# PITHAPUR RAJAH'S GOVERNMENT COLLEGE

**An Outcome Based Autonomous Institution Accredited with NAAC Grade "A" (3.17 CGPA)**

**Affiliated to Adikavi Nannaya University Rajamahendravaram**

**KAKINADA - 533 001, AP.**

# BOARD OF STUDIES OF CHEMISTRY

## B.Sc. Hons. CHEMISTRY MAJORS& B.Sc. CHEMISTRY UNDER CBCS

Meeting Minutes/ Resolutions

***Convened on 30 April 2024*AY 2024- 25**

## DEPARTMENT OF CHEMISTRY

## PITHAPUR RAJAH'S GOVERNMENTCOLLEGE (AUTONOMOUS)

**Opp. Mc. Laurin High School, Raja Ram Mohan Roy Road, Kakinada**

www.prgc.edu.in; e-mail: chemistry@prgc.edu.in

**PROCEEDINGS OF THE PRINCIPAL,**

**P.R. GOVERNMENT COLLEGE (A)KAKINADA- A.P**

**Present: Dr. B. V. Tirupanyam, M. Sc;**

**Ph.D.R.C.No.2/A.C./BOS/2024-25,**

**Dated: 23.04.2024**

**SUB:** P.R. Government College (A), Kakinada-UG Board of Studies (BOS)- B.Sc-Chemistry-Nomination of Members-Orders issued.

**REF:** 1. UGC Guidelines for Autonomous Colleges-2018.

**ORDERS:**

The Principal, P.R. Government College (A), Kakinada is pleased to constitute UG Boards of Studies in CHEMISTRY for framing the syllabi in respective Subject for all Semesters duly following the norms of the UGC Autonomous guidelines.

| S. No | Name of the Person | Designation |
|---|---|---|
| 1 | V. Sanjeeva Kumar | Chairman & Lecturer In charge |
| 2 | Dr. K. Jhansi Lakshmi<br>ASD Govt. Degree College for Women (Autonomous)Kakinada | University Nominee |
| 3 | Dr. D. Chenna Rao<br>Lecturer in Chemistry,<br>Govt. Degree College, Yeleswaram | Subject Expert -I |
| 4 | U. Sai Krishna<br>Lecturer in Chemistry, Govt. College, (Autonomous)Rajamahendravaram | Subject Expert - II |
| 5 | Dr. N. Ratnakar, AARKISH PHARMACEUTICALS INS NJ,NEW JERSEY | Subject Expert - III |
| 6 | Dr. P. KARUNA RAMAN MD, IDEAL ORGANICSHYDERABAD. | Representative from Industry |
| 7 | T. V. V. Satyanarayana | Member |
| 8 | P. Vijay Kumar | Member |
| 9 | V. Ram babu | Member |
| 10 | G. Pavani | Member |
| 11 | Dr. N. Bujji Babu | Member |
| 12 | Dr. Ch. Praveen | Member |
| 13 | V. Venkateswara Rao | Member |
| 14 | U.S.N. Prasad | Member |
| 15 | K.N.S. Swamy | Member |
| 16 | S. Vijaya Lakshmi | Member |
| 17 | D.Bhavyasri | Member |
| 18 | K.Umamaheswari | Student Alumni Member |
| 19 | Deepthi Anusha II FBC | Student Member |
| 20 | BVNagendra Kumar, II MCCS | Student Member |
| 21 | J.Veera Durga I CHEMISTRY MAJORS | Student Member |

The above members are requested to attend the BoS meeting on 30-04-2024 and share their valuablereviews, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college, the interest of the stakeholders and National requirements for consideration and approval of the IQAC and Academic Council.
- Suggest the panel of Paper Setters & Examiners to the academic council for appointment of Paper Setters& Examiners.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Coordinate research, teaching, extension and other activities in the Department of the college.

PRINCIPAL
P. R. Government College(A),
Kakinada

# PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A)
# DEPARTMENT OF CHEMISTRY

Meeting of Board of Studies in Chemistry is convened on 30 April 2024 through offline/ onlineat P.R. Govt. College (A), Kakinada, at 10.00 AM.

**Venue:** JKC AC HALLS, Dt: 30-04-2024, Tuesday – 10.00 A.M.

The Principal Dr. B.V. Tirupanyam; Chairman V. Sanjeeva Kumar; University Nominee Dr. K. JhansiLakshmi, Lecturer in Chemistry, ASD Govt. Degree College for Women (Autonomous), Kakinada; Dr. P. KARUNA RAMAN MD, IDEAL ORGANICS HYDERABAD. Industrialist: Subject Experts Dr. D. Chenna Rao, Lecturer in Chemistry, Govt. Degree College, Yeleswaram and U. Sai Krishna Lecturer in Chemistry, Govt. College, (Autonomous), Rajamahendravaram all the faculty members of the Chemistry Department and student alumni attended the meeting.

**Agenda:**

1. To discuss the I,II,III, IV semesters of a Single major system as B.Sc. Chemistry (Hons), B.Sc. Organic Chemistry (Hons), B.Sc. Analytical Chemistry (Hons) from the academic year 2024-25. &V ,VI semesters of CBCS System
2. To discuss IV year B.Sc. Honors to the students who were admitted in the academic year 2021-22.
3. To discuss the Semester System and revised Choice Based Credit System (CBCS)being implemented for the past 04 years, i.e., i.e. 2020-21.
4. To discuss and approve the Continuation/Modifications of the syllabus for the Odd& Even Semesters of I, II, III & IV Years for 2024-25.
5. Grant of Extra credits for Online SWAYAM MOOCs, edX, Coursera etc.
6. Syllabus, Model Question Papers and Model Blue Prints, Cos, POs, & PSOs mapping for I, II, III, IV, V, VII and VIII Semesters.
7. Teaching-learning methodology by 50:50 (External: Internal) ratio I, II, III & IV Year Students commenced w.e.f. 2021-22.
8. Minimum attendance of 75% for both I mid-term examination, and II mid- term examinationunder CIA component shall be the benchmark for attendance and itshall be approved in theBOS.
9. Minimum of 50% integration of ICT into a transaction of curriculum.
10. Remedial coaching and assignments for slow learners, project works, research, Conferences, Industrial /academic tours & PG Entrance Coaching etc., for advanced learners.
11. Panel of paper setters and examiners.
12. Implementation of compulsory Community Service Project (CSP)/ Internships/ Apprenticeship and Extension activities for the benefit of the society.
13. Department action plan for 2024-25.
14. To discuss and resolve the minor modifications/refinement if any, in the I, II, III, IV,V, VII,&VIII Semester.
15. Any Other Proposal with the permission of the Chairman.
16. Proposal to start new UG honors course i.e., BSc., Pharmaceutical Chemistry for the AY 2024-25.

**Resolutions:**

1. It is resolved to Approve the syllabus after certain additions and deletions were made during the BOS meeting in the existing syllabus for I,II,III, IV semesters of a Single major system as B.Sc. Chemistry (Hons), B.Sc. Organic Chemistry (Hons), B.Sc. Analytical Chemistry (Hons) from the academic year 2024-25. &V ,VI semesters of CBCS System.
2. It is resolved to approve the syllabus as per the APSCHE recommendations for IV year B.Sc. Honors to the students who were admitted in the academic year 2021-22.
3. It is resolved to approve the syllabus as per the recommendations of the BOS for the Semester System and revised Choice Based Credit System (CBCS)being implemented for the past 04 years, i.e., i.e. 2020-21.
4. It is resolved to approve the Continuation/Modifications of the syllabus for the Odd& Even Semesters of I, II, III & IV Years for 2024-25. As per the recommendations of the BOS.
5. IIt is resolved to approve the Extra credits for Online SWAYAM MOOCs, edX, Coursera etc. which is as per the guidelines of Autonomous examination Cell.
6. It is resolved to approve Syllabus, Model Question Papers and Model Blue Prints, Cos, POs, & PSOs mapping for I, II, III, IV, V, VII and VIII Semesters. With respect to the discussions held in the BOS.
7. It is resolved to approve the teaching learning methodology by 50:50 (External: Internal) ratio I, II, III & IV Year Students commenced w.e.f. 2021-22.
8. It is resolved to implement the Minimum attendance of 75% for both I mid-term examination and II mid- term examinationunder CIA component shall be the benchmark for attendance.
9. It is resolved to approve Minimum of 50% integration of ICT in transaction of curriculum.
10. It is resolved to implement Remedial coaching and assignments for slow learners, project works, research works, Conferences, Industrial /academic tours & PG Entrance Coaching etc., for advancedlearners.
11. It is resolved to propose Panel of paper setters and examiners for the academic year 2024-25.
12. It is resolved that the mandatory Community Service Project (CSP)/ Internships/ Apprenticeship and Extension activities are mandatory for overall growth of the student and benefit to the society.
13. It is resolved to approve Department action plan for the AY 2024-25.
14. It is resolved to approve the minor modifications/refinement if any, in the I, II, III, IV, V, VII,&VIII Semester.
15. It is resolved to send proposal to start new UG honors course i.e., B.Sc., Pharmaceutical Chemistry for the AY 2024-25.
16. It is resolved to send proposal to start diploma course in as per the NEP-2020 norms for the academic year 2024-25.

**DEPARTMENT OF CHEMISTRY**

**ACTION PLAN**

**ACADEMIC YEAR 2024-2025**

| S.No | Month | Activity planned |
|---|---|---|
| 1 | July 2024 | Enrollment of 3 months MOOCS/SWAYAM/NPTL/Edex etc by staff |
| 2 | July 2024 | Placement Drive through JKC |
| 3 | August 2024 | Invited talk |
| 4 | August 2024 | Study tour |
| 5 | August 2024 | Certificate/ Diploma course |
| 6 | September 2024 | National seminar/ online/offline |
| 7 | September 2024 | Sep 16 Ozone Day |
| 8 | October 2024 | Certificate course/Diploma course |
| 9 | November 2024 | Invited talk |
| 10 | December 2024 | Enrollment of 3 months MOOCS/SWAYAM/NPTL/Edex etc by students |
| 11 | December 2024 | International webinar |
| 12 | December 2024 | 10 December National Chemistry Day |
| 13 | January 2025 | Invited talk |
| 14 | January 2025 | Career Guidance |
| 15 | February 2025 | Community outreach program (In connection with the National Science Day) |
| 16 | March 2025 | Review of Research Publications for 24-25 |

# PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)

## KAKINADA

### IMPORTNANT DAYS OF OBSERVATION FOR AY 2024-25

| MONTH | DATE | NAME OF DAY | DEPARTMENT/STUDENT SUPPORTING WING |
|---|---|---|---|
| JANUARY | 26th | Republic Day | All Departments and student supporting wings |
| FEBRUARY | 28th | National Science Day | All Science departments |
| MARCH | 22nd | World Water Day | Chemistry |
| JUNE | 5th | World Environment Day | All Science departments |
| JULY | 11th | World Population Day | All Arts depts. |
| | 28th | World Nature Conservation Day | Life sciences |
| AUGUST | 15th | Independence Day | All Departments and student supporting wings |
| SEPTEMBER | 16th | World Ozone Day | Chemistry |
| | 21st | International Day of Peace | History |
| | 23rd | Mole Day | Chemistry |
| NOVEMBER | 11th | National Education Day | |

**Signature of the members who attended the board of studies in B.sc Honors Chemistry and B.sc Three major system chemistry on 30th April 2024 at 10 a.m. Mode of conduct of meeting offline / online**

| SL.NO | NAME | SIGNATURE | CONTACT NO. |
|---|---|---|---|
| 1 | V. Sanjeeva Kumar | V. S. | 9849324988 |
| 2 | Dr. K. Jhansi Lakshmi | K. Jhansi Lakshmi | 9441256409 |
| 3 | Dr. P. KARUNA RAMAN MD, IDEAL ORGANICS, HYDERABAD. | Dr.P.Karuna Raman | 9398249493 |
| 4 | Dr. D. Chenna Rao | | 9560740108 |
| 5 | U. Sai Krishna | U. Sai Krishna | 9347334707 |
| 6 | T. V. V. Satyanarayana | T. V. V. Satya | 9490876913 |
| 7 | P. Vijay Kumar | Pvijay | 9652023082 |
| 8 | V. Ram babu | | 9948485537 |
| 9 | G. Pavani | | 9912526493 |
| 10 | Dr. N. Bujji Babu | | 9441394792 |
| 11 | Dr. Ch. Praveen | praveen | 9491185518 |
| 12 | V. Venkateswara Rao | V. Venkateswara Rao | 9885165588 |
| 13 | U.S.N. Prasad | USNP | 6300882584 |
| 14 | K.N.S. Swamy | KNSSwamy | 9908900962 |
| 15 | S. Vijaya Lakshmi | S. Vijaya Lakshmi | 9133941966 |
| 16 | D.Bhavyasri | D. Bhavyasri | |
| 17 | Ch. Veni | Ch Veni | |
| 18 | Deepthi Anusha II FBC | P. Deepthi Anusha | 7382468859 |
| 19 | Syamala, II MCCS | A. Syamala | 6300192780 |
| 20 | | | |

**ADDITIONS/DELETIONS IN COURSESCHEMISTRY**

**2024-25**

| Year | SEMESTER & PAPER | ADDITIONS | DELETIONS |
|---|---|---|---|
| I | I & I | Adopted the same from APSCHE | |
| I | I & II | Adopted the same from APSCHE | |
| I | II & III | Adopted the same from APSCHE | |
| I | II & IV | Adopted the same from APSCHE | |
| II | III & III | Adopted the same from APSCHE | |
| II | IV & IV | Adopted the same from APSCHE | |
| II | IV & V | Adopted the same from APSCHE | |
| III | V & VIA | Added Green synthesis of pyrimidine | Green synthesis of Adipic acid |
| III | V & VIIA | NIL | NIL |
| III | VI | APPERENTICESHIP | |
| IV HONOURS | VII & VIIIA/B | Adopted the same from APSCHE | |
| IV HONOURS | VII & IXA/B | Adopted the same from APSCHE | |
| IV HONOURS | VII & XA/B | Adopted the same from APSCHE | |
| IV HONOURS | VII & XIA/B | Adopted the same from APSCHE | |
| IV HONOURS | VII & XIIA/B | Adopted the same from APSCHE | |
| IV HONOURS | XIII | ONLINE COURSE | |
| IV HONOURS | VIII & XIV A/B | Adopted the same from APSCHE | |
| IV HONOURS | VIII & XV A/B | Adopted the same from APSCHE | |
| IV HONOURS | VIII & XVIA/B | Adopted the same from APSCHE | |
| IV HONOURS | VIII & XVIIA/B | Adopted the same from APSCHE | |
| IV HONOURS | VIII & XVIIIA/B | Adopted the same from APSCHE | |
| IV HONOURS | XIX | ONLINE COURSE | |

**CIA structure for Single Major system**

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid-examinations will be conducted and the average of the two is considered.
- I mid-examination is to be conducted in offline mode at the college level and II mid-examination is to be conducted in online mode at the department level.
- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answerquestions with five marks each out of four questions and five objective questionswith one mark each for each paper.
- Question paper is to be given as per the following structure for the courses with **4 units**

| Unit No | Long Answer Question(10M) | Short Answer Question (5 M) | Objective Questions(1M ) |
|---|---|---|---|
| I | 1 | 0 | 1 |
| II | 1 | 0 | 1 |
| III | 0 | 2 | 1 |
| IV | 0 | 2 | 1+ one question from any unit with more syllabus weightage |

- For I mid examination to be conducted in offline mode, Question paperis to be given as per the following structure for the courses with **5 units**

| S.No | Unit No | Long Answer Question(10M) | Short Answer Question (5 M) | ObjectiveQuestions (1M) |
|---|---|---|---|---|
| 1 | I | 1 | 0 | 1 |
| 2 | II | 1 | 0 | 1 |
| 3 | III | 0 | 1 | 1 |
| 4 | IV | 0 | 1 | 1 |
| 5 | V | 0 | 1+ one question from any unit(III or IV or V) with more syllabus weightage | 1 |

- The remaining 25 marks for CIA are allocated as per the followingstructure.

| | | | | |
|---|---|---|---|---|
| Study Project-10M | Viva on theory- 3M | Assignment- 5M | Seminar- 5M | Clean & green and Attendance- 2M |

**CIA structure for 3 Major system**

- Out of 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will beconsidered
  .
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.

