTRY -VIB: ORGANIC CHEMISTRY V**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

## **Organic Spectroscopy**

General principles Introduction to absorption and emission spectroscopy.

*UV Spectroscopy:* Types of electronic transitions,  $\lambda_{\max}$ , Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of  $\lambda_{\max}$  for the following systems:  $\alpha,\beta$ -unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

*IR Spectroscopy:* Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

*NMR Spectroscopy:* Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne,

aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

(24

Lectures)

## **Carbohydrates**

Occurrence, classification and their biological importance.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and

anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections

and conformational structures; Interconversions of aldoses and ketoses; Killiani- Fischer

synthesis and Ruff degradation;

Disaccharides – Structure elucidation of maltose, lactose and sucrose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

(16

Lectures)

## Dyes

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing;

Synthesis and applications of: Azo dyes – Methyl orange; Triphenyl methane dyes -

Malachite green and Rosaniline ; Phthalein Dyes – Phenolphthalein; Natural dyes –

structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

(8

Lectures)

## Polymers

Introduction and classification including di-block, tri-block and amphiphilic polymers;

Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free

radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes;

Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes)

and thermosoftening (PVC, polythene);

Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and

synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives;

Introduction

to; Biodegradable and conducting polymers with examples.

(12 Lectures)



**Reference Books:**

- Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
- Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Billmeyer, F. W. Textbook of Polymer Science, John Wiley & Sons, Inc.
- Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. Polymer Science, New Age International (P) Ltd. Pub.
- Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc. •Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.
- Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, PrajatiPrakashan (2010).
- Kemp, W. Organic Spectroscopy, Palgrave

# **CHEMISTRY -VIB: ORGANIC CHEMISTRY V**

## **Practical VIB – Lab:**

### **60 Lectures**

- 1.Extraction of caffeine from tea leaves.
- 2.Preparation of urea formaldehyde resin.
- 3.Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, e.g. salicylic acid, cinnamic acid, nitrophenols etc.
- 4.Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
  4. Preparation of methyl orange.

### ***Reference Books:***

- Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).
- Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
- Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
- Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
- Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

# **CHEMISTRY-DSE-3: POLYMER CHEMISTRY**

**(Credits: Theory-06, Practicals-02)**

**Theory: 60 Lectures**

## **Introduction and history of polymeric materials:**

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

(4

Lectures)

**Functionality and its importance:** Criteria for synthetic polymer formation, classification of polymerization processes,

Relationships between functionality, extent of reaction and degree of polymerization.

Bifunctional systems, Poly-functional systems.

(8

Lectures)

## **Kinetics of Polymerization:**

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

(8

lectures)

## **Crystallization and crystallinity:**

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline

polymers, Factors affecting crystalline melting point.

(4 Lectures)

**Nature and structure of polymers**-Structure Property relationships.

(2 Lectures)

**Determination of molecular weight of polymers** ( $M_n$ ,  $M_w$ , etc) by end group analysis,

viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its

significance. Polydispersity index.

(8

Lectures)

**Glass transition temperature ( $T_g$ ) and determination of  $T_g$** , Free volume theory, WLF

equation, Factors affecting glass transition temperature ( $T_g$ ).

(8

Lectures)

**Polymer Solution** – Criteria for polymer solubility, Solubility parameter, Thermodynamics of

polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions,

Flory- Huggins theory, Lower and Upper critical solution temperatures.

(8

Lectures)

**Properties of Polymers** (Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers:

polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers,

poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and

related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone

polymers, polydienes,

Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide

polypyrrole, polythiophene)].

(10 Lectures)

***Reference Books:***

- *Seymour's Polymer Chemistry*, Marcel Dekker, Inc.
- G. Odian: *Principles of Polymerization*, John Wiley.
- F.W. Billmeyer: *Text Book of Polymer Science*, John Wiley.
- P. Ghosh: *Polymer Science & Technology*, Tata Mcgraw-Hill.
- R.W. Lenz: *Organic Chemistry of Synthetic High Polymers*.

## **CHEMISTRY PRACTICAL - DSE-3 LAB: POLYMER**

### **CHEMISTRY**

**60 Lectures**

#### **Polymer synthesis**

1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein
  - a. Preparation of IPC
  - b. Purification of IPC
  - c. Interfacial polymerization
3. Redox polymerization of acrylamide
4. Precipitation polymerization of acrylonitrile
5. Preparation of urea-formaldehyde resin

#### **Polymer analysis**

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Instrumental Techniques
3. IR studies of polymers

\*at least 7 experiments to be carried out.

#### **Reference Books:**

- Malcolm P. Stevens, Polymer Chemistry: An Introduction, 3rd Ed.
- Harry R. Allcock, Frederick W. Lampe and James E. Mark, Contemporary Polymer Chemistry, 3rd ed. Prentice-Hall (2003)
- Fred W. Billmeyer, Textbook of Polymer Science, 3rd ed. Wiley-Interscience (1984)
- Joel R. Fried, Polymer Science and Technology, 2nd ed. Prentice-Hall (2003)
- Petr Munk and Tejraj M. Aminabhavi, Introduction to Macromolecular Science, 2nd

ed. John Wiley & Sons (2002)

- L. H. Sperling, Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005)
- Malcolm P. Stevens, Polymer Chemistry: An Introduction, 3rd ed. Oxford University Press (2005)
- Seymour/ Carraher's Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr. (2013)

## **CHEMISTRY-DSE-4: INDUSTRIAL CHEMICALS AND ENVIRONMENT**

**(Credits: Theory-04, Practicals-02)**

**Theory: 60 Lectures**

**Industrial Gases and Inorganic Chemicals****Industrial Gases:** Large scale production, uses, storage and hazards in handling of the following

gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine,

fluorine, sulphur dioxide and phosgene.

*Inorganic Chemicals:* Manufacture, application, analysis and hazards in handling the following

chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

**(10 Lectures)**

### **Industrial Metallurgy**

Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

**(4 Lectures)**

### **Environment and its segments**

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>x</sub>, H<sub>2</sub>S and other foul smelling gases. Methods of estimation of CO, NO<sub>x</sub>,

SO<sub>x</sub> and control procedures. Effects of air pollution on living organisms and vegetation.



Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

*Water Pollution:* Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of

water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer,

etc.

Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste

water, industrial water and domestic water.

**(30 Lectures)**

### **Energy & Environment**

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

**(10 Lectures)**

### **Biocatalysis**

Introduction to biocatalysis: Importance in —Green Chemistry‖ and Chemical Industry.

**(6 Lectures)**

***Reference Books:***

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. NewDelhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.
- S.E. Manahan, *Environmental Chemistry*, CRC Press (2005).
- G.T. Miller, *Environmental Science* 11th edition. Brooks/ Cole (2006).
- A. Mishra, *Environmental Studies*. Selective and Scientific Books, New Delhi (2005).

## **CHEMISTRY PRACTICAL - DSE-4 LAB: INDUSTRIAL CHEMICALS & ENVIRONMENT**

### **60 Lectures**

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method  
(AgNO<sub>3</sub> and potassium chromate).
6. Estimation of total alkalinity of water samples (CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>) using double titration method.
7. Measurement of dissolved CO<sub>2</sub>.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

### ***Reference Books:***

- E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- S. S. Dara: *A Textbook of Engineering Chemistry*, S. Chand & Company Ltd. New Delhi.
- K. De, *Environmental Chemistry*: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, *Environmental Pollution Analysis*: Wiley Eastern Ltd, New Delhi.

**GOVERNMENT COLLEGE (A)  
RAJAMAHENDRAVARAM**

*(Accredited by NAAC "A+" Grade, CGPA 3.38/4.0, RAF 2017)*

**UG BOARD OF STUDIES 2021-22**



**DEPARTMENT OF CHEMISTRY  
For the Academic Year 2021-22**

**B.Sc., MCAC**

**Curriculum for the Academic Year 2021-22**

# **FIRST YEAR SEMESTER - I**

## MCAC Course Theory Papers

S.No	Semester	Paper	Title of the Paper
1.	I	General I	Inorganic and Physical Chemistry
2.	I	I	Basic principles and laboratory operations
3.	II	General II	Organic and General Chemistry
4.	II	II	Quantitative methods of analysis
5.	III	General III	Organic chemistry & inorganic chemistry
6.	III	III	Separation methods - I
7.	IV	General IV	Inorganic , Organic & Physical Chemistry
8.	IV	IV	Separation methods – II
9	V	General V	Applied inorganic chemistry and organic chemistry
10	V	V	Analytical biochemistry and environmental chemistry
11	V	General VI	Applied physical chemistry and organic chemistry
12	V	VI	Instrumental methods of analysis
13	VI	General Elective VII	Environmental Studies
14	VI	VII Analytical Elective	Analysis of applied industrial products
15	VI	Cluster	Cluster Papers

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS FOR I.B.SC., ANALYTICAL CHEMISTRY, SEMESTER -1**

**PAPER-1 FROM 2019 – 2020 ONWARDS**

**BASIC PRINCIPLES AND LABORATORY OPERATIONS**

**Total Hours: 60 Hrs**

**UNIT-I:**

**A. S.I UNITS –**

Definition of the seven base units (Mass, Length, Time, Temperature, Amount of substance, Electrical current and Luminous intensity); Derived units; Conversions between units; Significant figures.