- I mid examination to be conducted in offline mode in which the student should attempt **one essay** question for ten marks out of two questions, **two short** answer questions with five marks each out of four questions and five objective questions with one mark each
- The remaining 25 marks for CIA are allocated as per the following structure.

| | | | | |
|---|---|---|---|---|
| Project-10M | Viva on theory- 3M | Assignment- 5M | Seminar- 5M | Clean & green and Attendance- 2M |

**CIA structure for 3 Major system for Honors programmes**
**(2020-21AB)**

- Out of 40 marks for CIA, 20 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- I mid examination is to be conducted in offline mode at college level and II mid examination is to be conducted in online mode at department level.
- I mid examination to be conducted in offline mode in which the student should attempt **Two essay** questions for ten marks each out of three questions, **four short** answer questions with five marks each out of six questions.

- The remaining 20 marks for CIA are allocated as per the following structure.

| | | |
|---|---|---|
| **Assignment- 10M** | **Seminar- 5M** | **Quiz -5M** |

**Allotment of Extra credits guidelines**

| Sl.No. | Activity | Details of achievement | Credits |
|---|---|---|---|
| 1 | **MOOC Course** | *SWAYAM /NPTEL /CEC etc., (Course Completion certificate with credits should be produced for the claim of extra credits)* | *Total credits achieved will be considered* |
| 2 | **NCC** | ***B CERTIFICATE*** | *2* |
| | | *Participation in National Camp after 'B' certificate* | *3* |
| | | ***C CERTIFICATE*** | *4* |
| | | *Adventure camp/RD parade along with 'B'* | *5* |
| | | *Failed in B certificate Examination* | *1* |
| 3 | **Sports** | *Intercollegiate selection* | *2* |
| | | *South zone selection* | *3* |
| | | *All India participation* | *4* |
| | | *Winning medals in all India competitions* | *5* |
| 4 | **NSS** | *40% attendance in regular NSS activities* | *1* |
| | | *50% attendance with Community Service* | *2* |
| | | *Conduct of survey/Youth exchange/RD* | *3* |
| 5 | **JKC** | *Enrollment and training* | *1* |
| | | *Campus recruitment local level* | *2* |
| | | *MNCs/reputed companies* | *3* |
| 6 | **Community service** | *Participation in community service by departments (outreach programmes)* | *2* |
| 7 | **Culturalactivity** | *Winning medals at state level-2,District level-1* | *2*<br>*1* |
| 8 | **COP/Add on Course** | *Pass in Certificate Exam-1,*<br>*Diploma-2* | *1*<br>*2* |
| 9 | **Support services** | *Lead India, Health club, RRC and Eco Club etc.,participation in various programmes* | *1* |

# SEMESTER-I

I -SEMESTER

## COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Hours: 5hrs/week Credits: 4

**Course Objective:**

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in

these areas, enabling them to apply scientific principles to real-world situations.

**Learning outcomes:**

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations

3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical

principles can be used to explain and predict phenomena in different contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

| | PITHAPUR RAJAH'S GOVERNMENT COLEGE (A)<br>Kakinada<br>DEPARTMENT OF CHEMISTRY | Program & Semester<br>I B.Sc.<br>(I Semester) | | | |
|---|---|---|---|---|---|
| Course CodeCHE-1 | TITLEOFTHECOURSE<br>ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES (MATHS STREAM) | | | | |
| Teaching | HoursAllocated:9 (**Theory**) | L | T | P | C |
| Pre-requisites | Fundamentals | 9 | 9 | 0 | 3/5 |

UNIT III: ESSENTIALS OF CHEMISTRY: : 9hrs

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**I SEMESTER (Admitted batch 2023-24)**

**Course -1**

**Essentials and Applications of Mathematical, Physical and Chemical Sciences**

**Question Bank**

**Unit - III**

**Essay Questions 10M**

1) Discuss about the various branches of chemistry? BT-2

2) Write a note on classification of carbohydrates? BT-1

3) Write an essay on classification of Amino acids? BT-1

.

**Short questions 5M**

1) Explain the classification of lipids? BT-1

2) Distinguish anomers and epimers with suitable examples? BT-3

3) What are essential and non essential amino acids? Give examples. BT-2

4) Explain fat soluble vitamins? BT-1

5) Explain scope of chemistry? BT-1

Unit – IV

Short questions 5M

1) Write a note on clinical trials? BT-2

2) Explain the applications of chemistry in materials science? BT-

**I SEMESTER (Admitted batch 2023-24)**

**COURSE 1-ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES**

**MODEL QUESTION PAPER**

**Time: 2 Hours** **Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks.** **3 X 10 = 30M**

**Part – A**

1. Change the complex number -4+ i4√3 in polar form. (BT-2)
2. Explain Newtonian mechanics and Relativistic mechanics. (BT2)
3. Discuss about the various branches of chemistry? BT-2

**Part – B**

4. Spring has a natural length of 1m. A force of 24 N Stretches the spring to a length of 1.8m
   a) Find the force constant k
   b) How much work will be taken to stretch the spring 2 m beyond its natural length?
   c) How far will a 45-N force stretch the spring.
5. Categorize various types of Networks? [BT2]
6. Summarize the various applications of Physics in Environmental Monitoring and Sustainable Technologies. (BT3)

**Section-II**

**Answer any three of the following questions.** **4 X 5 = 20M**

7. Evaluate $sin45^{\circ}cos30^{\circ} - cos45^{\circ}sin30^{\circ}$ (BT-3)
8. Evaluate the angle between the vectors $\bar{a} = i\hat{} - j\hat{} + k\hat{}$ and $\bar{b} = i\hat{} + j\hat{} - k$ (BT-3)
9. Explain Laws of Thermodynamics and Physical significance.(BT1)
10. Distinguish anomers and epimers with suitable examples? BT-3
11. What are essential and non essential amino acids? Give examples. BT-2
12. Explain the applications of chemistry in materials science? BT-1
13. What is cryptography? What are its fundamental types? [BT1]

| | **PITHAPUR RAJAH'S GOVERNMENT COLEGE (A)**<br>**Kakinada**<br>**DEPARTMENT OF CHEMISTRY** | **Program & Semester** |
|---|---|---|
| Course CodeCHE-2 | TITLEOFTHECOURSE<br>ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES(MATHS STREAM) | I B.Sc.<br>(I Semester) |

| Teaching | HoursAllocated:9 (**Theory**) | L | T | P | C |
|---|---|---|---|---|---|
| Pre-requisites | | 9 | 9 | 0 | 3/5 |

UNIT III: ADVANCES IN CHEMISTRY: 9hrs

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**I SEMESTER (Admitted batch 2023-24)**

**Course -2**

**Advances in MathemaƟcal, Physical and Chemical Sciences**

**QuesƟon Bank**

**Unit - III**

**Essay Questions 10M**

1. What is Computer Aided Drug Design? Write briefly about Structure based drug design and Ligand based drug design? BT1

2. Explain the impact of Chemical pollutants on human health? BT2

Short answer Questions 5M

1. What are nano sensors? Write the applications of nano sensors? BT1

2. Explain dye degradation by photocatalysis method? BT3

3. Write about green house effect? BT1

4. Write the applications of chemical biology? BT2

**Unit – III**

**Short answer Questions 5M**

1. Write briefly about the solid waste management? BT1

2. Analyse various methods of water treatment? BT3

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA**

**I SEMESTER (Admitted batch 2023-24)**

**COURSE 2- ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES**

**MODEL QUESTION PAPER**

**Time: 2 Hours Max Marks: 50M**

**Section -I**

Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks. 3 X 10 = 30M

**Part – A**

1 -2 3 1 0 2

1. If $A$ = [ 2 3 −1] and $B$ = [0 1 2] from the product AB and BA and show

−3 1

that AB ≠ BA.

2 1 2 0

(BT-2)

2. Write in detail write about the storage of renewable energy (BT1)

3. What is Computer Aided Drug Design? Write briefly about Structure based drug design and Ligand based drug design? BT-1

**Part – B**

4. The half-life of radioactive cobalt is 5.27 years. Suppose that a nuclear accident has left the level of cobalt radiation in a certain region at 100 times the level acceptable for human habitation. How long will it be unit the region is again habitable? (BT-4)

5. Define Network? Explain various networking devices. [BT1]

6. Describe the recent advances in medical physics (BT2)

**Section-II**

Answer any three of the following questions. 4 X 5 = 20M

7. Find the equation of a line, which passes through the points (-1, 1) and (2, -4). (BT-1)

8. Find the derivative of x cosx. (BT-2)

9. Explain dye degradation by photocatalysis method? BT3

10. Write about green house effect? BT1

11. Write briefly about the solid waste management? BT1

12. Describe about Shape Memory Materials (BT2)

13. Explain various types of number systems in computer. [BT1]

| | **PITHAPUR RAJAH'S GOVERNMENT COLEGE (A) Kakinada DEPARTMENT OF CHEMISTRY** | **Program & Semester** I B.Sc. (I Semester) | | | |
|---|---|---|---|---|---|
| Course CodeCHE-1 | TITLEOFTHECOURSE INTRODUCTION TO CLASSICAL BIOLOGY (BIOLOGY STREAM) | | | | |
| Teaching | HoursAllocated:9 (**Theory**) | L | T | P | C |
| Pre-requisites | Fundamentals | 9 | 9 | 0 | 3/5 |

**Unit 5: Essentials of Chemistry**

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2. Branches of Chemistry

5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.4. Green chemistry.

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**DEPARTMENT OF CHEMISTRY**

**I SEMESTER (Admitted batch 2023-24)**

**Course -1**

**INTRODUCTION TO CLASSICAL BIOLOGY**

**Question Bank**

**ESSENTIALS OF CHEMISTRY Unit - V**

**Essay Questions 10M**

1) Explain the principles of Green Chemistry. BT-2

2) Write any five applications of Chemistry in your daily life? BT-1

3) Describe any five differences between ionic and covalent bond. BT-2

.

**Short questions 5M**

1. Define and scope of Chemistry.
2. Write any five branches of chemistry
3. Write a short note on hydrogen bonds
4. How do you consider Green Chemistry principles over traditional chemistry principles?
5. Which branch of chemistry do you think is useful in your daily life? why?

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA**

**I SEMESTER (Admitted batch 2023-24)**

**COURSE 1-INTRODUCTION TO CLASSICAL BIOLOGY**

**MODEL QUESTION PAPER**

**Time: 2 Hours** **Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt at least one question from each part. Each question carries 10 Marks.** **3 X 10 = 30M**

**Part – A**

1. Define taxonomy and explain hierarchy levels BT1
2. Explain the hierarchical classification of Kingdom animalia and chordate BT1
3. Describe the process of gametogenesis, highlighting the key differences between spermatogenesis and Oogenesis BT2

**Part – B**

4. Explain the fertilization in Angiosperms BT2
5. Explain the central dogma of molecular biology. BT2
6. Explain the principles of Green Chemistry BT2

**Section-II**

**Answer any three of the following questions.** **4 X 5 = 20M**

7.List out the rules and principles of ICBN BT-1
8. Compare C3 and C4 cycles BT-2
9. Explain the processes of Mushroom Cultivation BT-3
10. Hormonal disorder BT-1
11. Mitochondria BT-2
12. Discuss the application of Chemistry in daily life. BT1
13. Elaborate various branches of Chemistry. BT3

# SEMESTER-II

# CHEMISTRY MAJOR

| | PITHAPUR RAJAH'S GOVERNMENT COLEGE(A)<br>Kakinada<br>DEPARTMENT OF CHEMISTRY | Program & Semester<br><br>I B.Sc.<br>(II Semester) | | | |
|---|---|---|---|---|---|
| Course Code<br>CHE-3 | TITLEOFTHECOURSE<br>**GENERAL AND INORGANIC CHEMISTRY** | | | | |
| Teaching | HoursAllocated:45 (**Theory**) | L | T | P | C |
| Pre-requisites | Atomic models and chemical bonding | 45 | 10 | 30 | 3+1 |

**Course Objectives:**

1. Atomic Structure and Periodic table
2. Ionic bond
3. The Covalent Bond
4. Metallic and Weak Bonds
5. Acids and Bases.

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the structure of atom and the arrangement of elements in the periodic table |
| CO2 | Understand the properties of Ionic bond. |
| CO3 | Identify the structure of a given inorganic compound. |
| CO4 | Explain the existence of special types of compounds through weak chemical forces. |
| CO5 | Define acids and bases and predict the nature of salts |

**Course with focus on Skill Development/Employability/Entrepreneurship modules**

| Skill Developement | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**UNIT-I: Atomic Structure and Periodic table** **9 h**

Electronic configuration: Bohr theory, dual nature of electrons, Heisenberg uncertainty principle, the Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).