**B. CHEMICAL CONCENTRATIONS –**

Mole, molar mass; Calculations in grams and moles; Solutions and their concentrations- Molar concentrations; Analytical Molarity; Equilibrium molarity of a particular species; Percent concentration; Parts per million/ billion (ppm,ppb); Volume ratios for dilution procedures; p-functions; Classification and Preparation of Standard solutions.

**UNIT-II:**

**INTRODUCTION TO ANALYTICAL CHEMISTRY AND ANALYTICAL METHODS – I:**

General steps in chemical analysis; Introduction to methods of detecting analytes- Physical, Electromagnetic radiations and Electric charge; Single pan analytical balance (operation and construction), Errors in weighing and care of an analytical balance.

### **UNIT-III:**

#### **INTRODUCTION TO ANALYTICAL CHEMISTRY AND ANALYTICAL METHODS – II:**

Description and use of common laboratory apparatus – volumetric flask, burettes, pipettes, meniscus readers, weighing bottles, types of funnels, chromatographic columns, chromatographic jars, desiccators, drying ovens, filter crucibles, rubber police men; Calibration and use of volumetric glass ware. pH meter - components, use, maintenance, application of data; Laboratory note book.

### **UNIT-IV:**

#### **ERRORS IN CHEMICAL ANALYSIS:**

Types of Errors; Accuracy and Precision, Absolute and Relative uncertainty, Propagation of uncertainty, Gaussian distribution, Mean and Standard deviation; Confidence intervals; Statistical tests of data (F-test, t-test, Q-test for bad data, the methods of Least squares); Calibration curve; laboratory note book; Safety with chemicals and Wastes.

### **UNIT-IV:**

#### **PRINCIPLES OF THERMOGRAVIMETRY:**

Principles of TGA, DTA and thermometric titrations – Applications of  $\text{CaC}_2\text{O}\cdot\text{H}_2\text{O}$ ,  $(\text{CH}_3\text{COO})_2\text{Ca}\cdot\text{H}_2\text{O}$  and  $\text{HCl}$  Vs  $\text{NaOH}$  thermometric titrations.



**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**DEPARTMENT OF CHEMISTRY**  
**LB.SC., ANALYTICAL CHEMISTRY, SEMESTER -I PAPER-1**  
**BASIC PRINCIPLES AND LABORATORY OPERATIONS**  
**MODEL QUESTION PAPER**

**Time: 2 ½ Hrs.**

**Max.Marks: 50 M**

**SECTION-A**

**Answer ALL the questions**

**(4 X 7 = 28 M)**

1. What is concentration of a solution? Write about the following:

- 1)Analytical molarity.
- 2)Equilibrium molarity.
- 3)Percent concentration.

**(OR)**

2. What is S.I units? Explain about 7 base units of international system.

3. What is chemical analysis? what are the general steps involved in chemical analysis?

**(OR)**

4.Explain about the construction and working of single pan analytical balance.

5. Write about the following common laboratory apparatus:

- i) Desiccator
- ii) Rubber policeman
- iii) Meniscus reader
- iv) Pipettes

**(OR)**

6. Write the F-test and t-test while analyzing the data statistically.

7. Define Error and explain about the types of errors.

**(OR)**

8. What are Thermometric titrations and Write about the thermometric titration of HCl Vs NaOH.

### **SECTION-B**

**Answer any FOUR of the following:**

**(4 X 4 = 16 M)**

9. Write about the method of detection of analyte based on the electric charge.
10. What are Significant Figures? Give the rules to identify the significant figures.
11. Write about various types of funnels used in the laboratory.
12. Explain about Gaussian distribution.
13. Write about the principle of TGA.
14. Write a brief note on Parts per million and Parts per Billion.
15. Write a short note on electrodes used in pH meter.
16. Write a short note on Accuracy and Precision.

### **SECTION-C**

**Answer ALL questions:**

**(3 X 2 = 6 M)**

17. Write about Luminous intensity.
18. Define Electromagnetic radiation.
19. Calculate the weight of EDTA present in given 200ml 0.025M EDTA solution (mol.wt of EDTA is 372.24 g/mol).

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**I B.SC., ANALYTICAL CHEMISTRY, SEMESTER -1**

**FROM 2019 – 2020 ONWARDS**

**BASIC PRINCIPLES AND LABORATORY OPERATIONS**

**BLUE PRINT**

<b>Sl.No.</b>	<b>CHAPTER</b>	<b>Essay questions (7M)</b>	<b>Short answer questions (4M)</b>	<b>Very short answer questions (2M)</b>
<b>1.</b>	S.I Units	<b>2</b>	<b>2</b>	
<b>2.</b>	Introduction to Analytical chemistry and Analytical methods - I	<b>1</b>	<b>2</b>	<b>1</b>
<b>3.</b>	Introduction to Analytical chemistry and Analytical methods - II	<b>2</b>	<b>1</b>	<b>1</b>
<b>4.</b>	Errors in Chemical analysis	<b>2</b>	<b>2</b>	<b>1</b>
<b>5.</b>	Principles of Thermo gravimetry	<b>1</b>	<b>1</b>	<b>-</b>
	<b>Total questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**I B.SC., ANALYTICAL CHEMISTRY, SEMESTER -1**

**FROM 2019 – 2020 ONWARDS**

**BASIC PRINCIPLES AND LABORATORY OPERATIONS**

**PRACTICAL SYLLABUS**

1. Use and calibration of volumetric apparatus.
2. Preparation of standard solutions of Acids and Bases.
3. Estimation of Sodium carbonate by titrating with Hydrochloric acid.
4. Preparation of Standard solution of EDTA.
5. Estimation of Zinc using EDTA.
6. Use of pH meter (Determination of pH of given solutions by using pH meter).
7. Preparation of Buffer solutions.

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**I B.SC., ANALYTICAL CHEMISTRY, SEMESTER -1**

**FROM 2019 – 2020 ONWARDS**

**BASIC PRINCIPLES AND LABORATORY OPERATIONS**

**SCHEME OF VALUATION FOR PRACTICAL**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Total: 50 marks**

**Scheme for External Examination**

1) Record: 10 Marks

2) Practical: 40 Marks

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Practical - 40 Marks

**Splitting of Practical Marks:**

- i) Procedure in first 10 min. : 5 Marks
- ii) Formula with units : 5 Marks
- iii) Neat Tabulation : 5 Marks
- iv) Correct Calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 % : 15 Marks

Error > 15 % : 10 Marks (Minimum Marks)

**TOTAL MARKS: 50 M**

# **FIRST YEAR SEMESTER - II**

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS FOR I.B.SC., ANALYTICAL CHEMISTRY, II SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**PAPER-II QUANTITATIVE METHODS OF ANALYSIS**

**Total Hours: 60 Hrs**

**UNIT – I**

**GRAVIMETRIC ANALYSIS – I**

**15 Hours**

- A. Precipitation method- Mechanism of Precipitation (steps involved in precipitation) – Nucleation & Crystal Growth- Induction Period  
Purity of Precipitates: Co-Precipitation and Post Precipitation (only concepts) – Re-Precipitation.  
Drying and Ignition of precipitates.
- B. Volatilization methods: Volatilization of analyte or its decomposition products at a suitable temperature. (Collection and Weighing of the volatile product or, alternatively, the mass of the product is determined indirectly from the loss in mass of the sample).  
Example: Determination of the Sodium Hydrogen Carbonates content of antacid tablets.