Periodicity: periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical, and diagonal relationships in the periodic table. General

properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect

**UNIT-II : Ionic bond** **9h**

Properties of ionic compounds, factors favouring the formation of ionic compounds- ionization potential, electron affinity, and electronegativity. Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Stability of ionic compounds in terms of ΔHf and Uo. Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.

**UNIT-III: The Covalent Bond** **12 h**

Valance Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules-$BeCl_2$, $BF_3$, $CH_4$, $PCl_5$, $SF_6$– VSEPR model-effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, isoelectronic principle, illustration of structures by VSEPR model-$NH_3$, $H_2O$, $SF_4$, $ICl^-$, $XeF_4$, $XeF_6$

Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules ($N_2$, $O_2$, CO and NO)

**Unit-IV: Metallic and Weak Bonds** **9 h**

The Metallic bond: metallic properties, free electron theory, Valence Bond Theory, band theory of metals. Explanation of conductors, semiconductors and insulators.

Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds; associated molecules-ethanol and acetic acid; Vander Waals forces, ion dipole-dipole interactions.

**Unit-5: Acid Bases** **9h**

Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, the solvent system, Non-aqueous solvents: classification-protonic and aprotic solvents, liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.

Types of chemical reactions: acid-base, oxidation-reduction, calculation of oxidation number. Definition of pH, $pK_a$, $pK_b$. Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

**Reference books**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | J. D. Lee | Concise Inorganic Chemistry | Blackwell Science |
| 2 | B. R. Puri, L. R. Sharma, K. C. Kalia, | Principles of Inorganic Chemistry | Shoban Lal Nagin Chand and Co |
| 3 | D. F. Shriver and P. W. Atkins, | Inorganic Chemistry | W. H. Freeman and Co |

**WebLinks:**

**Course outcome & Program outcome mapping**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the structure of atom and the arrangement of elements in the periodic table |
| CO2 | Understand the structure of atom and the arrangement of elements in the periodic table |
| CO3 | Identify the structure of a given inorganic compound. |
| CO4 | Explain the existence of special types of compounds through weak chemical forces. |
| CO5 | Define acids and bases and predict the nature of salts |

**CO-PO Mapping:** **1: Low =1 ; 2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 1 |
| CO2 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |
| CO5 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5): Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employe

**Weightage to content**

**Semester -II**

**Course - 3**

| S.No | CourseContent | Long Answer | ShortAnswer | Totalmarks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Atomic Structure and Periodic table | 2 | 2 | 30 | Understanding, Application |
| 2 | Ionic bond | 1 | 1 | 15 | Remembering, Understanding |
| 3 | Covalent bond | 1 | 1 | 15 | Analysizing & Creation |
| 4 | Metallic and Weak bonds | 1 | 1 | 15 | Evaluation, Understanding |
| 5. | ACIDS & BASES | 1 | 2 | 20 | Understanding, Application |
| | **TOTAL** | **6** | **7** | **95** | |

# P.R. GOVERNMENT COLLEGE (A), KAKINADA

**I YEAR B.Sc (Examination at the end of II semester)**
**(COURSE – 3 - Inorganic and General Chemistry)**
**MODEL PAPER**

**Duration: 2hr** **Max.Marks:50M**

## Section -I

**Answer any three of the following questions. Must attempt atleast one question from each part.**

**Each question carries 10 Marks.** **3 X 10 = 30M**

### Part – A

1. Write a short note on a) Significance of wave function
   b) Electronic configuration rules.
2. Define lattice enthalpy. Determine lattice enthalpy by using born Haber cycle take an example.
3. Write about ionization energy and atomic size. What is the relation between them and justify your answer with an example.

### Part - B

4. Why $O_2$ is paramagnetic and $N_2$ is diamagnetic? Explain with the help of molecular orbital diagrams.
5. Describe the properties of metals by using free electron theory and band theory.
6. Write a brief note on Pearson concept of HSAB principle.

## Section II

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Predict the relation between pauling and Mulliken scale to explain electron negativity.
8. Explain Heisenberg uncertainty principle.
9. Write the factors favourable for the formation of ionic compounds. Explain with examples.
10. Illustrate the structure of ammonia and $XeF_4$ by VSEPR model.
11. Compare strength of hydrogen bonding strength In o-Nitrophenol and p- Nitro phenol.
12. Describe the nature of salts $NH_4Cl$, $CuSO_4$ and $KNO_3$.
13. Explain solvent effect of ammonia on alkali metals and alkaline earth metals.

**SEMESTER-II**

**COURSE 3: GENERAL AND INORGANIC CHEMISTRY**

Practical Credits: 1 2 hrs/week

## Practical- I Qualitative Analysis of SIMPLE SALT

Qualitative inorganic analysis (Minimum of Six simple salts should be analysed) 50 M

### I. Course outcomes:

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

1. Understand the basic concepts of qualitative analysis of inorganic simple salt.
2. Use glassware, equipment and chemicals and follow experimental procedures inthe laboratory
3. Apply the concepts of common ion effect, solubility product and concepts relatedto qualitative analysis

**Laboratory course syllabus: Analysis of SIMPLE SALT 50 M**

**I.**

Analysis of simple salt containing ONE anion and ONE cation from the following:
Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

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

### Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning.
2. Class Tests, Work sheets 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

## SCHEME OF VALUATION

| | |
|---|---|
| a. Preliminary Tests | 05 M |
| b. Identification of anion | 08 M |
| c. Conformation tests for anion | 10 M |
| d. Identification cation(Group separation table) | 10 M |
| e. Conformation of Cation | 05 M |
| f. Report | 02 M |
| g. Viva voce | 05 M |
| h. Record | 05 M |
| **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)<br>KAKINADA<br>DEPARTMENT OF CHEMISTY | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code<br>CHE-4 | TITLEOFTHECOURSE<br>**COURSE 4: INORGANIC CHEMISTRY** | I B.Sc.<br>(II Semester) | | | |
| Teaching | HoursAllocated:45 (**Theory**) | L | T | P | C |
| Pre-requisites | Fundamentals of classification of Elements. | 45 | 10 | 30 | 3+1 |

**CourseOutcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the structures of Diborane ,interhalogen compounds and Daily life applications of silicones. |
| CO2 | Identify the Charecteristics of d – block elements particularly variable oxidation states,Magnetic properties and catalytic Properties. |
| CO3 | Understand how to separate the Lanthanoid complexes. |
| CO4 | Define n/p ratio and Binding energy and predict the types of Radioactive series. |

**Course with focus on Skill Development/Employability/Entrepreneurship modules**

| SkillDevelopment | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**UNIT –I Chemistry of p-block elements – I 9 h**

Group 13: Preparation & structure of Diborane, Borazine and $(BN)_x$ Group14: Preparation, classification and uses of silicones and Silanes. Group 15: Preparation & structure of Phosphonitrilic Chloride $P_3N_3Cl_6$

**Unit II Chemistry of p-block elements – II 9 h**

Group 16: Classification of Oxides, structures of oxides and Oxoacids of Sulphur

Group 17: Preparation and Structures of Interhalogen compounds. Pseudohalogens,

**UNIT-III Chemistry of d-block elements: 9 h**

Characteristics of d-block elements with special reference to electronic configuration,variable valence, colour, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states of 3d series-Latimer diagrams.

**UNIT-IV Chemistry of f-block elements: 9 h**

Chemistry of lanthanides - electronic configuration, oxidation states, lanthanide contraction, consequences of lanthanide contraction, colour, magnetic properties.

Separation of lanthanides by ion exchange method.

Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

**Unit – V Radioactivity 9 h**

Definition, Isotopes, n/p ratio, binding energy, types of radioactivity, Soddy-Fajan's displacement law,Law of Radioactivity, Radioactive decay series, Nuclear Reactions- fission and fusion, Applications of radioactivity.

**Textbooks:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | J D Lee | Concise Inorganic Chemistry | |
| 2 | Puri and Sharma | Inorganic chemistry | |

**Reference books**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Cotton and Wilkinson | Basic Inorganic Chemistry | |
| 2 | Satya Prakash | Advance Inorganic chemistry vol-I | |
| 3 | Maheshwar Sharon | Nuclear Chemistry | |

**WebLinks:**

1. https://www.slideshare.net/terencepereira58/diborane
2. https://www.youtube.com/watch?v=xKzaHJAEPeA
3. https://www.idc-online.com/technical_references/pdfs/chemical_engineering/Oxides.pdf
4. https://www.youtube.com/watch?v=4aoUwJ5COpg
5. https://byjus.com/jee/lanthanides/
6. https://www.youtube.com/watch?v=PNQVovRfIoA
7. https://web.pdx.edu/~pmoeck/lectures/modern/TRM-13.ppt
8. https://www.toppr.com/ask/en-np/question/state-soddyfajans-displacement-laws-for-radioactive-transformations/

**Course outcome & Program outcome mapping**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the structures of Diborane ,interhalogen compounds and Daily life applications of silicones. |
| CO2 | Identify the Charecteristics of d – block elements particularly variable oxidation states,Magnetic properties and catalytic Properties. |
| CO3 | Understand how to separate the Lanthanoid complexes. |
| CO4 | Define n/p ratio and Binding energy and predict the types of Radioactive series. |

**CO-PO Mapping: 1: Low =1 ;2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0**

| CO | PO1 | PO 2 | PO3 | PO 4 | PO 5 | PO6 | PO 7 | PSO1 | PSO2 | PSO 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 2 | | |
| CO2 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 2 | | |
| CO3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | | |
| CO4 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | | |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5): Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena,
processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry
**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation
and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to contentSemester -II**
**Course - 4**

| S.No | CourseContent | Long Answer | ShortAnswer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Chemistry of p – block elements. | 1 | 2 | 20 | Understanding, Application |
| 2 | Chemistry of p – block elements. | 2 | 1 | 25 | Remembering, Understanding |
| 3 | Chemistry of d- block elements. | 1 | 1 | 15 | Analysizing & Creation |
| 4 | Chemistry of f-block elements. | 1 | 1 | 15 | Evaluation, Understanding |
| 5. | Radioactivity | 1 | 2 | 20 | Understanding, Application |
| | **TOTAL** | **6** | **7** | **95** | |

**P.R. GOVERNMENT COLLEGE (A), KAKINADA**

**I YEAR B.Sc (Examination at the end of II semester)**
**(COURSE – 4 Inrganic Chemistry)**
**MODEL PAPER**

**Duration: 2hr** **Max.Marks:50M**

## Section – 1

**Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks.** **3 X 10M = 30M**

**Part –A**

**1**. Write any two preparation methods of diborane and deduce its structure.

2.write a short note on

a) Oxo acids of Sulphur

b) classification of oxides based on chemical properties.

3.Define interhalogen compounds and draw the structure of $ClF_3$ and $BrF_5$.

**Part – B**

4.Write an essay on characteristics of d- block elements.

5.How to separate the lanthanides by using ion exchange method.

6.explain the following

a) Soddy- Fajan's displacement law.

b) law of Radioactivity

## Section – II

**Answer any four of the following questions. Each carries 5 marks.** **4 X 5M= 20M**

7. Why Borazine is called as inorganic Benzene. Support your answer with proof?
8. Write the Daily life applications of silicones?
9. Explain the structure and hybridization of $So_3$.
10. Why Particularly d- block elements act as catalysts. Explain with suitable examples?
11. Define Lanthanide contraction and write its consequences?
12. Define Isotopes, n/p ratio and Binding energy?
13. Write a short note on applications of Radioactivity?

**SEMESTER-II**

**COURSE 4: ORGANIC CHEMISTRY**

Practical Credits: 1 2 hrs/week

**Preparation of Inorganic compounds:**

1. Crystallization of compounds and determination of melting point.
2. Preparation of Cuprous chloride.
3. Preparation of Potash Alum.
4. Preparation of Chrome Alum.
5. Preparation of Ferrous oxalate
6. Preparation of Ferrous ammonium sulphate.

**Learning Out comes**:

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

1. Understand the basic concepts of inorganic preparations.
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
3. Apply the properties of various elements for the preparation of inorganic compounds.

**Lab References:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Vogel's, | Quanlitative Inorganic Analysis | Seventh edition, Pearson. |

Co-Curricular Activities:

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

1. For Teacher: Training of students by teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.
2. For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the techniques used for the separation of organic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3. Max marks for Fieldwork/project work Report:05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

b) Suggested Co-Curricular Activities

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

**SCHEME OF VALUATION**

Practical Paper – 4:: Inorganic Chemistry(at the end of semester II)

| | |
|---|---|
| a. Procedure & Equation | 13M |
| b. Preparation | 15M |
| c. Report the yield | 2M |
| d. Determination of Melting Point | 10M |
| e. Viva voce | 05M |
| f. Record | 05M |
| **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)<br>KAKINADA<br>DEPARTMENT OF CHEMISTY | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code<br>CHE-5 | TITLEOFTHECOURSE<br>**COURSE 5: FUNDAMENTALS IN ORGANIC CHEMISTRY** | II B.Sc.<br>(III Semester) | | | |
| Teaching | HoursAllocated:45 (**Theory**) | L | T | P | C |
| Pre-requisites | Fundamentals of organic reagents and reactions | 45 | 10 | 30 | 3+1 |

**CourseOutcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand and explain the differential behaviour of organic compounds based onfundamental concepts learnt |
| CO2 | Formulate the mechanism of organic reactions by recalling and correlating thefundamental properties of the reactants involved. |
| CO3 | Learn and identify many organic reaction mechanisms |
| CO4 | Correlate and describe the stereo-chemical properties of organic compounds andreactions |

**Course with focus on Skill Development/Employability/Entrepreneurship modules**

| SkillDevelopment | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**Unit 1: Structural theory in Organic Chemistry (9 h)**

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents). Reaction intermediates – Carbocations, carbanions & free radicals. Bond polarization: Factors influencing the polarization of covalent bonds, inductive effect - Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

**Unit II: Saturated Hydrocarbons (Alkanes and Cycloalkanes) 9 h**

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, 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 monosubstituted cyclohexane.

**UNIT-III: Unsaturated Hydrocarbons (Alkenes and Alkynes) 9 h**

General methods of preparation, physical and chemical properties, Saytzeff and Hoffmann eliminations (with mechanism), Electrophilic Additions, ($H_2$, HX) mechanism (Markownikoff/ Antimarkownikoff addition) with suitable examples-syn and anti-addition;
addition of $X_2$, HX. Oxymercuration demercuration, ozonolysis, hydroxylation, Diels Alder reaction, 1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylationof terminal alkynes.

**UNIT-IV: Benzene and its reactivity (9 h )**
Structure of Benzene – Preparation - polymerisation of acetylene and decarboxylation- Properties - mechanism of electrophilic aromatic substitution of Friedel- Craft's alkylation and acylation. halogenation and nitration.

**UNIT-V: Orientation of aromatic substitution (9 h )**

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation) Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like $NO_2$ and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens.

**Textbooks:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | **O.P Agarwal** | **Unified Chemistry** | JPNP publications |
| 2 | **Bhal and Arun Bhal** | **Text book of Advanced organic chemistry** | S.Chand publications |

**Reference books**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | **Finar, I. L** | **Organic Chemistry (Volume 1)** | Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation). |
| 2 | **Morrisson and Boyd** | **Organic Chemistry** | **Oxford University Press** |
| 3 | **J.March** | **Organic reaction Mechanisms** | **Oxford University Press** |

**WebLinks:**

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==
2. https://courseware.cutm.ac.in/wp-content/uploads/2020/05/preparationofalkanesclass11-151207081547-lva1-app6891.pd
3. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==
4. https://byjus.com/chemistry/diene/
5. https://colapret.cm.utexas.edu/courses/Chapter%2022-benzos.pdf

**Course outcome & Program outcome mapping**

| On Completion of the course, the students will be able to | |
|---|---|
| CO 1 | Understand and explain the differential behaviour of organic compounds based onfundamental concepts learnt |
| CO 2 | Formulate the mechanism of organic reactions by recalling and correlating thefundamental properties of the alkanes and cyclo alkanes involved. |
| CO 3 | Learn and identify many organic reaction mechanisms of alkenes and alkynes |
| CO 4 | Correlate and describe aromaticity & orientation effects of various substituents on the electromatic substitution in benzene |

**CO-PO Mapping: 1: Low =1 ;2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0**

| CO | PO1 | PO 2 | PO3 | PO 4 | PO 5 | PO6 | PO 7 | PSO1 | PSO2 | PSO 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 2 | | |
| CO2 | 3 | 1 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 2 | | |
| CO3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | | |
| CO4 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | | |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both

qualitatively and quantitatively in laboratories and in industries.
**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5): Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena,
processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry
**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation
and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**
**Semester -II**
**Course - 5**

| S.No | CourseContent | Long Answer | ShortAnswer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Structural theory in Organic Chemistry. | 2 | 1 | 20 | Understanding, Application |
| 2 | Saturated Hydrocarbons (Alkanes and Cycloalkanes). | 1 | 2 | 25 | Remembering, Understanding |
| 3 | Unsaturated Hydrocarbons (Alkenes and Alkynes) | 1 | 2 | 15 | Analysizing & Creation |
| 4 | Benzene and its reactivity | 1 | 1 | 15 | Evaluation, Understanding |
| 5. | Orientation of aromatic substitution | 1 | 1 | 20 | Understanding, Application |
| | **TOTAL** | **6** | **7** | **95** | |

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**II YEAR B.Sc (Examination at the end of III semester)**
**(COURSE – 5 Basic Principles of Organic Chemistry)**
**MODEL PAPER**

**Duration: 2hr** **Max.Marks:50M**

## Section – 1

**Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks.** **3 X 10M = 30M**

**Part -A**

1. Write about inductive effect and its applications. BT1, CO1
2. Elaborate the mechanism of markonikoff and anti markonikoff addition of HBr to propene. BT2, CO3.
3. Write any two preparation methods of cyclo alkanes? Explain the stability of cyclo alkanes with Baeyer's strain theory.BT1, CO2.

**Part-B**

4. Discuss the mechanism of electrophilic substitution reactions of benzene. BT3, CO4
   a) Nitration b) Friedel - Craft alkylation
5. Explain the Concept of aromaticity. How the Huckel's rule is applicable to Benzenoid and Non - Benzenoid compounds? BT4, CO4
6. What is the Mesomeric effect and explain the acidity of phenol? BT2, CO1

**Section - II**

**Answer any four of the following questions. Each carry 5 marks. 4 X 5M= 20M**

7. Why 2- butene is more stable than 1- butene? Explain. BT3, CO1
8. How do you prepare alkanes by using Wurtz reaction and Corey House synthesis? BT3, CO2
9. Explain the conformational analysis of n - butane. BT2, CO2
10. Write about Diels Alder reaction.BT2, CO3
11. Explain acidity of alkyne. BT3, CO3
12. Write any two methods for the preparation of benzene. BT1, CO4
13. How does the methoxy group effects the incoming electrophile in Benzene towards electrophilic substitution reaction? BT4, CO4

.

**SEMESTER-III**

**COURSE 5: FUNDAMENTALS IN ORGANIC CHEMISTRY**

Practical Credits: 1 2 hrs/week

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

**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 thelaboratory.

2. Determine melting and boiling points of organic compounds.

3. Understand the application of concepts of different organic reactions studied in theory partof organic chemistry.

**Lab References:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Vogel A I | Practical organic Analysis | Seventh edition, Pearson. |
| 2 | Bansal R.K | Laboratory Manual of Organic **Chemistry** | Wiley-Eastern |
| 3 | Ahluwalia & Aggarwal R | Comprehensive Practical Organic Chemistry | University press. Delhi |

Co-Curricular Activities:

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

1. For Teacher: Training of students by teacher in laboratory and field for not lessthan15 hourson the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.

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

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

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

5. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of videos and othermaterial.

3. Visits of facilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts

## SCHEME OF VALUATION

Practical Paper –5 :: Fundamental in organic Chemistry(at the end of semester III)

| S.NO | TEST | MARKS |
|---|---|---|
| 1 | Color, State + Melting/Boiling Point | 2+2 M |
| 2 | Ignition test | 2 M |
| 3 | Solubility | 2 M |
| 4 | Unsaturation test | 4 M |
| 5 | Lassaigne test | 4 M |
| 6 | Any one preliminary test for Functional group | 4 M |
| 7 | Any one Confirmation test for Functional group | 4 M |
| 8 | Any one derivative for Functional group | 4 M |
| 9 | Report | 2 M |
| 10 | Record | 10 M |
| 11 | Viva voce | 10 M |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE<br>Kakinada | Program & Semester<br><br>II B.Sc. Chemistry Hons<br>(III Semester) | | | |
|---|---|---|---|---|---|
| Course Code<br>CHE-VI | TITLE OF THE COURSE<br>**ORGANIC CHEMISTRY**<br>**2023-24 AB** | | | | |
| Teaching | Hours Allocated: 45 (**Theory**) | L | T | P | C |
| Pre-requisites | Halogen compounds, Hydroxy compounds, Carbonyl compounds, Carboxylic acids, Carbohydrates, | 45 | 10 | 30 | 3+1 |

**Course Objectives:**

1. Halogen compounds
2. Hydroxy compounds
3. Carbonyl compounds
4. Carboxylic acids
5. Carbohydrates

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the concept of SN1andSN2and SNi mechanisms |
| CO2 | Describe the reactivity of alcohols and phenols. |
| CO3 | Achieve the skills required to propose various mechanisms for carbonyl compounds |
| CO4 | Apply the concepts for synthesizing various organic compounds |
| CO5 | Interconvert the monosaccharides |

**Course with focus on employability / entrepreneurship / Skill Development modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**UNIT-I : HALOGEN COMPOUNDS** **( 9 h)**

**Alkyl halides:** Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - nucleophilic substitution reactions–SN1and SN2 and SNi mechanisms with energy profile diagrams, stereo chemical aspects and effect of solvent. Williamson's synthesis.

**Aryl halides:** Preparation i) from phenols ii) Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism); relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

**UNIT- II : HYDROXY COMPOUNDS ( 9 h )**

**Alcohols:** Preparation of $1^{o}$ ,$2^{o}$ ,$3^{o}$ alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties – substitution of –OH by using $PCl_5$, PCl3, PBr3, $SOCl_2$ and with HX / $ZnCl_2$, Oxidation of alcohols with PCC, PDC; Oxidation of diols by $HIO_4$ and $Pb(OAc)_4$, Pinacol Pinacolone arrangement with mechanism, relative reactivity of 1°, 2°, 3° alcohols.

**Phenols :**Preparation from diazonium salt and Cumene. Reactions and mechanism– Reimer– Tiemann,Kolbe–Schmitt Reactions, Fries and Claisen rearrangement

**UNIT-III** : **CARBONYL COMPOUNDS ( 9 h )**

Preparation from-Acid chlorides,1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, NaHSO3 and alcohols. Addition-elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semicarbazide. Oxidations and reductions (Clemmensen's, Wolf–Kishner's, with$LiAlH_4$ & $NaBH_4$).

**Reaction & Mechanism-** Aldol condensation, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Claisen-Schmidt reaction, Haloform reaction.

**Unit-4 : CARBOXYLIC ACIDS AND ACTIVE METHYLENE COMPOUNDS 9h**

**Carboxylic Acids:** Preparation from Grignard reagent and hydrolysis of nitriles, Reactions of monocarboxylic acids- Reactions involving -H, -OH and -COOH groups, formation of salts, esters, acidchlorides, amides and anhydrides. Degradation of carboxylic acids by Huns-Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction. Mechanisms of acidic and alkaline hydrolysis of esters, Reformatsky reactions, Curtius rearrangement.

**Active methylene compounds:** Keto-enol tautomerism, preparation of Aceto Acetic Ester (AAE) by Claisen condensation with mechanism, synthetic applications of AAE in the preparation of mono carboxylic acids, di carboxylic acids, α,β-unsaturated acids and heterocyclic compounds.

**Unit-5: CARBOHYDRATES** **9h**

Classification and their biological importance, Monosaccharides: Structural elucidation 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– Haworth structure of maltose, lactose and sucrose

| Unit No | Additions | Deletions | Remarks as per Blooms Taxonomy |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

**Reference & Text books:**


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

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

3) Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition,1985.


**Weightage to content**
**Semester -III**
**Paper-VI**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Halogen Compounds | 1 | 2 | 20 | Understanding, Application |
| 2 | Hydroxy Compounds | 1 | 2 | 20 | Remembering, Understanding |
| 3 | Carbonyl Compounds | 1 | 1 | 15 | Application & Creation |
| 4 | Carboxylic Acids and Active Methylene Compounds | 2 | 1 | 25 | Remembering, Understanding |
| 5 | Carbohydrates | 1 | 1 | 20 | Application & Creation |
| | **TOTAL** | **6** | **7** | **95** | |

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA**

**II YEAR B.Sc Chemistry Hons (2023-24 AB)**
**(Examination at the end of III semester)**
**Paper-VI :: ORGANIC CHEMISTRY)**
**MODEL PAPER**

**Duration: 2hrs** **Max. Marks: 50**

---

## PART- A

Answer any **THREE** of the following questions by choosing at least **ONE** from each section. Each carries **TEN** marks 3 X 10 = 30 M

SECTION -A

1. Unit - I
2. Unit - II
3. Unit – III

SECTION -B

4. Unit - IV
5. Unit - IV
6. Unit – V

## PART- B

Answer any **FOUR** questions. Each carries FIVE marks 4 X 5 = 20 Marks

7. Unit – I
8. Unit – I
9. Unit – II
10. Unit – II
11. Unit – III
12. Unit – IV
13. Unit – V

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A) :: KAKINADA**
**II YEAR B.Sc Chemistry Hons (2023-24 AB)**
**(Examination at the end of III semester)**
**Practical Paper – VI :: Organic Chemistry**

**Credits: 01** 30 hrs (2 h / W) **50Marks**

## Organic preparation

**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 perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
4. 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.

**Syllabus - Organic preparations (50M)**

i. Acetylation of β-naphthol, vanillin and salicylic acid by: a) Using conventional method. b) Using green approach
ii. Preparation of Nerolin

**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 .

**Reference books**:

1. Vogel A.I .Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University press

| | PITHAPUR RAJAH'S GOVERNMENT COLEGE(A)<br>Kakinada<br>DEPARTMENT OF CHEMISTRY | Program & Semester<br><br>II B.Sc.<br>(III Semester) | | | |
|---|---|---|---|---|---|
| Course Code<br>CHE-7 | TITLEOFTHECOURSE<br>PHYSICAL CHEMISTRY – I<br>(Solutions & Electro Chemistry) | | | | |
| Teaching | HoursAllocated:45 (**Theory**) | L | T | P | C |
| Pre-requisites | | 45 | 10 | 30 | 3+1 |

**Course Objectives:**

1. Understanding Solutions
2. Electrochemical Concepts
3. Equilibrium in Electrochemical Systems
4. Applications of Electrochemistry
5. Problem-solving Skills

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the ideal and non ideal behaviour of solutions |
| CO2 | Determine the molecular mass of non-volatile solutes. |
| CO3 | Discuss the basic concepts of Photochemistry. |
| CO4 | Apply the principles of electrical conductivity. |
| CO5 | Explain the importance of emf and its applications |

**Course with focus on Skill Development/Employability/Entrepreneurship modules**

| Skill Developement | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

PHYSICAL CHEMISTRY – I

( Solutions & Electro Chemistry **Syllabus)**

Unit I Solutions ( 9 h )

Classification - Miscible, Partially miscible and Immiscible - Raoult's Law - AzeotropesHCl-H2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

Unit II Colligative Properties ( 9 h )

Relative lowering of Vapour Pressure, Elevation in boing point depression in freezing point and Osmotic pressure. Determination of molecular mass of non-volatile solute by OstwaldWalker method, Cottrell's method, Rast method and Barkeley-Hartley method. Abnormal colligative properties. Van't Hoff factor.

Unit III – Photochemistry ( 9h )

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, chemiluminescence - Photosensitized reactions- energy transfer processes (simple example), quenching, Photo stationary state.

Unit IV Electrochemistry-I ( 9 h )

Conductance, Specific conductance, equivalent conductance and molar conductance - 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 (derivation excluded), Application of conductivity measurements- conductometric titrations.