**UNIT – II**

**GRAVIMETRIC ANALYSIS – II**

**15 Hours**

- A. Properties of Precipitates and Precipitating Reagents: Particle size, Filterability of Precipitates (factors that determine particle size, formation of precipitates and particle size).
- B. Colloidal Precipitates (coagulation of colloids, peptization of colloids, treatment of colloidal precipitates) and Crystalline Precipitates (particle size and filterability).
- C. Co-precipitation (surface adsorption, mixed-crystal formation, occlusion, and mechanical entrapment, co precipitation errors)
- D. Precipitation from Homogeneous Solution.

### **UNIT – III**

#### **VOLUMETRIC ANALYSIS:**

**15 Hours**

- A. Definitions: Titrimetry, Volumetric titrimetry, Coulometric titrimetry. The equivalence point and the end point, Indicator.
- B. Classification and principles of volumetric methods: Acid-Base titrations, Redox Titrations - Complexometric Titrations - Precipitation Titrations.
- C. Acid-Base titrations - Theory of indicators, Buffer solutions - Aqueous and Non-Aqueous Acid-Base Titrations.
- D. Redox titrations – types of indicators.

### **UNIT – IV**

#### **INTRODUCTION TO CENTRIFUGATION AND ENVIRONMENTAL ANALYSIS**

**15 Hours**

- A. Centrifugation – Types of centrifugation techniques.
- B. Sedimentation and relative centrifugal force.
- C. Types of rotors.
- D. Sampling: Types of sampling – Cone and Quarter Method of Solid Sampling
- E. Environmental pollution from industrial effluents and radiochemical waste.
- F. Introduction to water analysis.

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**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**  
**DEPARTMENT OF CHEMISTRY**  
**LB.SC., ANALYTICAL CHEMISTRY, II SEMESTER PAPER-II**  
**FROM 2019 – 2020 ONWARDS**  
**QUANTITATIVE METHODS OF ANALYSIS**  
**MODEL PAPER**

**Time: 2<sup>1</sup>/<sub>2</sub> hrs.**

**Max.Marks: 50 M**

**SECTION-A**

**Answer ALL the questions**

**(4 X 7 = 28 M)**

1.Explain about the mechanism of Precipitation in Gravimetric analysis.

**(OR)**

2.What is Co-Precipitation and write about different methods of co-precipitation.

3.Explain about Precipitation from Homogenous solution.

**(OR)**

4.Explain about the Properties of Precipitates and Precipitating reagents.

5.Explain about the Theories of indicators.

**(OR)**

6. Write about the principles of aqueous and non-aqueous Acid-Base titrations.

7. Define Centrifugation and explain about the types of Centrifugation techniques.

**(OR)**

8. Write about the analysis of Water.

### **SECTION-B**

**Answer any FOUR of the following:**

**(4 X 4 = 16 M)**

9. Write about the Crystalline precipitates.
10. What is Volatilization and explain with an example.
11. Write about various types of indicators used in the Redox titrations.
12. Explain about sedimentation.
13. Write about the principle of complexometric titration.
14. Write a brief note on Coagulation of colloids.
15. How do you determine the amount of sodium bicarbonate present in an antacid tablet.
16. Write a short note on types of rotors.

### **SECTION-C**

**Answer ALL questions:**

**(3 X 2 = 6 M)**

17. Write about Mechanical entrapment.
18. Define Relative centrifugal force.
19. Differentiate between end point and Equivalence point.

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**I B.SC., ANALYTICAL CHEMISTRY, II SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**QUANTITATIVE METHODS OF ANALYSIS**

**BLUE PRINT**

<b>Sl.No.</b>	<b>CHAPTER</b>	<b>Essay questions (7M)</b>	<b>Short answer questions (4M)</b>	<b>Very short answer questions (2M)</b>
<b>1.</b>	Gravimetric analysis - I	<b>2</b>	<b>2</b>	<b>-</b>
<b>2.</b>	Gravimetric analysis - II	<b>2</b>	<b>2</b>	<b>1</b>
<b>3.</b>	Volumetric Analysis	<b>2</b>	<b>2</b>	<b>1</b>
<b>4.</b>	Introduction to Centrifugation and Environmental Analysis	<b>2</b>	<b>2</b>	<b>1</b>
	<b>Total questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**I.B.SC., ANALYTICAL CHEMISTRY, II SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**QUANTITATIVE METHODS OF ANALYSIS**

**PRACTICAL SYLLABUS**

1. Determination of amount of Carbonate and Bicarbonate in water by titrating with Hydrochloric acid.
2. Determination of amount of Acetic acid in the given sample of Vinegar.
3. Determination of Iron by titrating with Potassium dichromate solution.
4. Estimation of strength of magnesium sulphate solution in the by using EDTA
5. Determination of amount of Calcium and Magnesium in the given mixture by using EDTA.
6. Homogenous Precipitation of Nickel as its Dimethylglyoxime (Gravimetry).

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**I.B.SC., ANALYTICAL CHEMISTRY, II SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**QUANTITATIVE METHODS OF ANALYSIS**

**SCHEME OF VALUATION FOR PRACTICAL**

**Time: 2<sup>1</sup>/<sub>2</sub> hrs**

**Total: 50 marks**

**Scheme for External Examination**

1) Record: 10 Marks

2) Practical: 40 Marks

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Practical - 40 Marks

**Splitting of Practical Marks:**

- i) Procedure in first 10 min. : 5 Marks
- ii) Formula with units : 5 Marks
- iii) Neat Tabulation : 5 Marks
- iv) Correct Calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 % : 15 Marks

Error > 15 % : 10 Marks (Minimum Marks)

**TOTAL MARKS: 50 M**

# **SECOND YEAR SEMESTER - III**

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

Syllabus for B.Sc. II Year Semester – III Effective from 2018 – 2019 onwards

**ANALYTICAL CHEMISTRY- Paper III**

**SEPARATION METHODS**

**Total Hours: 60 Hrs**

**UNIT – I:**

**15hrs**

**Solvent Extraction:**

Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application - Determination of Iron (III).

**Chromatography:**

Classification of chromatographic methods: Principle of differential migration, description of the chromatographic process, distribution coefficients, modes of chromatography, performing column chromatography.

Chromatography - theory and practice: Introduction, the chromatograph (elution time and volume), capacity factor, column efficiency and resolution, sample preparation.

**UNIT – II:**

**15hrs**

**A. Techniques of Paper Chromatography:**

Principle, experimental modifications, various modes of development, nature of the paper, detection of spots, retardation factors, factors that affect the reproducibility of R<sub>f</sub> values (due to paper, solvent system, sample, development procedure), selection of solvent, quantitative analysis. Applications.

**B. Thin layer chromatography:**

Principle, stationary phase, adsorbents, liquid phase supports, plate preparation, mobile phase, sample application, development, saturation of chamber, detection of spot, R<sub>f</sub> values (effect of adsorbent, solvent, solute, development process), quantitative analysis, applications.

**UNIT – III:****15hrs****A. Adsorption Chromatography:**

Principle, adsorbents, solvents, nature of solute, operating parameters, retention volumes and times, applications.

**Column Chromatography:** Principle, columns, matrix materials, stationary phase, column packing, application of sample, column development and sample elution, detectors and fraction collectors, applications.

**B. High Performance Liquid Chromatography:**

Principle, column, matrices and stationary phases, column packing, mobile phase and pumps, application of sample, detectors, applications.

**UNIT – IV:****15hrs****A. Liquid-Liquid Partition, Chromatography:**

Principle, normal phase chromatography, reversed- phase liquid chromatography, reversed phase liquid chromatography, applications.

**B. Ion Exchange:**

Introduction, principle, action of ion exchange resins, separation of inorganic mixtures, applications, Solvent extraction: Principle and process,

**Ion- Exchange Chromatography:** Principle, ion exchangers, ion- exchange equilibria, ion - exchange resin selectivity, column operations (column development, detection of solute bands), factors affecting retention volumes, applications.