Unit V Electrochemistry-II ( 9 h )

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metalmetal 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. Fuelcells – Basic concepts, examples and applications

**Reference books**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Prutton and Marron | Principles of physical chemistry | |
| 2 | Anthony R. West | Solid State Chemistry and its applications | |
| 3 | K L Kapoor | Text book of physical chemistry | |
| 4 | S Glasstone | Text book of physical chemistry | |
| 5 | Bahl and Tuli | Advanced physical chemistry | |
| 6 | GurudeepRaj | Advanced physical chemistry | |
| 7 | Puri, Sharma and Pathania | Principles of physical chemistry | |

**WebLinks:**

**Course outcome & Program outcome mapping**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand the ideal and non ideal behaviour of solutions |
| CO2 | Determine the molecular mass of non-volatile solutes. |
| CO3 | Discuss the basic concepts of Photochemistry. |
| CO4 | Apply the principles of electrical conductivity. |
| CO5 | Explain the importance of emf and its applications |

**CO-PO Mapping:** **1: Low =1 ; 2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 1 | 2 | 3 | 1 | 4 | 1 | 4 | 2 |
| CO2 | 2 | 4 | 1 | 4 | 1 | 3 | 2 | 1 | 3 | 2 |
| CO3 | 2 | 3 | 2 | 3 | 1 | 2 | 4 | 2 | 1 | 2 |
| CO4 | 2 | 4 | 2 | 2 | 3 | 2 | 1 | 2 | 3 | 1 |
| CO5 | 1 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 1 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5): Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our undergraduates would be able to:

**PSO 1-** Evaluate, analyze, interpret, and effectively apply the basic laws, principles, phenomena,processes, and mechanisms involved in the domain of organic, inorganic, physical, and analyticalChemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education, and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation,and reaction mechanisms with an understanding of basic tools to be employed

**Weightage to content**
**Semester -III**
**Course - 7**

| S.No | CourseContent | Long Answer | ShortAnswer | Totalmarks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Unit I Solutions | 2 | 2 | 30 | Understanding, Application |
| 2 | Unit II Colligative Properties | 1 | 1 | 15 | Remembering, Understanding |
| 3 | Unit III – Photochemistry | 1 | 1 | 15 | Analysizing & Creation |
| 4 | Unit IV Electrochemistry-I | 1 | 1 | 15 | Evaluation, Understanding |
| 5. | Unit V Electrochemistry-II | 1 | 2 | 20 | Understanding, Application |
| | **TOTAL** | **6** | **7** | **95** | |

# P.R. GOVERNMENT COLLEGE (A), KAKINADA

**II YEAR B.Sc (Examination at the end of III semester)**

**(COURSE – 7 -** PHYSICAL CHEMISTRY – I
(Solutions & Electro Chemistry)

**MODEL PAPER**

---

**Duration: 2hr** **Max.Marks:50M**

## Section -I

**Answer any three of the following questions. Must attempt atleast one question from each part.**

**Each question carries 10 Marks.** **3 X 10 = 30M**

**Part – A**

1. UNIT-I
2. UNIT-I
3. UNIT-II

**Part - B**

4. UNIT-III
5. UNIT-IV
6. UNIT-V

## Section II

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. UNIT-I
8. UNIT-I
9. UNIT-I I
10. UNIT-III
11. UNIT-IV
12. UNIT-V
13. UNIT-V

**SEMESTER-III**

**COURSE 7: PHYSICAL CHEMISTRY -I**

Practical Credits: 1 2 hrs/week

**Practical- PHYSICAL CHEMISTRY -I (PHYSICAL CHEMISTRY) 50 M**

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

- Apply the principles of phase equilibrium to determine the critical solution temperature (CST) for a binary system.
- Understand the role of electrolytes in altering the intermolecular forces and interactions between solvent and solute molecules.
- Understand the principles of conductometric titration, including the equivalence point, conductivity changes, and titration curves.
- Apply the principles of conductometric titration to determine the concentration of weak acid solutions.
- Interpret experimental data to calculate the concentration of acetic acid solution using standard sodium hydroxide solution.
- Understand the principles of potentiometric titration, including the use of a pH meter to monitor changes in solution acidity.
- Apply titration calculations and the Nernst equation to determine the concentration of hydrochloric acid solution accurately.

**Laboratory course syllabus: CST, Conductometric and Potentiometric Titrimetry 50 M**

1. Determination of CST for Phenol-water system.
2. Effect of electrolyte on CST.
3. Conductometric titration - Determination of concentration of HCl solution using standard NaOH solution.
4. Conductometric titration – Determination of concentration of CH3COOH Solution using standard NaOH solution.
5. Potentiometric titration-Determination of concentration of HCl using standard NaOH solution.

**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

## SCHEME OF VALUATION

| | |
|---|---|
| a. Procedure in first 20 Minutes | 10 M |
| b. Tabular form& Formula | 10 M |
| c. Graph & Calculation | 10 M |
| d. Result with error <2%<br>>2% | 10 M<br>05 M |
| e. Viva voce | 05 M |
| f. Record | 05 M |
| **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code - **8** | TITLE OF THE COURSE **INORGANIC AND PHYSICAL CHEMISTRY** | II B.Sc. (III Semester) | | | |
| Teaching | Hours Allocated: 45 (**Theory**) | L | T | P | C |
| Pre-requisites | Properties of d- Block elements, Basic terminology of Complex compounds, Basic Definitions of thermodynamic Macroscopic properties. | 45 | 10 | 30 | 3+1 |

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understanding the Structure and reactivity of Coordination compounds wrt bonding theories like VBT & CFT |
| CO2 | Apply the Knowledge of Coordination chemistry in various applications such as catalysis, material sciences, medicines and Organometallic chemistry. |
| CO3 | Apply the 18-electron rule & identify the importance of metals in Organometallic Chemistry. |
| CO4 | Discuss the basic concepts of Thermodynamics. |

**Course with focus on employability/entrepreneurship/SkillDevelopment modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Unit I: Coordination Chemistry-I ( 9 h )**

IUPAC nomenclature of Coordination compounds, structural and stereo isomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Postulates magnetic properties- Inner and outer orbital complexes. Limitations of VBT, CFT- Postulates- Splitting in Octahedral, tetrahedral, tetragonal and square planar fields. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Factors affecting the magnitude of crystal field splitting energy, Spectro chemical series, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion.

**UNIT–II Coordination Chemistry II (9 h)**

**1. Inorganic molecular Reaction Mechanism: ( 6 h)**

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: (3 h)**

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.

**Unit III Organo metallic compounds (9 h)**

Definition and classification of organo metallic Compounds on the basis of bond type, Metalcarbonyls:18electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. π-acceptor behavior of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

**Unit IV Thermodynamics- I (9 h)**

Concept of heat(q), work(w), internal energy(U), State function and Path function- statement of first law; enthalpy(H), relation between heat capacities, calculations of q, w, U and H for reversible, irreversible processes, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. Temperature dependence of enthalpy of formation- Kirchoff's equation.

**Unit V Thermodynamics II (9 h)**

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 nonspontaneous processes, Helmholtz and Gibbs equation - Criteria for spontaneity.

**Suggested Co-Curricular and Extra Curricular Activities**

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

**Text books:**

1) Concise coordination chemistry by Gopalan and Ramalingam

2) Coordination Chemistry by Basalo and Johnson

3) Text book of physical chemistry by S Glasstone

4) Concise Inorganic Chemistry by J.D. Lee

5) Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

6) A Text Book of Physical Chemistry by K. L. Kapoor Vol 2, 6th edition, 2019.

7) Inorganic Chemistry Huheey, Harper and Row.

8) Modern Inorganic Chemistry, W.L. Jolly, Mc Graw Hill.

9) Text book of Physical Chemistry by Atkins

**CO-PO Mapping:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understanding the Structure and reactivity of Coordination compounds wrt bonding theories like VBT & CFT |
| CO2 | Apply the Knowledge of Coordination chemistry in various applications such as catalysis, material sciences, medicines and Organometallic chemistry. |
| CO3 | Apply the 18-electron rule & identify the importance of metals in Organometallic Chemistry. |
| CO4 | Discuss the basic concepts of Thermodynamics. |

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3; 4: No Correlation = 0**

| | PO1 | PO2 | PO 3 | PO 4 | PO5 | PO 6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |

## PROGRAMME OUTCOMES

At the completion of the B.Sc. Chemistry program, the students of our department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5): Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to contentSemester -III**

**Paper-VIII**

**INORGANIC AND PHYSICAL CHEMISTRY**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | **Coordination Chemistry-I** | 2 | 2 | 30 | Understanding, Application |
| 2 | Coordination Chemistry II | 1 | 1 | 15 | Remembering, Understanding |
| 3 | Organo metallic compounds | 1 | 1 | 15 | Analyzing & Creation |
| 4 | Thermodynamics- I | 1 | 2 | 20 | Evaluation, Understanding |
| 5 | Thermodynamics- II | 1 | 1 | 15 | Application & Creation |
| | **TOTAL** | **6** | **7** | **95** | |

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**
**II YEAR B.Sc (Examination at the end of III semester)**
**INORGANIC AND PHYSICAL CHEMISTRY**
**Paper-VIII**
**MODEL PAPER**

**Duration: 2hrs.** **Max.Marks:50**

---

## PART-I

Answer any **THREE** of the following by Choosing at least **ONE** from each section 3×10=30M

## SECTION-A

1. Discuss the salient features of crystal field theory. Explain the Crystal field splitting of d- orbitals in Octahedral, complexes?
2. Explain the Geometry and magnetic properties of Following compounds on basis of VBT
   i. $[Co(NH_3)_6]^{+3}$ ii. $[Ni(CO)_4]$
3. Explain the factors affecting the stability of complexes.

## SECTION-B

4. What is Organometallic Compounds? Explain the classification of organometallic Compounds on the basis of bonding
5. Derive the equations for work done by ideal gas at isothermal and adiabatic conditions.
6. What is Carnot cycle? Explain Efficiency of Heat Engine by Carnot cycle?

## PART-II

Answer any **Four** Questions from the following 4×5=20M

7. Discuss about Structural isomerism in coordination compounds with examples
8. Calculate EAN of the following i. $K_3[Fe(CN)_6]$ ii. $[Co(NH_3)_6]$
9. What is Trans effect? Write its applications?
10. Define 18 electron rule. Explain with an example.
11. Derive the relation between $C_P$ and $C_V$
12. Explain Joule Thomson Effect.
13. Explain Concept of Entropy?

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**II YEAR B. Sc (Examination at the end of III semester)**

**INORGANIC AND PHYSICAL CHEMISTRY**

**QUESTION BANK**

**Unit-I**

## Essay Questions

1. Explain the Geometry and Magnetic Properties of any two of the following

a) $[Co(NH_3)_6]^{+3}$ b) $[Fe(CN)_6]^{-4}$ c)$[Cr(NH_3)_6]^{+3}$
d) [Ni(CO)4] e)$[Cu(NH_3)_4]^{+2}$ f) $[COF_6]^{-3}$

Complex compounds based on valence Bond theory.

2. Discuss the salient features of crystal field theory. Explain the Crystal field splitting of d-orbitals in Octahedral, complexes?
3. Explain Crystal Field theory in Tetrahedral and Square Planar Complexes?
4. Explain the different types of Structural isomerism exhibited by complexes with examples?

### Short Answer Questions

1. Explain High spin and Low spin complexes with examples.
2. What is a chelating? Give two examples.
3. What is meant by CFSE? Give two examples?
4. Define Stereoisomerism? Give two examples

**Unit-II**

## Essay Questions

1. Explain determination of composition of complex by job's method.
2. Explain the factors affecting the stability of complexes.
3. Explain the mechanism of ligand substitution reactions with examples.

### Short Answer Questions

1. What is Trans effect? Write its applications?
2. What are labile and inert complexes? Give examples.

**Unit-III**

**Essay Questions**

1. What is Organometallic Compounds? Explain the classification of organometallic Compounds on the basis of bonding
2. Give the preparation of mono and binuclear carbonyl Compounds?

**Short Answer Questions**

1. Define 18 electron rule. Explain with an example.
2. Write the Concept of hapticity of organic ligands with one example.

**Unit-IV&V**

Essay Questions

1. Define heat capacities and derive the relation between Cp and Cv
2. Derive the equations for work done by ideal gas at isothermal and adiabatic conditions.
3. Derive Kirchhoff's equation.
4. What is Carnot cycle? Explain Efficiency of Heat Engine by Carnot cycle?

Short Answer Questions

1. Explain Concept of Entropy?
2. Explain Joule Thomson Effect
3. State and explain first law of thermodynamics?

**SEMESTER-III**
**COURSE CODE 8: QUALITATIVE INORGANIC ANALYSIS**
**Credits: 01**
**Qualitative inorganic analysis**
**(Minimum of 4 Mixtures should be analyzed)**

**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 relatedto qualitative analysis.

**Analysis of Mixture 50M**

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, Aluminum, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, magnesium and Ammonium.

Minimum of Four mixtures should be analyzed.

**List of Text books:**

1. A textbook of qualitative inorganic analysis by A.I. Vogel.

**SCHEME OF VALUATION**
**SEMESTER-III**
**COURSE CODE 8: QUALITATIVE INORGANIC ANALYSIS**

| | | |
|---|---|---|
| a. | Preliminary tests for Anions | - 6 marks |
| b. | Sodium carbonate extract preparation | - 4 marks |
| c. | Confirmation tests for anions | -8 marks |
| d. | Group separation table | -10 marks |
| e. | Confirmation tests for cations | - 6 Marks |
| f. | Report | - 6 Marks |
| g. | Record | -05 marks |
| h. | Viva voce | -05 marks |
| | **TOTAL** | **-50 marks** |

**Co-Curricular Activities:**

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

1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of involves identification and conformation of cations and anions containing one less familiar cation and one interfering anion.

2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

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

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

5. Unit tests (IE).

# SEMESTER-V

| | PITHAPUR RAJAH'S GOVERNMENT COLEGE(A)<br>Kakinada<br>DEPARTMENT OF CHEMISTRY | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code<br>CHE-6A | TITLEOFTHECOURSE<br>**SYNTHETIC ORGANIC CHEMISTRY** | III B.Sc.<br>(V Semester) | | | |
| Teaching | HoursAllocated:60 (**Theory**) | L | T | P | C |
| Pre-requisites | Symmetry and Photochemistry, Oxidation, Reduction and Named synthetic reactions | 60 | 10 | 30 | 4+2 |

**Course Objectives:**

1. Pericyclic Reactions
2. Organic Photochemistry
3. Retro synthesis
4. C-C bond formation, Oxidation and Reduction Reactions.

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Student will acquire knowledge on basic concepts in different types of pericyclic reactions |
| CO2 | Student will get the knowledge in understanding the fundamental concepts involved in the organic photochemistry and gets acquainted with new kind of reactions |
| CO3 | Student shall have opportunity to understand the importance of retrosynthesis in organic chemistry which is a key analysis in recent research trends. |
| CO4 | Students shall Comprehend the applications of different novel reagents and reactions in synthetic organic chemistry. |

**Course with focus on Skill Development/Employability/Entrepreneurship modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**UNIT-I Pericyclic reactions: 15 h**

A brief introduction to synthetic organic chemistry – Features and classification of pericyclic reactions: Phases, nodes and symmetry properties of molecular orbitals in ethylene,1,3-butadiene,1,3,5-hexatriene, Thermal and photochemical reactions. Introduction of Frontier Molecular Orbitals –

Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward-Hoffmann selection rules. (Correlation diagrams are not required) Cycloaddition reactions: Definition and examples, definitions of suprafacial and antrafacial addition, Woodward-Hoffmann selection rules. (Correlation diagrams are not required)

**UNIT-II Organic photochemistry: 9h**

Jablonski diagram-singlet and triplet states -Photochemistry of Carbonyl compounds- π−π* and *n*−π* transitions, Norrish type-1and type-2 reactions - Paterno– Buchi reaction - Photo Fries Rearrangement.

**UNIT-III Retrosynthesis 12 h**

Important terms in Retrosynthesis with Examples-Disconnection, Target molecule, FGI, Synthon, Retrosynthetic analysis, chemo selectivity, regio selectivity & stereo selectivity. Importance of Order of events in organic synthesis – Retrosynthetic analysis of the compounds: a. Aspirin, b. 4-Nitro toluene, c. Paracetamol.

**Unit-4: Synthetic Reactions 12 h**

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

**Unit-5: Reagents in Organic Chemistry 12h**

Oxidizing agents: PCC, $OsO_4$, $SeO_2$ (Riley oxidation), mCPBA.

Reducing agents: LiAlH4 (with mechanism), NaBH4(with mechanism), Metal-solvent reduction (Birchreduction), Introduction Catalytic reduction (Heterogeneous catalysis).

Additions and Deletions

| Unit No | Additions | Deletions | Expected levels of learning as per Blooms taxonomy for assessment of CO | Percentage added/deleted |
|---|---|---|---|---|
| 1 | -------- | ------- | ---- | -<br>- |
| 2 | --------- | ----- | ------ | - |
| 3 | Retrosynthesis of Aspirin | Retrosynthesis of cyclohexene | K6 | 5 % |
| 4 | Barton reaction | --- | K2, K3 | 5 % |
| 5 | $NaBH_4$(Mechanism), mCPBA | DDQ | K2, K3 | 5 % |

$K_1$ = Remembering, $K_2$= Understanding, $K_3$= Applying, $K_4$ = Analyzing,
$K_5$ = Evaluating, $K_6$ = Create

**Textbooks:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | S.M. Mukherjee and S.P. Singh | Reaction Mechanism in Organic Chemistry | Trinity Press |
| 2 | Jonathan Clayden, Nick Greeves and Stuart Warren | Organic Chemistry | Oxford University Press |

**Reference books**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Ian Fleming | Pericyclic Reactions | Oxford University Press |
| 2 | Sankararaman | Pericyclic Reactions-A Textbook: Reactions, Applications and Theory | WILEY-VCH |
| 3 | S.M. Mukherjee, | Pericyclic reactions-A Mechanistic study | Macmillan India |
| 4 | Stuart Warren | Organic synthesis: The disconnection approach | John Wiley&Sons. |
| | S.N. Sanyal | Reactions, Reagents and Rearrangements | Bharati Bhawan Publishers |

**WebLinks:**

1. https://youtu.be/c9-h83KDiAk
2. https://youtu.be/NDHQ7W2TKIY
3. https://youtu.be/mdWsJWybUcA
4. https://youtu.be/CyYUGaSWihE

**Course outcome & Program outcome mapping**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Student will acquire knowledge on basic concepts in different types of pericyclic reactions |
| CO2 | Student will get the knowledge in understanding the fundamental concepts involved in the organic photochemistry and gets acquainted with novel reactions |
| CO3 | Student shall have opportunity to understand the importance of retro synthesis in organic chemistry which is a key analysis in recent research trends. |
| CO4 | Students shall Comprehend the applications of different novel reagents and reactions in synthetic organic chemistry. |

**CO-PO Mapping:**

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0**

| | PO1 | PO 2 | PO3 | PO 4 | PO 5 | PO6 | PO 7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5): Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry
**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**

**Semester -V**

**Paper-6A**

**SYNTHETIC ORGANIC CHEMISTRY**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Pericyclic reactions | 1 | 1 | 15 | Understanding, Application |
| 2 | Organic Photo Chemistry | 1 | 2 | 20 | Remembering, Understanding |
| 3 | Retrosynthesis | 1 | 1 | 15 | Analyzing & Creation |
| 4 | Synthetic Reactions | 2 | 1 | 25 | Evaluation, Understanding |
| 5 | Reagents in Organic Chemistry | 1 | 2 | 20 | Application & Creation |
| | **TOTAL** | **6** | **7** | **95** | |

**P.R. GOVERNMENT COLLEGE (A), KAKINADA**

**III YEAR B.Sc (Examination at the end of V semester)**

**(Synthetic Organic Chemistry)**

**Paper-6A**

**MODELPAPER**

**Duration: 2hrs.** **Max.Marks:50**

---

## SECTION-I

**Answer any THREE of the following questions. And attempt one question from Each section part Each question carries TEN marks** **3X10=30Marks**

### PART-A

1. Discuss Electro cyclic reactions by taking anyone example with any one method.
2. Elaborate Paterno–Buchi reaction and Norrish type– II reaction with an example.
3. Devise ways for retrosynthetic analysis of Aspirin and Paracetamol.

### PART- B

4. Suggest the acceptable mechanism for reduction with LiAlH4 and give any two synthetic applications of LiAlH4.
5. How can you describe the mechanisms of Suzuki coupling and Robinson annulation?
6. Elaborate the mechanism of Heck reaction and Shapiro reaction.

## SECTION-II

**Answer any FOUR of the following questions. Each question carries FIVE marks** **4 X 5=20Marks**

7. Draw the Molecular orbital diagram of 1,3-butadiene.
8. How would you generalize Norrish Type–I reaction.
9. What is Photo Fries rearrangement?
10. What can you infer Target molecule and synthon with an example?
11. Suggest the mechanism of Stork– Enamine alkylation reaction.
12. How would you explain Birch reduction with mechanism?
13. How would you present $SeO_2$ as oxidizing agent.

## LABORATORY COURSE

**Practical Paper – 6A :: Synthetic Organic Chemistry**

(at the end of semester V) 30hrs (2h/W) 50Marks

**Learning Out comes**:

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

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of an azodye.

Practical (Laboratory) Syllabus

1. Identification of various equipment in the laboratory.
2. Acetylating of 10amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil-Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of1,1-bis-2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.

**Lab References:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Vogel A.I | Practical Organic Chemistry | Longman Group Ltd. |
| 2 | Bansal R.K | Laboratory Manual of Organic Chemistry | Wiley-Eastern |
| 3 | Ahluwalia & Aggarwal R | Comprehensive Practical Organic Chemistry | Universitypress. Delhi |
| 4 | Mann F.G and Saunders B.C | Practical Organic Chemistry | Pearson Education |

Co-Curricular Activities:

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

**For Teacher:** Training of students by teacher in laboratory and field for not lessthan15 hourson the field techniques/skills of preparation of acetanilide, preparation of azodye, use of separating funnel for solvent extraction, separation of organic compounds in a mixture.

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

Max marks for Fieldwork/project work Report:05.

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

Unit tests (IE).

a) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of videos and other material.

3. Visits of facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts

## SCHEME OF VALUATION

Practical Paper – 6A :: Synthetic Organic Chemistry
(at the end of semester V)

| | | |
|---|---|---|
| a. | Correct Equation withMechanism | 10 marks |
| b. | Procedure | 10 marks |
| c. | Recrystallization with M. P | 10 marks |
| d. | Yield | 10 marks |
| e. | Record | 05 marks |
| f. | Viva voce | 05 marks |
| | **TOTAL** | **50 marks** |

| | PITHAPUR RAJH'S GOVERNMENT COLLEGE(A) KAKINADA | Program & Semester | | | |
|---|---|---|---|---|---|
| CourseCode CHE-7A | TITLE OF THE COURSE **ANALYSIS OF ORGANIC COMPOUNDS** | III B.Sc. (V Semester) | | | |
| Teaching | Hours Allocated:60 (**Theory**) | L | T | P | C |
| Pre-requisites | Symmetry and Photochemistry, Oxidation, Condensation and Reduction reactions | 60 | 10 | 30 | 4+2 |

**Course Objectives:**

1. Gains knowledge in Mass spectrometry
2. Structural elucidation by IR, NMR and Mass spectroscopic techniques
3. Applications of Paper and Thin layer chromatographic techniques
4. Problem solving approach to elucidation of the structure and separation of organic compounds.

**CourseOutcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Identify the importance of mass spectrometry in the structural elucidation of organic compounds |
| CO2 | Acquire the knowledge on structural elucidation of organic compounds |
| CO3 | Understand various chromatography methods in the separation and identification of organic compounds. |
| CO4 | Demonstrate the knowledge gained in solvent extraction for the separation of organic compounds |

**Coursewithfocusonemployability/entrepreneurship/SkillDevelopment modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**Unit-1: Mass Spectrometry** **10h**

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, Electron Ionization (Electron Impact, EI), Molecular ions, Nitrogen rule, McLafferty rearrangement, Metastable ions, Isotopic abundance.Basic fragmentation types. Fragmentation patterns in Butane, Toluene, 2- Butanol, Pentanamine.

**Unit-2: Structural elucidation of organic compounds using IR, NMR, mass spectral data-** **8h**

2,2,3,3-Tetramethylbutane, Phenylacetylene, Butane-2,3-dione, Propionic acid, Methylpropionate and N,N- dimethyl amine.

**Unit-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data- 8h**

Butyraldehyde, acetophenone, benzoic acid, propane nitrile and p-nitroaniline

**Unit-4: Separation techniques-1 12h**

Solvent extraction-Principle and theory, Types of solvent extraction-Batch extraction, Continuous extraction and Counter current extraction techniques.

Chromatography- Principle and theory, classification, types of adsorbents, eluents, Rf values and factors affecting Rfvalues. Thin layer chromatography -principle, experimental procedure, advantages and applications.

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

Paper chromatography-Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.

Column chromatography- Principle, classification, experimental procedure, advantages and applications.

**Textbooks:**

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition Pearson
2. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M. West and Douglas A.Skoog, Ninth edition, Cengage.
3. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA

**Referencebooks**


1. Introduction to Spectroscopy by Pavia, Lampman, Kriz and Vyvyan, Fifth edition, Cengage
2. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science
3. Spectroscopy of Organic Compounds by P.S. Kalsi, Seventh edition, New Age International.
4. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
5. Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
6. Quantitative analysis by R.A.Day Jr. and A.L. Underwood, Sixth edition, Pearson

**WebLinks:**

1. https://youtu.be/rzF-dW08UIw
2. https://youtu.be/bPsXkPYexJY
3. https://youtu.be/inbiTYI5Nlw
4. https://www.youtube.com/watch?v=qpZhc2Zn_TI

**Course outcome & Program outcome mapping**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Identify the importance of mass spectrometry in the structural elucidation of organic compounds |
| CO2 | Acquire the knowledge on structural elucidation of organic compounds |
| CO3 | Understand various chromatography methods in the separation and identification of organic compounds. |
| CO4 | Demonstrate the knowledge gained in solvent extraction for the separation of organic compounds |

**CO-POMapping:**

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3 ; 4: No Correlation = 0**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO2 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO3 | 1 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 2 |
| CO4 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge :** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving :** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) :Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such

as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning :** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**
**Semester -V**
**Paper-7A**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | Mass Spectrometry | 1 | 2 | 20 | Understanding, Evaluating |
| 2 | Structural elucidation of organic compounds using IR, NMR, mass spectral data | 1 | 1 | 15 | Analyzing, Applying |
| 3 | Structural elucidation of organic compounds using IR, NMR, mass spectral data | 1 | 1 | 15 | Analyzing, Applying |
| 4 | Separation techniques-1 | 2 | 1 | 25 | Remembering, Applying |
| 5 | Separation techniques-2 | 1 | 2 | 20 | Evaluating, Creation |
| | **TOTAL** | **6** | **7** | **95** | |

**P.R. GOVERNMENT COLLEGE(A),KAKINADA**

**III YEAR B.Sc (Examination at the end of V semester)**
**Paper-7A :: Analysis of Organic Compounds**
**MODELPAPER**

**Duration: 2hrs.30Min** **Max.Marks:50**

## Section -I

**Answer any three of the following questions. Must attempt at least one question from each part.**
**Each question carries 10 Marks.** **3 X 10 = 30M**

**Part – A**

1. i) What is the significance of Isotopic abundance in Mass Spectrometry.
   ii) What are metastable ions. How can you describe their characteristics.

2. Write the IR, NMR and Mass spectral analysis for 2,2,3,3- tetramethyl butane and methylPropionate.

3. Write the IR, NMR and Mass spectral analysis of Propane nitrile and Butyraldehyde.

**Part – B**

4. Explain Batch and Counter current extraction techniques.

5. Explain the Principle, experimental procedure and advantages of ThinLayer Chromatography?

6. How would you elaborate ascending, descending, radial and two dimensional paper chromatography. Suggest any of its applications.

## Section -II

**Answer any four of the following questions. Each question carries 5 marks.** **4 X 5 = 20M**

7. How can you describe Electron Impact ionization.
8. Elaborate on McLafferty rearrangement.
9. What is the IR spectral data analysis for Propionic acid.
10. How would you explain NMR spectral data for acetophenone and P-Nitro Aniline?
11. What do you remember about the principle and theory involved in solvent extraction.
12. How could you explain the principle and experimental procedure involved in Paper chromatography.
13. Point out the experimental procedure involved in Column chromatography.

| Unit No | Additions | Deletions | Expected levels of learning as per Blooms Taxonomy for assessment of CO | Percentage of Syllabus Added/deleted |
|---|---|---|---|---|
| 1 | Fragmentation patterns in Butane and Pentanamine | ---- | Understanding, Applying | 2 % |
| 2 | ---- | ---- | Understanding | 2 % |
| 3 | Butyraldehyde, Propanenitrile | Coumarin | Applying, Analyzing | 2 % |
| 4 | Types of Solvent extraction- Continuous and Counter current extraction techniques | Application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base& neutral. | Understanding | 2 % |

*LABORATORY COURSE*

**Practical Paper – 7A:: Analysis of Organic Compounds**

**(at the end of semester V)** 30hrs(2h/W) **50Marks**

## Learning Outcomes:

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

- Perform the organic qualitative analysis for the detection of N, S and halogens usingthe green procedure.
- Acquire skills in these parathion of organic compounds in the given mixture usingsolvent extraction.
- Learn the procedure for the separation of mixture of amine acids using PaperChromatography.
- Prepare the TLC plates for TLC chromatography.
- Acquire skills in conducting column chromatography for the separation of dyes in thegiven mixture.