**Suggested Readings:**

1. F.W. Fifield and D. Kealy: Analytical Chemistry.
2. Daniel C Harris: Exploring chemical analysis.
3. Daniel C Harris: Quantitative chemical analysis.
4. R.V. Dilts Analytical Chemistry- Methods of Separation.
5. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM.**

**DEPARTMENT OF CHEMISTRY**

**II B.Sc., ANALYTICAL CHEMISTRY PAPER - III**

**SEPARATION METHODS**

**MODEL QUESTION PAPER**

**TIME: 2½ hr.**

**MARKS: 50 M**

**PART-A**

**Answer ALL Questions. All questions carry equal marks.**

**4x7= 28 Marks**

1. Mention the principle of solvent extraction. Write a note on any two Solvent extraction methods.

(OR)

2. Write a short note on the following:

- 1) Different Chromatographic methods of development.
- 2) Stationary & Mobile Phases

3. Write the principle and any three development techniques of Paper Chromatography.

(OR)

4. Explain the process of Thin Layer Chromatography.

5. Explain the principle, column packing and column development in Column Chromatography.

(OR)

6. Write about the principle, instrumentation and applications of High performance liquid Chromatography.

7. Write the principle and separation of Inorganic mixtures by Ion Exchange Technique.

(OR)

8. Give the principle and applications of Ion Exchange Chromatography.

**SECTION-B**

**Answer Any Four Questions**

**4 x 4 = 16 Marks**

9. Write about Synergism.

10. Principle of Differential Migration.

11. What are Stationary & Mobile Phases in Paper Chromatography?

12. Advantages of Thin Layer Chromatography over Paper Chromatography.
13. Write a note on adsorbents in Column chromatography.
14. What is Rf value? Explain the factors affecting Rf value.
15. What is reversed phase liquid Chromatography?
16. Any four properties of Ion-Exchange Resins.

### **SECTION-C**

**Answer All Questions**

**3 x 2 = 6 Marks**

1. Differentiate between solvent extraction and chromatography.
2. Mention any two applications of Paper chromatography & TLC.
3. What is meant by matrix materials?

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM.**

**DEPARTMENT OF CHEMISTRY**

**II B.Sc., ANALYTICAL CHEMISTRY PAPER - III**

**SEPARATION METHODS**

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<b>Sl.No.</b>	<b>CHAPTER</b>	<b>Essay questions (7M)</b>	<b>Short answer questions (4M)</b>	<b>Very short answer questions (2M)</b>
<b>1.</b>	Solvent Extraction & Chromatography	<b>2</b>	<b>2</b>	<b>1</b>
<b>2.</b>	Techniques of Paper Chromatography & Thin Layer Chromatography	<b>2</b>	<b>2</b>	<b>1</b>
<b>3.</b>	Adsorption/Column Chromatography & HPLC	<b>2</b>	<b>2</b>	<b>1</b>
<b>4.</b>	Liquid-Liquid Partition & Ion Exchange Chromatography	<b>2</b>	<b>2</b>	<b>-</b>
	<b>Total questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM.**

**DEPARTMENT OF CHEMISTRY**

**ILB.Sc., ANALYTICAL CHEMISTRY PAPER - III**

**SEPARATION METHODS**

**PRACTICAL SYLLABUS**

1. Determination of Rf value of amino acids using paper chromatography.
2. Separation and identification of monosaccharide present in a given mixture by paper Chromatography.
3. Determination of equivalent conductance of a weak electrolyte (acetic acid) at Different concentrations.
4. Determination of adulterant in some common food items:
  - i) Chicory in coffee powder,
  - ii) foreign resin in Asafoetida
  - iii) Chilli powder
  - iv) Turmeric Powder
  - v) Pulses

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM.**

**II.B.Sc., ANALYTICAL CHEMISTRY PAPER - III**

**SEPARATION METHODS**

**SCHEME OF VALUATION FOR PRACTICAL**

**Total No. of Marks: 50 Marks**

**Record : 10 Marks**

**Practical : 40 Marks**

**Principle - 5M**

**Procedure - 5M**

**Tabulation – 5M**

**Practical - 25M (For Material / Calculation)**

**Total: 50 Marks**

# **SECOND YEAR SEMESTER - IV**

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**II B.SC ANALYTICAL CHEMISTRY, IV SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**PAPER – IV: SEPARATION METHODS – II**

**Unit-I:**

**GEL, AFFINITY AND GAS CHROMATOGRAPHY:**

- A. Gel chromatography: Principle, types of gels, separation by gel chromatography, applications
- B. Affinity chromatography: Principle, materials, selection and attachment of ligand, practical procedure, applications
- C. Gas chromatography: Apparatus and materials, preparation and application of samples, separation conditions, detectors, applications

**Unit-II:**

**ELECTROPHORESIS:**

- A. Electrophoresis-I: Theory and classification, factors affecting mobility, macromolecular size and charge, interactions with supporting electrolyte, PH and concentration discontinuities, factors affecting electrophoresis phenomena
- B. Electrophoresis-II: electrolysis, electro-osmosis, temperature and supporting media, instrumentation, methodology, preparation of gel-staining and de-staining, preparative zone electrophoresis, continuous electrophoresis, applications

**Unit-III:**

**DIALYSIS AND MEMBRANE FILTRATION AND GENERAL LABORATORY METHODS:**

- A. Dialysis and membrane Filtration: Dialysis, classification of dialysis: Electrodialysis (ED) and Reverse Electrodialysis (RED), types of filtrations: Micro Filtration (MF), Ultra Filtration (UF), Nano Filtration (NF), and Reverse Osmosis (RO), Filters-nitrocellulose, fiberglass, polycarbonate

B. General laboratory methods: Distillation, drying solvents, fractional crystallization, recrystallization, acid-base, complexation and precipitation titrations, vacuum filtration.

#### **Unit-IV:**

#### **CENTRIFUGATION METHODS:**

Introduction, Basic principles of sedimentation and relative centrifugal force, preparative centrifugation and ultracentrifugation, different types of rotors, density gradients, types of centrifugation techniques.

#### **References**

1. R. V. Dilts: Analytical Chemistry- Methods of Separation.
2. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.
3. F.W. Fifield and D. Kealy: Principles and practice of analytical chemistry.
4. Vogel's textbook of quantitative chemical analysis, 6th edition.
5. Vogel's textbook of quantitative chemical analysis, 7th edition.



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**DEPARTMENT OF CHEMISTRY**

**II.B.SC ANALYTICAL CHEMISTRY, IV SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**PAPER – IV: SEPARATION METHODS – II**

**MODEL QUESTION PAPER**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Marks: 50M**

**PART-A**

**Answer all questions**

**(4x7=28 Marks)**

1. Write the principle of Gel Chromatography and write different types of gels used in chromatography.

(OR)

2. Write the principle of gas chromatography and write briefly about apparatus and materials used in gas-liquid chromatography.
3. Write the principles of electrophoresis and write the factors affecting the electrophoresis.

(OR)

4. Write a note on preparative zone and continuous electrophoresis.
5. Write briefly about nitrocellulose and fibre glass filters.

(OR)

6. Write briefly about general laboratory methods.
7. 4. Write briefly about the centrifugal methods.

(OR)

8. Write a note on different types of rotors

**PART-B**

**Answer any four questions**

**(4x4=16 Marks)**

9. Write a note on detectors of gas chromatography.
10. Write a note on practical procedure of affinity chromatography.
11. Write a note on the effect of charge and macromolecular size in electrophoresis.
12. Write the applications of electrophoresis.
13. Briefly write about polycarbonate.
14. Write about dialysis and membrane filtration.
15. Write the different types of centrifugation techniques.
16. Write about sedimentation process.

**PART-C**

**Answer all questions**

**(3x2=6 Marks)**

17. Write the principle of affinity chromatogram.
18. Write a note about supporting media used in electrophoresis.
19. Define crystallization?