**Practical (Laboratory) Syllabus**:

- Green procedure for organic qualitative analysis: Detection of N, S and halogens
- Separation of organic compounds in a mixture (acidic compound + neutral compound) using separation technique.
- Separation of organic compounds in a mixture (basic compound + neutral compound) using separation technique.
- Separation of given mixture of amino acids (glycine and phenylalanine) using ascending paper chromatography.
- Separation of a given dye mixture (methyl orange and methylene blue) using TLC(using alumina adsorbent).
- Separation of Chlorophyll and Xanthophyll from the leaves of spinach or tekoma using ascending paper chromatography.
- Separation of mixture of methyl orange and methylene blue by Paper Chromatography

## SCHEME OF VALUATION

Practical Paper – 7 A:: Analysis of Organic Compounds

(at the end of semester V)

| | |
|---|---|
| a. Nature of the mixture | 5 marks |
| b. Separation of the mixture into two components | 10 marks |
| Systematic analysis of each component which involves following | |
| c. Preliminary Tests (Ignition, M.P/B.P, Unsaturation) | 03 + 03 marks |
| d. Detection of extra elements | 04 + 04 marks |
| e. Detection of the functional group (Preliminary & Confirmation) | 04+ 04 marks |
| f. Report | 01 + 01 marks |
| g. Viva voce | 06 |
| h. Record | 05 |
| **TOTAL** | **50 marks** |

### References:


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

**Co-CurricularActivities**

**a) Mandatory:***(Lab/fieldtrainingofstudentsbyteacher:(lab:10+field:05*):

1. **For Teacher**: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of detection of N, Sand halogens using the green procedure, preparation of TLC plates, detection of organic compounds using Rf values in TLC/ paper chromatography, loading of column, selection of solvent system for column chromatography, separation of aminoa cids and dye mixture using chromatographic techniques.

2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand-written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

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

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

5. Unit tests(IE).

**b)** Suggested Co-Curricular Activities

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

# B.VOC

## HORTICULTURE&AQUACULTURE

| | P R Govt College (A) Kakinada | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code CHE-6D | TITLE OF THE COURSE **ENVIRONMENTAL CHEMISTRY** | III B.Voc. (V Semester) | | | |
| Teaching | Hours Allocated: 60 (**Theory**) | L | T | P | C |
| Pre-requisites | Environmental issues – classification, Identification and solutions | 60 | 10 | 30 | 4+2 |

**Course Objectives:**

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

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

**Course with focus on employability / entrepreneurship / Skill Development modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Syllabus:**

**UNIT-I Introduction** **12 h**

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Non renewable resources.

**UNIT- II Air Pollution** **12 h**

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

**UNIT – III Water pollution** **14 h**

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Total dissolved solids, alkalinity– Hardness

of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects.

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

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

**UNIT-V Ecosystem and biodiversity** **12h**

**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 –biodiversity at national, global and regional level.

**1. Text books**

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

**2. Reference books**

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

**Web Links:**

1. https://youtu.be/c9-h83KDiAk
2. https://youtu.be/NDHQ7W2TKIY
3. https://youtu.be/mdWsJWybUcA
4. https://youtu.be/CyYUGaSWihE

**Weightage to content**

**Semester -V**

**Paper-6D**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | **Introduction to Environment** | 1 | 2 | 20 | Understanding, Application |
| 2 | **Air Pollution** | 2 | 2 | 30 | Remembering, Understanding |
| 3 | **Water Pollution** | 2 | 1 | 25 | Application & Creation |
| 4 | **Chemical toxicology** | 1 | 2 | 20 | Remembering, Understanding |
| 5 | **Ecosystem and biodiversity** | 2 | 1 | 25 | Application & Creation |
| | **TOTAL** | **8** | **8** | **120** | |

**P.R. COLLEGE (A), KAKINADA**

**III YEAR B.Voc (Examination at the end of V semester)**

**(Environment Chemistry)**

**Paper-6D**

**MODEL PAPER**

**Duration: 2hrs.30 Min** **Max. Marks: 60**

---

## PART- A

Answer any **Four** of the following questions. Each carries FIVE marks 4 X 5 = 20 Marks

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

## PART- B

Answer ALL the questions. Each carries TEN marks 4 X 10 = 40 Marks

1. Explain the toxicity of Lead and Mercury.

   (OR)

   Describe various effects of human activities on environment

2. Explain the classification of air pollution?

   (OR)

   Explain the following terms . a) Photochemical smog b) Bhopal gas disaster

3. Explain any two methods for conversion of hard water into soft water.

   (OR)

   Explain any two water quality parameters.

4. Explain Nitrogen and Phosphorus cycle.

   (OR)

   Define Biodiversity and explain level and types of Biodiversity

*LABORATORY COURSE*

**Practical Paper – 6D :: Environmental Chemistry**

**(at the end of semester V)** 30 hrs (2 h / W) **50Marks**

**I Lab work-Skills Outcomes:**

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

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

**II. Practical (Laboratory) Syllabus**

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

a) Permanent hardness b) Temporary hardness

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

III. **Co-Curricular Activities:**

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

1. For Teacher: Skills training of students by the teacher in classroom, lab and field for not less than15 hours on field related quantitative techniques for the water quality parameters, soil pollution and air pollution.
2. For Student: Individual visit to any one of the local field agencies/research laboratories in universities/research organizations/private sector culminating

writing and submission of ahand- written fieldwork/project work Report not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of places visited, observations, findings and acknowledgements.
5. Unit tests (IE).

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

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

# SEMESTER-VI

## APPRETICESHIP

# NDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

## Assessment methodology for Internships / On the Job Training / Apprenticeship under the revised CBCS (2020 – 21 onwards)

## Third internship/Apprenticeship (5th/6th Semester period):

During the entire 5th /6th Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work.

**Learning outcomes**

- Explore career alternatives prior to graduation.
- Integrate theory and practice.
- Assess interests and abilities in their field of study.
- Learn to appreciate work and its function towards future .
- Develop work habits and attitudes necessary for job success.
- Develop communication, interpersonal and other critical skills in the future job.
- Build a record of work experience.
- Acquire employment contacts leading directly to a full-time job followinggraduation from college.
- Acquire additional skills required for world of work.

**Assessment model for the semester long apprenticeship / on the job training / internships during the V/VI Semester:**

The assessment for the V / VI Semester long apprenticeship is for 200 marks and credits assigned are 12.

A monthly report is to be submitted to the teacher guide online within 15 days afterthe completion of the every month upto four months. The last two months of internship period shall be used for preparation of final project report simultaneously undergoing on the job training / internship / apprenticeship.

The assessment for this internship / on the job training will be both internal and external assessment. The internal assessment will be for 25% of marks which willbe continuous and the assessment by the industry / enterprise / organization where the student does his/her internship will be indicated in grades. This assessment is to be conducted by a responsible person (General Manager / HR Manager / Head of the Division) in consultation with the supervisor under whom the internship was done.

The components of internal assessment during *this* ***third internship / Project Work / On the Job Training / Apprenticeship*** shall include the following components and based on the entries of Project Log and Project Report:

a. Involvement in the work assigned
b. Regularity in the work assigned
c. New knowledge acquired
d. New skill acquired

The Project Report should contain

a. Introduction.
b. Project specifications (area / background of the work assigned).
c. Problems taken up.
d. Analysis of the problem.
e. Recommendations and conclusions.

The Project Presentation is to be made by the student after he/she reports back tothe College. The components for assessment are –

a. assessing the involvement in the project
b. presentation skills
c. final outcome of the project as evinced by the student.

There shall be a final evaluation committee comprising of Principal, Teacher Guide, Internal Expert and External Expert nominated by the affiliating University. The final evaluation committee shall consider the following for evaluation –

A. Monthly Reports submitted by the student

B. Final Project Report

C. Grading given by the Company / Business unit / Enterprise where the student has undergone the training. The grades shall be converted into marks on the scale followed by the University.

To evaluate and award marks, the Committee conducts viva voce examination at the college.

Example:

| | |
|---|---|
| Name of the Student: | |
| Class & Year of Study | |
| Registered Number | |
| **Internal Assessment Component** | **Max. Marks** |
| 1. Project Log | 10 |
| 2. Project Implementation | 20 |
| 3. Project Report | 10 |
| 4. Presentation | 10 |
| **TOTAL** | **50** |
| **External Assessment Component** | **Max. Marks** |
| Performance Assessmentby the Evaluation Committee, converting the grades awarded by the industry, enterprise, etc. | **100** |
| External Viva Voce | **50** |
| **GRAND TOTAL** | **200** |

# SEMESTER-VII

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code **CHE-VIIIA** | TITLE OF THE COURSE **ADVANCE STUDIES IN COMPLEXES AND GROUP THEORY** | IV B.Sc. (VII Semester) | | | |
| Teaching | Hours Allocated: 60 (**Theory**) | L | T | P | C |
| Pre-requisites | Understanding the nature of bonding in metal complexes, Basic knowledge on Symmetry elements and operations. | 60 | 10 | 30 | 4+1 |

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | The student will understand the chemistry of lanthanides and actinides |
| CO2 | Students can enhance their knowledge in VSEPR, MO theories. |
| CO3 | Student will able to Understand the Crystal field theory and Jahn Teller Effects. |
| CO4 | Student can inculcate understanding concepts of group theory |

**Course with focus on employability/entrepreneurship/SkillDevelopment modules**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Skill Development | | | Employability | | | Entrepreneurship | |

**Unit-I: Chemistry of non- transition elements: 12Hours**

Inter halogen compounds, Halogen oxides and oxyfluorides, Clathrate compounds, Spectral and Magnetic properties of Lanthanides and Actinides. Analytical applications of Lanthanides and Actinides. Synthesis, properties and structure of B-N, S-N, P-N cyclic compounds. Intercalation compounds.

Metal π- complexes: preparation, structure and bonding in Nitrosyl, Dinitrogen and Dioxygen complexes.

**Unit-II: Structure and Bonding: 12Hours**

pπ-dπ bonding, Bent's rule, Non-valence cohesive forces, VSEPR theory. Molecular Orbital theory, Symmetry of Molecular orbitals, Molecular orbitals in triatomic ($BeH_2$) molecules and ions ($NO^{-2}$) and

energy level diagrams. Application of MO theory to square planar ($PtCl_4^{-2}$) and octahedral complexes ($CoF_6^{-3}$, $Co(NH_3)_6^{+3}$).Walsh diagrams for linear ($BeH_2$) and bent ($H_2O$) molecules.

**Unit-III: Metal–ligand bonding: 12Hours**

Crystal Field Theory of bonding in transition metal complexes-Splitting of d-orbitals in octahedral, tetrahedral, square planar and Trigonal bipyramidal and Square pyramidal fields. Tetragonal distortions - Jahn-Teller effect. Applications and limitations of CFT. Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor andπ – acceptor ligands on Δo. Experimental evidence for π-bonding in complexes.

**Unit-IV: Metal–ligand Equilibria in solutions: 12Hours**

Step wise and overall formation constants. Trends in stepwise constants (statistical effect and statistical ratio). Determination of formation constants by Spectrophotometric method (Job's method) and Ph metric method (Bjerrum's). Stability correlations -Irwing-William's series. Hard and soft acids and bases (HSAB), Acid-base strengths.

**Unit- V: Group theory 12Hours**

Basic concepts of Symmetry and Group theory – Symmetry elements, symmetry operations and point groups – Schoen flies' symbols –Classification of molecules into point groups–Axioms of Group theory– Group multiplication tables for $C_2V$ and $C_3V$ point groups - Similarity Transformation and classes – Representations – reducible and irreducible representations, Mulliken symbols, Orthogonality theorem and its implications, character table and its anatomy.

**Suggested Co-Curricular Activities**

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

**Text books:**


1. Inorganic Chemistry Huheey, Harper and Row.
2. Physical methods in inorganic chemistry, R.S.Drago. Affliated East-West Pvt. Ltd.
3. Concise inorganic chemistry, J.D. Lee, ELBS.
4. Modern Inorganic Chemistry, W.L. Jolly, Mc Graw Hill.
5. Inorganic Chemistry, K.F. Purcelland J.C .Kotz Holt Saunders international.
6. Concepts and methods of inorganic chemistry, B.E. Douglas and D.H.M.C. Daniel, oxford Press.
7. Introductory quantum Mechanics, A.K. Chandra.

8. Quantum Chemistry, R.K. Prasad.

**Reference books:**

1. Inorganic Chemistry, Atkins, ELBS.

2. Advanced Inorganic Chemistry, Cotton and Wilkinson, Wiley Eastern.

3. Text book of Coordination chemistry, K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.

4. Group Theory and its Applications to Chemistry, K.V. Raman, Tata Mc Graw– Hill Publishing Company Ltd. New Delhi.

5. Chemical Applications of Group Theory, F.A. Cotton Wiley Eastern Limited New Delhi.

**CO-PO Mapping:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | The student will understand the chemistry of lanthanides and actinides |
| CO2 | Students can enhance their knowledge in VSEPR, MO theories. |
| CO3 | Student will able to Understand the Crystal field theory and Jahn Teller Effects. |
| CO4 | Student can inculcate understanding concepts of group theory |

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3; 4: No Correlation = 0**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 1 | 1 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) :Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**

**Semester -VII**

**Paper-VIIIA**

**ADVANCE STUDIES IN COMPLEXES AND GROUP THEORY**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | **Chemistry of non- transition elements** | 1 | 2 | 20 | Understanding, Application |
| 2 | **Structure and Bonding** | 2 | 2 | 30 | Remembering, Understanding |
| 3 | **Metal–ligand bonding** | 2 | 1 | 25 | Analyzing & Creation |
| 4 | **Metal–ligand Equilibria in solutions** | 1 | 2 | 20 | Evaluation, Understanding |
| 5 | **Group theory** | 2 | 1 | 25 | Application & Creation |
| | **TOTAL** | **8** | **8** | **120** | |

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**IV YEAR B.Sc (Examination at the end of V semester)**
**(ADVANCE STUDIES IN COMPLEXES AND GROUP THEORY)**
**Paper-VIIIA**
**MODELPAPER**

**Duration: 2.30hrs.** **Max.Marks:60**

## SECTION-I

**Answer any FOUR of the following questions. Each question carries FIVE marks**
**4 X 5=20Marks**

1. Draw the structures of Phospho nitrolic compounds.
2. Write any five differences between Lanthanides & Actinides
3. Discuss Bent's rule.
4. Calculate EAN of K4(Fe(CN)6 and Co(NH3)6.
5. Explain paramagnetic behavior of Fe(cl)6.
6. Experimental evidence for π bonding in complex.
7. What are inert and labile complexes give example.
8. Water molecule exhibit $C_{2v}$ point group justify it.