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**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**II B.SC ANALYTICAL CHEMISTRY, IV SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**PAPER – IV: SEPARATION METHODS – II**

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<b>Sl.No.</b>	<b>CHAPTER</b>	<b>Essay questions (7M)</b>	<b>Short answer questions (4M)</b>	<b>Very short answer questions (2M)</b>
<b>1.</b>	UNIT-I : GEL, AFFINITY AND GAS CHROMATOGRAPHY	<b>2</b>	<b>2</b>	<b>1</b>
<b>2.</b>	UNIT-II: ELECTROPHORESIS	<b>2</b>	<b>2</b>	<b>1</b>
<b>3.</b>	UNIT: III DIALYSIS AND MEMBRANE FILTRATION AND GENERAL LABORATORY METHODS	<b>2</b>	<b>2</b>	<b>1</b>
<b>4.</b>	UNIT: IV CENTRIFUGATION METHODS	<b>2</b>	<b>2</b>	<b>-</b>
	<b>Total questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

**GOVERNMENT COLLEGE (A), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**II B.SC., ANALYTICAL CHEMISTRY, IV SEMESTER**

**PAPER-IV: SEPARATION TECHNIQUES**

**PRACTICAL SYLLABUS**

**Time: 45 Hours (3 Hrs/Wk)**

1. Determination of the strength of the given HCl solution by titrating it against NaOH solution conductometrically
2. Separation of a mixture of Ni<sup>2+</sup> and Cu<sup>2+</sup> by TLC and identify the ions.
3. Determination residual chlorine in city water supply using colorimetry
4. Determination of adsorption isotherm and adsorption constant (k) of acetic acid on activated charcoal.
5. Determination of nicotine content in cigarette tobacco

**References:**

1. R. V. Dilts: *Analytical Chemistry- Methods of Separation.*
2. O. Mikes, R.A. Chalmers: *Laboratory Handbook of Chromatographic Methods.*
3. F.W. Fifield and D.Kealy: *Principles and practice of analytical chemistry.*
4. Vogel's *textbook of quantitative chemical analysis, 6th edition.*
5. Vogel's *textbook of quantitative chemical analysis, 7th edition.*
6. Keith Wilson and John Walker: *Practical Biochemistry.*
7. David J.Holme and Hazel Peck: *Analytical Biochemistry.*
8. David Freifelder: *Physical Biochemistry.*

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**DEPARTMENT OF CHEMISTRY**

**II B.SC ANALYTICAL CHEMISTRY, IV SEMESTER**

**FROM 2019 – 2020 ONWARDS**

**PAPER – IV: SEPARATION METHODS – II**

**SCHEME OF VALUATION FOR PRACTICAL**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Total: 50 marks**

**Scheme for External Examination**

- 1) Record: 10 Marks
- 2) Practical: 40 Marks

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Practical - 40 Marks

**Splitting of Practical Marks:**

- v) Procedure in first 10 min. : 5 Marks
- vi) ii) Formula with units : 5 Marks
- vii) Neat Tabulation : 5 Marks
- viii) Correct Calculation : 5 Marks

Error < 10%: 20 Marks

Error 10-15 %: 15 Marks

Error > 15 %: 10 Marks (Minimum Marks)

**TOTAL MARKS: 50 M**

**THIRD YEAR  
SEMESTER - V**

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-V**

**SYLLABUS FOR SEMESTER-V**

**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**

45hrs (3h/w)

**UNIT-I: BASIC UNDERSTANDING OF THE STRUCTURES, PROPERTIES AND FUNCTIONS OF CARBOHYDRATES, LIPIDS, AND PROTEINS: (12 Hours)**

1. Proteins- structure, classification and functions.
2. Carbohydrates – Polysaccharides – Definition, Classification, Isolation (from mushrooms) and characterization of polysaccharides.
3. Classification and properties of lipids, functions of steroid hormones.
4. Enzymes- nomenclature, classification, effect of pH and temperature on enzyme activity, enzyme inhibition.
5. Introduction to Lipoproteins.

**UNIT – II: CLINICAL CHEMISTRY - A DIAGNOSTIC APPROACH BY BLOOD/URINE ANALYSIS: (10 Hours)**

1. Blood: Composition and functions of blood, blood coagulation.
2. Blood collection and preservation of samples.
3. Anemia.
4. Estimation of glucose, urea, creatinine, cholesterol and bilirubin in blood.
5. Formation of urine.
6. Composition of normal and pathological urine.

**UNIT-III: MICROBIOLOGICAL ANALYSIS: (8 Hours)**

Microbiological Analysis: Definition, functions - Different culture media used for microbiological analysis - Microbiological assay of antibiotics (cylinder or cup plate method) - microbiological analysis of water by membrane filtration method.

**UNIT-IV: DRUG FORMULATIONS AND DRUG ANALYSIS: (8 Hours)**

Brief introduction to different types of formulations - Additives used in tablet manufacture - Analysis, uses and formulations of following drugs: Aspirin, Sulphadiazine, Phenobarbitone, Methyl Dopa, Vitamin – C, Salicylic acid.

**UNIT-V: ENVIRONMENTAL CHEMISTRY: (7 Hours)**

Concept and scope of environmental chemistry -nomenclature -environmental segments - The natural cycles of the environment -the hydrological cycle -the oxygen cycle -the nitrogen cycle. Classification of water pollutants - Dissolved Oxygen-BOD-COD- Waste water treatment (General). Disposal of radioactive wastes.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-V**

**SEMESTER - V**

**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**

**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Max. Marks: 50M**

**SECTION – A**

**Answer all the questions**

**4x7=28M**

1. What are Polysaccharides? How they are classified and explain the Isolation of Polysaccharides.

(OR)

2. Define Protein. Write a detailed account on structure of Proteins.
3. Write about the procedure for the Estimation of glucose and Cholesterol in Blood.

(OR)

4. Write detailed note on Composition of Blood.
5. Explain the Microbiological analysis of water by membrane filtration method.

(OR)

6. Write a detailed account on different Formulations of drug manufacturing.
7. Write about the Estimation, formulations and uses of Aspirin.

(OR)

8. Write about the general procedure for the treatment of Waste water.

**SECTION – B**

**Answer any FOUR of the following**

**4x4=16M**

9. Write about the functions of Steroid hormones.
10. Write a short note on effect of temperature on enzyme activity.
11. Write a brief note on composition of normal and pathological urine.
12. Give the process of collection and preservation of blood samples.
13. What are the different Culture media that are used for the microbiological analysis?
14. Write about procedure for the analysis of Methyl Dopa.

15. Write about the Additives that are used in the manufacture of Tablets.
16. Give a brief account of Hydrological cycle of Environment.

**SECTION – C**

**Answer all the questions**

**3x2=6M**

17. What are Lipoproteins and give two examples.
18. Define Anemia and write the normal range of Hemoglobin in blood.
19. Define BOD and COD.



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**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-V**

**SEMESTER-V**

**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**

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<b>S.No</b>	<b>NAME OF THE UNIT</b>	<b>ESSAY QUESTIONS (07 M) Knowledge</b>	<b>SHORT ANSWER QUESTION (04 M) Under standing</b>	<b>VERY SHORT ANSWER QUESTION (02 M) Skill /Application</b>
UNIT-I	Basic understanding of the structures, properties and functions of carbohydrates, lipids, and proteins	02	02	01
UNIT-II	Clinical chemistry: A diagnostic approach by blood/urine analysis	02	02	01
UNIT-III	Microbiological analysis	01	01	-
UNIT-IV	Drug formulations and Drug analysis	02	02	-
UNIT-V	Environmental chemistry	01	01	01
	<b>TOTAL</b>	08	08	03

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-V SEMESTER-V**

**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**

**Practical-V Analysis of Bio Products and Environmental analysis**

**30 hrs (2 h / w)**

Identification and estimation of the following:

1. Qualitative analysis of Carbohydrates.
2. Quantitative analysis of Carbohydrates.
3. Qualitative analysis of Lipids.
4. Qualitative analysis of Proteins.
5. Determination of the Saponification number of oil.
6. Estimation of Alkalinity of water.
7. Estimation of Acidity of Water.

Suggested Readings:

1. T. G. Cooper: Tool of Biochemistry.
2. Keith Wilson and John Walker: Practical Biochemistry.
3. Alan H Gowenlock: Varley's Practical Clinical Biochemistry.
4. Thomas M. Devlin: Textbook of Biochemistry.
5. Jeremy M. Berg, John L Tymoczko, Lubert Stryer: Biochemistry.
6. G. P. Talwar and M Srivastava: Textbook of Biochemistry and
7. Human Biology.
8. A.L. Lehninger: Biochemistry.
9. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.
10. Environmental chemistry by A.K.De
11. A text book of Engineering chemistry by S.S.Dara
12. A text book of Industrial chemistry by B.K.Sharma

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-V SEMESTER-V**

**ANALYTICAL BIOCHEMISTRY AND ENVIRONMENTAL CHEMISTRY**

**Practical-V Analysis of Bio Products and Environmental analysis**

**SCHEME OF VALUATION FOR PRACTICAL**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Total: 50 marks**

**Scheme for External Examination**

- 1) Record: 10 Marks
- 2) Practical: 40 Marks

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Practical - 40 Marks

**Splitting of Practical Marks:**

- i) Procedure in first 10 min. : 5 Marks
- ii) Formula with units : 5 Marks
- iii) Neat Tabulation : 5 Marks
- iv) Correct Calculation : 5 Marks

Error < 10%: 20 Marks

Error 10-15 %: 15 Marks

Error > 15 %: 10 Marks (Minimum Marks)

**TOTAL MARKS: 50 M**

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**SYLLABUS FOR III B.Sc., ANALYTICAL CHEMISTRY PAPER-VI SEMESTER – V**

**INSTRUMENTAL METHODS OF ANALYSIS**

**Total hrs: 45 Hours(3hrs/w)**

**UNIT:I UV AND VISIBLE SPECTROPHOTOMETRY 9 Hours**

Lambert-Beer's law: Principles - Instrumentation, Single/double beam instrument and its applications  
IR SPECTROSCOPY: Principle - Instrumentation and applications

**UNIT-II: ATOMIC EMISSION SPECTROSCOPY (FLAME PHOTOMETRY) 9Hrs**

Principle - Instrumentation - Interferences - Analytical techniques for Flame photometry - Calibration plots (Working curves). Determination of Alkali and Alkaline earth metals in natural water (any two metal ions)

**UNIT-III: ATOMIC ABSORPTION SPECTROSCOPY 9 Hours**

Principle - Instrumentation - Radiation sources (line sources) - Hollow cathode lamps and Discharge lamps. Interferences - Analytical techniques for AAS - Calibration plots. Applications - Determinations of Calcium and Magnesium in tap water.

**UNIT-IV: POLAROGRAPHY AND COULOMETRY 9 Hours**

(a) Polarography: Basic Principles - DME - Advantages and Disadvantages Diffusion Current - The Ilkovic equation (derivation not required). Half - Wave potential - Experimental set up - Applications. Determination of Copper and Zinc in Brass.

(b) Coulometry: Types of coulometric methods: Potentiostatic and amperostatic; principles, instrumentation and applications, applications.

**UNIT-V: BASIC ELECTRO-ANALYTICAL CHEMISTRY 9 Hours**

Electrochemical cells, cell potentials, electrode potentials, calculation of cell potentials and currents in electrochemical cells, types of polarization, types of electroanalytical methods, problems. Ion-selective Electrodes: Types of ion-selective electrodes: Glass, liquid ion exchange membrane, neutral carrier membrane, coated wire, gas sensing, air gap and biomembrane electrodes; theory of ion selective electrode and ion-selectivity coefficient; problems.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VI SEMESTER – V**

**INSTRUMENTAL METHODS OF ANALYSIS**

**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Max. Marks: 50M**

**SECTION – A**

**Answer all questions**

**4x7=28M**

1. Write the principle of lamberts - beer's law. Instrumentation of double beam spectrometer.

(OR)

2. Instrumentation of I.R spectroscopy? Write one application.
3. Write the principal and instrumentation of flame photometry.

(OR)

4. Determination of Alkali and Alkaline earth metals in natural water.
5. Write the analytical techniques for AAS and write its applications.

(OR)

6. Write about electro-chemical cells and write types of polarization.
7. Explain half wave- potential - experimental set up and applications.

(OR)

8. Write the principle and instrumentation of coulometer.

**SECTION – B**

**Answer any FIVE of following**

**4x4=16 M**

9. Write the applications of lamberts-beers law.
10. Write the single and double beam instrumentation.
11. Write about calibration plots.
12. Write analytical techniques of flame photometry.
13. Write the instrumentation of AAS.
14. Determination of calcium and magnesium in water.

15. Determination of copper and zinc in brass.
16. Write about glass and bio membrane in electrode.

**SECTION – C**

**Answer all the questions**

**3x2=6 M**

17. Write lamberts-beers law.
18. Write the principle of AAS.
19. Write any two advantages of diffusion current.

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**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VI SEMESTER – V**

**INSTRUMENTAL METHODS OF ANALYSIS**

**BLUE PRINT**

<b>S.No</b>	<b>NAME OF THE UNIT</b>	<b>ESSAY QUESTIONS (07 M) Knowledge</b>	<b>SHORT ANSWER QUESTION (04 M) Under standing</b>	<b>VERY SHORT ANSWER QUESTION (02 M) Skill /Application</b>
UNIT-I	Introduction to spectroscopic method of analysis	02	02	01
UNIT-II	Atomic emission spectroscopy	02	02	01
UNIT-III	Atomic Absorption spectroscopy	01	01	-
UNIT-IV	Polarography & coulometry	02	02	-
UNIT-V	Basic Electro-Analytical chemistry	01	01	01
	<b>TOTAL</b>	08	08	03

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**JILB.Sc., ANALYTICAL CHEMISTRY PRACTICAL-VI SEMESTER - V**

**SYLLABUS FOR PRACTICALS**

**INSTRUMENTAL METHODS OF ANALYSIS**

**45 hrs (3 h / w)**

- 1) Determination of metals in given samples by AAS technique.
- 2) Preparation of standard calibration graphs of Pb, Cd, Zn and Fe by AAS
- 3) Determination of Sodium by Flame Photometry.

Suggested Readings:

1. P.W. Atkins: Physical Chemistry.
2. G.W. Castellan: Physical Chemistry.
3. C.N. Banwell: Fundamentals of Molecular Spectroscopy.
4. Brian Smith: Infra red Spectral Interpretations: A Systematic Approach.
5. W.J. Moore: Physical Chemistry.



**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PRACTICAL-VI SEMESTER - V**

**SCHEME OF VALUATION FOR PRACTICALS**

**INSTRUMENTAL METHODS OF ANALYSIS**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Total: 50 marks**

**Scheme for External Examination**

- 1) Record: 10 Marks
- 2) Practical: 40 Marks

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Practical - 40 Marks

**Splitting of Practical Marks:**

- i) Procedure in first 10 min. : 5 Marks
- ii) Formula with units : 5 Marks
- iii) Neat Tabulation : 5 Marks
- iv) Correct Calculation : 5 Marks

Error < 10%: 20 Marks

Error 10-15 %: 15 Marks

Error > 15 %: 10 Marks (Minimum Marks)

**TOTAL MARKS: 50 M**

**THIRD YEAR  
SEMESTER - VI**

# **PAPER - VII**

# **ELECTIVE**

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., SYLLABUS FOR ANALYTICAL CHEMISTRY**

**PAPER-VII SEMESTER - VI**

**ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

**UNIT-I:**

**ANALYSIS OF SOAPS AND PAINTS: 9 Hours**

Analysis of soaps: moisture and volatile matter, total alkali, total fatty acid, total fatty matter, silicates and chlorides.

Analysis of paints: Vehicle and pigments, Barium Sulphate, total lead, lead chromate.

**UNIT- II:**

**ANALYSIS OF FATS, OILS AND INDUSTRIAL SOLVENTS: 9 Hours**

Analysis of oils: saponification value, iodine value, acid value, ester value, bromine value, acetyl value.

Analysis of industrial solvents like benzene, acetone, methanol and acetic acid.,  
Determination of methoxyl and N-methyl groups.

**UNIT-III:**

**ANALYSIS OF FERTILIZERS STARCH, SUGARS AND PAPER: 9hours**

urea, NPK fertilizer, super phosphate, Analysis of DDT, BHC, Endrin, Endosulphon,  
Malathion, parathion.

Analysis of starch, sugars, cellulose and paper.

**UNIT –IV:**

**ANALYSIS OF GASES: 9 Hours**

Gas analysis: carbon dioxide, carbon monoxide, oxygen, hydrogen, hydrocarbons, Cetane number

Analysis of Fuel gases like: water gas, producer gas, kerosene (oil) gas.

Ultimate analysis: carbon, hydrogen, nitrogen, oxygen, sulphur.

**UNIT – V:**

**ANALYSIS OF COMPLEX MATERIALS 9 Hours**

Analysis of cement- loss on ignition, insoluble residue, total silica, sesqui oxides, lime, magnesia, ferric oxide, sulphuric anhydride.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VII SEMESTER - VI**

**ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Max. Marks: 50M**

**SECTION – A**

**Answer all the questions**

**4x7=28M**

1. a) Write about the analysis of total fatty acids and fatty matter in soaps.  
OR  
b) Write about the analysis of Barium sulphate pigment in total paint.
2. a) What is Saponification Value? How do you determine the saponification value of an oil?  
OR  
b) Write the procedure to analyse the Benzene and Methanol in industrial solvents.
3. a) Write a detailed account on Analysis of NPK Fertilizers.  
OR  
b) Write about the estimation of Starch and cellulose.
4. a) Write about the Estimation of Carbon dioxide and Carbon monoxide gases.  
OR  
b) Write the Ultimate Analysis for Magnesia and ferric oxide in cement.

**SECTION – B**

**Answer any FOUR of following**

**4x4=16M**

5. Write about the analysis of total alkali in soaps.
6. Write about the procedure for the determination of Iodine value in oils.
7. Write a brief note on Analysis of DDT.
8. Discuss about octane number.
9. Write a brief note on total silica in cement.
10. Write about procedure for the Analysis of Vehicle in paints.
11. Write about the analysis of any one industrial solvent.
12. Give a brief account of Analysis of Malathion.

**SECTION – C**

**Answer all the questions**

**3x2=6M**

13. What are Inorganic pigments in the paints? give two examples.
15. What is water gas?
16. What are sesqui oxides?

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VII SEMESTER - VI**

**BLUE PRINT FOR ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

<b>Unit</b>	<b>Chapter</b>	<b>Essay Question (07 M) Knowledge</b>	<b>Short Answer Question(04M) Understanding</b>	<b>Very short Answer Question (02 M) SkillApplication</b>
Unit-1	Analysis of Soaps, Detergents and Paints	02	02	01
Unit-2	Analysis of Fats & Oils and Industrial Solvents	02	02	-
Unit-3	Analysis of Fertilizers, Starch, Sugars and Paper	02	02	01
Unit-4	Analysis of Gases	01	01	01
Unit-5	Analysis of Complex Materials	01	01	-
	<b>Total No of Questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VII SEMESTER - VI**

**ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

**PRACTICAL SYLLABUS**

45 hrs (3 h / w)

**Analysis of Heavy & Fine Chemicals**

1. Preparation of soaps and detergents.
2. Estimation of EDTA in detergent and shampoo.
3. Assay of soaps and detergent.
4. Determination of washing strength of detergents by surface tension method.
5. Determination of CMC of detergents.
6. Preparation and characterization of copper sulphate.
7. Preparation and characterization of methyl orange and methyl red.
8. Estimation of  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$  in washing soda.
9. Determination of Thiosulphate content of a commercial hypo solution.
10. Estimation of available chlorine in the sample of bleaching powder.

**SUGGESTED BOOKS:**

1. F.J.Welcher-Standard methods of analysis,
2. A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,
3. H.H.Willard and H.Deal- Advanced quantitative analysis- Van Nostrand Co,
4. F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
5. J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on analytical chemistry and its applications -- Inter Science- Vol I to VII.,
6. G.Z.Weig - Analytical methods for pesticides, plant growth regulators and food additives - Vols I to VII,
7. Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
8. F.J.Welcher-Standard methods of analysis,
9. Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi, CBS Publishers and Distributors, New Delhi
10. G.Ingram- Methods of organic elemental micro analysis- Chapman and Hall.,
11. H.Wincciam and Bobbles (Henry J)- Instrumental methods of analysis of food additives.,
12. H.Edward-The Chemical analysis of foods; practical treatise on the examination of food stuffs and the detection of adulterants

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VII SEMESTER – VI**

**ANALYSIS OF APPLIED INDUSTRIAL PRODUCTS**

**SCHEME OF VALUATION FOR PRACTICALS**

**Time: 2<sup>1</sup>/<sub>2</sub> hr**

**Total: 50 marks**

**Scheme for External Examination**

- 1) Record: 10 Marks
- 2) Practical: 40 Marks

**SCHEME OF VALUATION:**

For Record - 10 Marks

For Practical - 40 Marks

**Splitting of Practical Marks:**

- v) Procedure in first 10 min. : 5 Marks
- vi) ii) Formula with units : 5 Marks
- vii) Neat Tabulation : 5 Marks
- viii) Correct Calculation : 5 Marks

Error < 10%: 20 Marks

Error 10-15 %: 15 Marks

Error > 15 %: 10 Marks (Minimum Marks)

**TOTAL MARKS: 50 M**



**THIRD YEAR  
SEMESTER - 6  
CLUSTER**

# PAPER VIII-B1

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**  
**DEPARTMENT OF CHEMISTRY**  
**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B1 SEMESTER – VI**  
**FUEL CHEMISTRY AND BATTERIES**

Total Hours : 45Hrs

**UNIT –I** **12 h**

Review of energy sources (renewable and non-renewable) – classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non-fuel) in various industries, its composition, carbonization of coal - coal gas, producer gas and water gas – composition and uses – fractionation of coal tar – uses of coal tar based chemicals, requisites of a good metallurgical coke, coal gasification (Hydro gasification and catalytic gasification) coal liquefaction and solvent refining.

**UNIT-II** **6 h**

Petroleum and petrol chemical industry: Composition of crude petroleum, refining and different types of petroleum products and their applications.

**UNIT-III** **10 h**

Fractional distillation (principle and process), cracking (Thermal and catalytic cracking). Reforming petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas), fuels derived from biomass, fuel from waste, synthetic fuels (gaseous and liquids), clear fuels, petrochemicals: vinyl acetate, propylene oxide, isoprene, butadiene, toluene and its derivative xylene.

**UNIT-IV** **10 h**

Lubricants Classification of lubricants, lubricating oils (conducting and non-conducting), solid and semi solid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pour point) and their determination.

**UNIT-V** **7 h**

Batteries Primary and secondary batteries, battery components and their role, Characteristics of battery. Working of following batteries: Pb-Acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

**REFERENCE BOOKS**

1. E. Stochi: Industrial chemistry , Vol-1, Ellis Horwood Ltd. UK.
2. P.C. Jain, M. Jain: Engineering chemistry, Dhanpat Rai & sons, Delhi.
3. B.K. Sharma: Industrial Chemistry, Goel Publishing house, Meerut.

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**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B1 SEMESTER – VI**

**FUEL CHEMISTRY AND BATTERIES**

**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Maximum Marks: 50**

**SECTION-A**

**Answer ALL the questions.**

**4 x 7 = 28M**

1. Write in detail about renewable and non-renewable energy sources.

(OR)

2. Write about the composition and uses of producer gas and water gas.  
3. Explain the composition of the crude petroleum.

(OR)

4. Describe the refining of petroleum.  
5. Discuss about fractional distillation.

(OR)

6. Write about the non-petroleum fuels.  
7. Explain the classification of lubricants.

(OR)

8. What are the properties of lubricants?

**SECTION-B**

**Answer any FOUR of the following questions.**

**4x4 = 16 Marks**

9. What are the uses of coal in various industries?  
10. Discuss the gasification of coal.  
11. Write the applications of different petroleum products.  
12. Short note on cracking.  
13. Write about synthetic fuels.  
14. What are conducting and non-conducting lubricating oils?  
15. Fuel cells.  
16. Write about the primary and secondary batteries.

**SECTION-C**

**Answer ALL the questions.**

**3x2 = 6 Marks**

17. What is carbonisation of coal?  
18. What are conducting lubricants?  
19. Write about polymer cell.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B1 SEMESTER – VI**

**FUEL CHEMISTRY AND BATTERIES**

**BLUE PRINT**

<b>SL.NO</b>	<b>Chapter</b>	<b>Essay Question (07 M) Knowledge</b>	<b>Short Answer Question(04M) Understanding</b>	<b>Very short Answer Question (02 M) SkillApplication</b>
1	Unit-1	02	02	01
2	Unit-2	02	02	-
3	Unit-3	02	02	01
4	Unit-4	01	01	01
5	Unit-5	01	01	-
	<b>Total No of Questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B1 SEMESTER – VI**

**PRACTICAL VIII-B1**

**PROJECT WORK**

**SCHEME OF VALUATION – VIII B1 (PROJECT WORK)**

**PROCESS OF PROJECT WORK:**

- Four weeks duration for multi-disciplinary training in the institution.
- Each candidate has to submit a project report after completion.
- One Faculty member has to supervise the above process

# **PAPER VIII - B2**

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B2 SEMESTER – VI**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**No. of h/w: 3h**

**UNIT-I**

Recapitulation of s- and p-Block Elements 8 h Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Milliken and Alfred – Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.

**UNIT – II**

**15 h**

Silicate Industries Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass. Ceramics: Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre. Cements: Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

**UNIT – III**

**8 h**

Fertilizers: Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphate, polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

**UNIT – IV**

**8 h**

Surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-



friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

## **UNIT – V**

**6 h**

Alloys: Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of steel (removal of silicon decarbonisation, demagnetization, desulphurization, dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels. Chemical explosives: Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

## **REFERENCE BOOKS**

1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: Introduction to Ceramics, Wiley Publishers, New Delhi.
4. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. P. C. Jain & M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
7. B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B2 SEMESTER – VI**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**MODEL QUESTION PAPER**

**Time: 2½ hr**

**Maximum Marks: 50**

**SECTION-A**

**Answer ALL the questions.**

**4 x 7 = 28M**

1. Discuss the unusual oxidation states of carbon and nitrogen.

(OR)

2. Describe the anomalous behaviour of lithium and boron.

3. Give the composition and properties of coloured glass and photosensitized glass.

(OR)

4. Explain the manufacturing of cement and its setting process.

5. Write about the manufacturing of any two nitrogen fertilizers.

(OR)

6. Write about the manufacturing of any two phosphorous fertilizers.

7. Give the process of manufacturing of steel.

(OR)

8. Write the preparation and explosive properties of RDX.

**SECTION-B**

**Answer any FOUR of the following questions.**

**4x4 = 16 Marks**

9. Write about diagonal relationship.

10. Discuss the classification of glasses.

11. Write about Carbon nanotubes.

12. Describe the manufacturing of urea.

13. What are emulsifying agents? Give examples.
14. Explain about metallic coatings.
15. Write a note on non-ferrous alloys.
16. Explain the properties of steels.

**SECTION-C**

**Answer ALL the questions.**

**3x2 = 6 Marks**

17. What are allotropes of carbon?
18. What are NPK fertilizers?
19. What are enamel paints?

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B2 SEMESTER – VI**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**BLUE PRINT**

SL.NO	Chapter	Essay Question (07 M) Knowledge	Short Answer Question(04M) Understanding	Very short Answer Question (02 M) SkillApplication
1	Unit-1	02	01	01
2	Unit-2	02	02	-
3	Unit-3	02	01	01
4	Unit-4	00	02	01
5	Unit-5	02	02	-
	<b>Total No of Questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B2 SEMESTER – VI**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**PRACTICAL SYLLABUS VIII-B2**

**45 ours (3hr/wk)**

**1. Electrochemistry:**

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

**2. pH metry:**

i) Preparation of phosphate buffer solutions.

ii) pH metric titration of weak acid, acetic acid with strong base, NaOH and calculation of dissociation constant.

**3. Colorimetry:**

i) Verification of Beer-Lambert law for  $\text{KMnO}_4$  and determination of concentration of the given solution.

ii) Verification of Beer-Lambert law for  $\text{K}_2\text{Cr}_2\text{O}_7$  and determination of concentration of the given solution.

iii) Verification of Beer-Lambert law for  $\text{CuSO}_4$  and determination of concentration of the given solution.

iv) Composition of complex of  $\text{Cu}^{2+}$ -EDTA disodium salt.

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B2 SEMESTER – VI**

**INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE**

**SCHEME OF VALUATION**

**Max. Marks: 50**

**Time: 2½ hrs.**

For Record - 10 Marks

Marks for Viva-voce - 5 Marks

Marks for Practical - 35 Marks

**Splitting of Practical Marks:**

Procedure in first 10 min. : 5 Marks

ii) Formula with units : 5 Marks

iii) Neat tabulation & correct calculation : 5 Marks

Error < 10% : 20 Marks

Error 10-15 % : 15 Marks

Error > 15 % : 10 Marks (Minimum Marks)

# PAPER VIII - B3

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAMAHENDRAVARAM**

**DEPARTMENT OF CHEMISTRY**

**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B3 SEMESTER – VI**

**POLYMER TECHNIQUES**

**TOTAL HOURS: 45HRS**

**UNIT-I** **12 h**

Introduction of polymers: Basic definitions, degree of polymerization, classification of polymers - Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers, Plastics, Elastomers, Fibres and Resins, Linear, Branched and Cross Linked polymers, Addition polymers and Condensation Polymers, mechanism of polymerization. Free radical, ionic and Zeigler – Natta polymerization.

**UNIT-II** **10 h**

Techniques of Polymerization: Bulk polymerization, solution polymerization, suspension and emulsion polymerization. Molecular weights of polymers: Number average and weight average molecular weights Determination of molecular weight of polymers by Viscometry, Osmometry and light scattering methods.

**UNIT-III** **6 h**

Kinetics of Free radical polymerization, Glass Transition temperature (T<sub>g</sub>) and Determination of T<sub>g</sub>: Free volume theory, WLF equation, factors affecting glass transition temperature (T<sub>g</sub>).

**UNIT-IV** **9 h**

Polymer additives: Introduction to plastic additives – fillers, Plasticizers and Softeners, Lubricants and Flow Promoters, Anti aging additives, Flame Retardants, Colourants, Blowing agents, Cross linking agents, Photo stabilizers, Nucleating agents.

**UNIT-V** **8 h**

Polymers and their applications: Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Terelene, Polyacrylonitrile, Nylon6,6 and silicones.



## REFERENCE BOOKS

1. Seymour, R.B. & Carraher, C.E. Polymer Chemistry: An Introduction, Marcel Dekker, Inc. New York, 1981.
2. Odian, G. Principles of Polymerization, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. Textbook of Polymer Science, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. Polymer Science & Technology, Tata McGraw-Hill Education, 1991.34
5. Lenz, R.W. Organic Chemistry of Synthetic High Polymers. Interscience Publishers, New York, 1967.

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**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B3 SEMESTER – VI**

**POLYMER TECHNIQUES**

**MODEL QUESTION PAPER**

**Time: 2<sup>1</sup>/<sub>2</sub> hrs**

**Maximum Marks: 50**

**SECTION-A**

**Answer ALL the questions.**

**4 x 7 = 28M**

1. Give an account of classification of polymers.  
(OR)
2. Write the mechanism of free radical polymerization.
3. How is molecular weight of a polymer determined by viscometry  
(OR)
4. Give an account on bulk and solution polymerization techniques.
5. Discuss the use of fillers and plasticizers in improving the properties of polymers.  
(OR)
6. Write notes on flame retardants and cross linking agents.
7. Discuss the kinetics of free radical polymerization.  
(OR)
8. Write the preparation and industrial applications of polythene and teflon.

**SECTION-B**

**Answer any FOUR of the following questions.**

**4x4 = 16 Marks**

9. What are thermo plastics and thermo setting plastics?
10. Write about condensation polymerization.
11. Define number average and weight average molecular weights.
12. Write a note on emulsion polymerization.
13. Give the Williams-Landel-Ferry equation.
14. Illustrate the colourants and photosensitizers.
15. What are the factors affecting T<sub>g</sub>?

16. Write any two applications of PVC and PAN

**SECTION-C**

**Answer ALL the questions.**

**3x2 = 6 Marks**

17. What is co polymer give example.
18. What is glass transition temperature?
19. What is nucleating agent? Give example.

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**III B.Sc., ANALYTICAL CHEMISTRY PAPER-VIII-B3 SEMESTER – VI**

**POLYMER TECHNIQUES**

**BLUE PRINT**

<b>SL.NO</b>	<b>Chapter</b>	<b>Essay Question (07 M) Knowledge</b>	<b>Short Answer Question(04M) Understanding</b>	<b>Very short Answer Question (02 M) SkillApplication</b>
1	Introduction of polymers	02	02	01
2	Techniques of Polymerization	02	02	-
3	Kinetics of polymers	01	02	01
4	Polymer additives	02	01	01
5	Polymers and their applications	01	01	-
	<b>Total No of Questions</b>	<b>08</b>	<b>08</b>	<b>03</b>

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**PRACTICAL SYLLABUS VIII-B3**

**45 Hours (3hr/wk)**

1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbituric Acid
5. Preparation of Phenyl azo  $\beta$ -naphthol

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**SCHEME OF VALUATION**

**Max. Marks: 50 Marks**

**Time: 3 hrs.**

For Record - 10 Marks

For Viva-voce - 5 Marks

For Practical - 35 Marks

**Splitting of Practical Marks :**

- i) Procedure : 20 Marks
- ii) Equation : 5 Marks
- iii) M.P. : 5 Marks
- iv) Report of yield : 5 Marks

**THE END**