## SECTION-II

**Answer the following questions. Each section part Each question carries TEN marks** **4X10=40Marks**

9. Explain salient features of VSEPR theory with suitable examples?

(OR)

10. Explain the crystal field Splitting of d-orbitals in octahedral & Square planar complexes.
11. Write a brief note on Pearson acid base (HSAB) theory

(OR)

12. Explain the Spectral & magnetic properties of lanthanoids & Actinoids
13. Discuss the Symmetry of various molecular orbitals

(OR)

14. How would you determine the composition of the complex compound by using Job's method?
15. Explain Grate Orthogonality theorem & it's applications.

(OR)

16. Give suitable point group of following compounds
    Benzene,B2H6, CO2 and XeF4

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

Inorganic Chemistry-I: Advance Studies in Complexes and Group theory

**Learning Outcomes:**

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

1. List out, identify and handle various equipment in Chemistry lab.
2. Understand the basic concepts of qualitative analysis of inorganic mixture.
3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis.
4. Acquire skills in elimination interfering anion.
5. Identification of less familiar cation.

**Syllabus:**

I. Synthesis of Inorganic Metal Complexes:

Synthesis of 3d transition metal complexes of tetrahedral, square planar and octahedral geometries.

(i) Tetra ammine copper (II) sulphate monohydrate

(ii) Potassium tris(oxalato) ferrate (III) trihydrate

(iii) Tris(thiourea)copper(I) sulphate

II. Systematic Semi micro qualitative Analysis of Inorganic six radical mixtures In systematic Semi micro qualitative inorganic analysis, inorganic mixture contains three cations and three anions. The analysis involves identification and conformation of cations and anions containing one less familiar cation (Tungsten, Molybdenum, Zirconium, Thorium, Titanium, Uranium, Cerium, Vanadium, Lithium, Berkelium etc.,) and one interfering anion.

Anions: $CO_3^{-2}$, $S^{-2}$, $SO_3^{-2}$, $Cl^-$, $Br^-$, $I^-$, $NO_3^-$, $SO_4^{-2}$, $CH_3COO^-$, $C_2O_4^{-2}$, $C_4H_4O_6^{-2}$, $PO_4^{3-}$, $CrO_4^{-2}$, $AsO_4^{3-}$, $F^-$, $BO_3^{3-}$,

Cations:

Ammonium ($NH_4^+$)

1st group: Hg, Ag, Pb, Tl, W

2nd group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo

3rd group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be

4th group: Zn, Mn, Co, Ni

5th group: Ca, Ba, Sr 6th group: Mg, K, Li

Note: A minimum of 4 inorganic mixtures must be analysed in this Semester.

## Lab References:

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | G. Marrand B. W. Rockett | Practical Inorganic Chemistry | Longman Group Ltd. |
| 2 | G.Pass H.Sutchiffe | Practical Inorganic Chemistry | 2nd Addn JohnWiley&Sons |
| 3 | M.A.Malati, | Experimental Inorganic/Physical Chemistry | Horwood Publishing, Chichester, UK(1999) |
| 4 | G. Svehla. | Textbook of semi micro qualitative analysis, 5th Edition | Vogel's |

Co-Curricular Activities:

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

1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of involves identification and conformation of cationsand anions containing one less familiar cation and one interfering anion.
2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Field work/project work Report: 05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

**SCHEME OF VALUATION**

Practical Paper – VIII A :: ADVANCE STUDIES IN COMPLEXES AND GROUP THEORY

| | | |
|---|---|---|
| a. | Preliminary tests for Anions | - 6 marks |
| b. | Sodium carbonate extract preparation | - 4 marks |
| c. | Confirmation tests for anions | -8 marks |
| d. | Group separation table | 10 marks |
| e. | Confirmation tests for cations | - 6 Marks |
| f. | Report | - 6 Marks |
| g. | Record | 05 marks |
| h. | Viva voce | 05 marks |
| | **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester IV B.Sc. (VII Semester) | | | |
|---|---|---|---|---|---|
| Course Code **CHE-IXA** | TITLE OF THE COURSE **SPECTROSCOPY OF ORGANIC COMPOUNDS** | | | | |
| Teaching | Hours Allocated: 60 (**Theory**) | L | T | P | C |
| Pre-requisites | Basic knowledge on Molecular and Atomic spectroscopic techniques. | 60 | 10 | 30 | 4+1 |

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Gain insight into the basic fundamental principles of IR, UV-Vis, Mass & ESR spectroscopic techniques. |
| CO2 | Interpret UV-visible and IR spectroscopy as a tool forfunctional group identification in organic molecules |
| CO3 | Interpret NMR and Mass spectroscopy as a tool forfunctional group identification in organic molecules |
| CO4 | Interpret of ESR and ORD for identification in organic molecules. |

**Course with focus on employability/entrepreneurship/SkillDevelopment modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Unit-I : UV-Vis Spectroscopy** **12 hours**

**UV Spectroscopy:** Energy transitions – Simple chromophores – UV absorption of Alkenes – polyenes unsaturated cyclic systems – Carbonyl compounds, α, β-unsaturated carbonyl systems - Woodward Fieser rules – aromatic systems – solvent effects – geometrical isomerism – acidand base effects – typical examples – calculation of λmax values using Woodward - Fieser rules.

ORD: Theory of optical rotatory dispersion, α-Axial halo ketone rule and octant rule Application of these rules in the determination of absolute configuration of cyclohexanones, decalones and cholestanones.

Circular Dichroism: Principle – positive and negative cotton effects – Absolute configuration.

**Unit-II : Infrared Spectroscopy (FT-IR)** **12 hours**

Fundamental modes of vibrations – Stretching and bending vibrations – overtones, combination bands and Fermi resonance, factors influencing vibrational frequencies, hydrogen bonding – fingerprint region and its importance – Study of typical group frequencies for – CH, -OH, -NH, -CO-$NH_2$, -CC, -CHO, -CO and aromatic systems. Application in structural determination –Simple problems

**Unit-III: 1H NMR spectroscopy:** **12 hours**

a) Magnetic properties of Nuclei, Nuclear resonance, Fourier Transformation and its importance in NMR. Equivalent and non-equivalent protons, The chemical shift and it's importance, calculation of chemical shift, factors affecting the chemical shifts such as electronegativity and anisotropy, effect of deuteration, Signal integration, Spin-spin coupling: vicinal (Karplus relationships), germinal and long range. Coupling constants (J) and factors affecting coupling constants. –Shielding and deshielding mechanisms in acetylene carbonyl and Benzene, anisotropy –Spin-Spin Interactions related to first order and higher order spectra (AB, $A_2$; $AB_2$, ABX, ABC, AMX) –temperature dependence spectra, Hydrogen bonding. Nuclear Overhauser effect (NOE).

**Unit-IV: Electron Spin Resonance Spectroscopy (ESR):** **12 hours**

Basic Principles, Comparison of NMR & ESR. Determination of 'g' value, Factors affecting the 'g' value. Isotropic and Anisotropic constants. Splitting, hyperfine 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 (a) Methyl radical (CH3·), (b) Benzene anion (C6H6-).

**UNIT-V MASS SPECTROMETRY** **12 hours**

Introduction, ion production, type of ionization, EI, CI, FD, and FAB-factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular-ion peak, metastable peak, Mac Lafferty rearrangement. Nitrogen rule, isotope labeling. High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

**Suggested Co-Curricular Activities**

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

**Suggested Text Books:**

1. Organic spectroscopy, W. Kemp 5th Ed, ELBS

2. Spectroscopy of organic compounds, RM Silversteen and others, 5th Ed, John Wiley
3. Spectroscopy of organic compounds, P.S. Kalsi, Wiley, 1993.

**References:**

1. NMR in chemistry-A multi nuclear introduction, William Kemp, McMillan, 1986.
2. Spectroscopic methods in Organic chemistry, DH Williams & I Flemming

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Gain insight into the basic fundamental principles of IR, UV-Vis, Mass & ESR spectroscopic techniques. |
| CO2 | Interpret UV-visible and IR spectroscopy as a tool forfunctional group identification in organic molecules |
| CO3 | Interpret NMR and Mass spectroscopy as a tool forfunctional group identification in organic molecules |
| CO4 | Interpret of ESR and ORD for identification in organic molecules. |

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3; 4: No Correlation = 0**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 3 | 1 | 1 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge :** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving :** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) :Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning :** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**

**Semester -VII**

**Paper-IXA**

**SPECTROSCOPY OF ORGANIC COMPOUNDS**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | **UV-Vis Spectroscopy** | 2 | 2 | 30 | Understanding, Application |
| 2 | **Infrared Spectroscopy (FT-IR)** | 1 | 1 | 15 | Remembering, Understanding |
| 3 | **1H NMR spectroscopy** | 2 | 2 | 30 | Analyzing & Creation |
| 4 | **Electron Spin Resonance Spectroscopy (ESR)** | 1 | 1 | 15 | Evaluation, Understanding |
| 5 | **MASS Spectrometry** | 2 | 2 | 30 | Application & Creation |
| | **TOTAL** | **8** | **8** | **120** | |

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**IV YEAR B.Sc (Examination at the end of V semester)**
**(SPECTROSCOPY OF ORGANIC COMPOUNDS)**
**Paper-IXA**
**MODELPAPER**

**Duration: 2.30hrs.** **Max.Marks:60**

## SECTION-I

**Answer any FOUR of the following questions. Each question carries FIVE marks** **4 X 5=20Marks**

1. Write a short note on meta stable ions.
2. Explain alpha halo axial ketone rule
3. Write Wood ward fisher's rules for calculating λmax in conjugated dienes.
4. How to separate o-chloro benzoic acid and meta -chloro benzoic acid by using Finger print region
5. What is chemical shift & write its significance
6. Explain shielding & de-shielding mechanism in acetylene & benzene
7. Write a short note on Comparison & Difference of N.M.R & E.S.R
8. Explain hyperfine splitting coupling in CH3 radical.

## SECTION-II

**Answer the following questions. Each section part Each question carries TEN marks** **4X10=40Marks**

9. Write about wood ward, fisher-and scoot rules for calculating max in α, β unsaturated compounds. And calculate λmax of Crotonic acid

(OR)

10.Write a brief note on Factors influencing vibrational frequencies.
11. How electronegativity, anisotropy, and solvent influence the chemical shift values of explain with suitable examples.

(OR)

12.Determination of 'g' value & What are the factors effecting the 'g' value.
13. Write an essay on fragmentation modes in Mass spectrometry.

(OR)

14. Elaborate the mechanism of Mc.lafferty rearrangement and isotopic abundance.
15. Define octant rule and explain sign of Cotton effect of Decalones.

(OR)

16. Write a brief note on instrumentation of MASS spectrometry.

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

Spectroscopy of Organic Compounds

**Learning Outcomes:**

By the end of the course students will be able to

1. Identify the functional groups present in the molecules
2. Apply data to in identification of the molecule
3. Describe principles involved in Spectroscopic methods
4. Predict number of signals, splitting patterns in the proton NMR of a compound
5. Develop ability in the combined use of mass spectrometry and spectroscopic techniques for structure elucidation

**Practical Syllabus**

Problems involving individual spectral methods – UV, IR, PMR and Mass

Problems involving combined any two of UV, IR, PMR and Mass

Problems involving combined any three of UV, IR, PMR and Mass

Problems involving all four UV, IR, PMR and Mass spectral data.

**Lab References:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | William Kemp, McMillan | NMR in chemistry-A multi nuclear introduction | Longman Group Ltd. |
| 2 | DH Williams & I Flemming | Spectroscopic methods in Organic chemistry | 2nd Addn JohnWiley&Sons |

Co-Curricular Activities:

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

1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of involves identification and conformation of cationsand anions containing one less familiar cation and one interfering anion.
2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

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

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

5. Unit tests (IE).

## SCHEME OF VALUATION

Practical Paper – IXA : SPECTROSCOPY IN ORGANIC COMPOUNDS

| | | |
|---|---|---|
| a. | Calculation of $\lambda_{Max}$ | - 5 marks |
| b. | Vibrational Frequency Values of different bonds present in the molecule | - 10 marks |
| c. | Draw the NMR spectra | - 10 marks |
| d. | Mass Fragmentions | -10 marks |
| e. | Deduce the Final Structure | -5 marks |
| f. | Record | 05 marks |
| g. | Viva voce | 05 marks |
| | **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code **CHE-XB** | TITLE OF THE COURSE **INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS** | IV B.Sc. (VII Semester) | | | |
| Teaching | Hours Allocated: 60 (**Theory**) | L | T | P | C |
| Pre-requisites | Fundamental Knowledge in Electromagnetic radiation, and laws of Absorption. | 60 | 10 | 30 | 4+1 |

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Handle analytical data |
| CO2 | Understand basic components of IR, FTIR, UV-Visible and Mass spectrometer. |
| CO3 | Interpret of IR, FTIR, UV-visible spectra and their applications. |
| CO4 | Understand the use of single and double beam instruments. Learn elemental analysis, Electro analytical Methods, Radio chemical Methods, X-rayanalysis and electron spectroscopy |

**Course with focus on employability/entrepreneurship/SkillDevelopment modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Unit- I: Introduction to analytical methods of data analysis and Electroanalytical Methods: 10 hours**

Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiations. Potentiometry & Voltammetry.

**Unit –II: Molecular spectroscopy 14 hours**

Infrared spectroscopy: Interaction of radiations 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), and advantages of Fourier-Transform Infrared (FTIR) spectroscopy.

Applications: Issues of quality assurance and quality control, special problems for portable instrumentation and rapid detection.

**Unit- III: UV-Visible/ Near IR Spectroscopy 12hours**

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, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

**Unit–IV: Mass spectroscopy 12 hours**

Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadra pole. Resolution, time and multiple separations, detection and interpretation.

**Unit – V: Elemental analysis 12 hours**

Atomic spectroscopy: Atomic absorption, atomic emission, and atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), wavelength separation and resolution (dependence on technique), detection of radiation (simultaneous/scanning, signal noise), interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

**Suggested Co-Curricular Activities**

Training of students by related industrial experts.

Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.

Visits of abilities, firms, research organizations etc.

Invited lectures and presentations on related topics by field/industrial experts.

**Suggested Text Books:**

Willard, H.H.; Merritt, L.L. Jr.; Dean, J.A.; Settle, F.A. Jr.(2004), Instrumental methods of analysis, 7th edition, CBS Publishers.

Skoog, D.A.; Holler, F. J.; Crouch, S.(2006), Principles of Instrumental Analysis, Thomson Brooks/Cole.

Ban well, C.N. (2006), Fundamentals of Molecular Spectroscopy, Tata McGraw- Hill Education

**Reference Books:**

Skoog, D. A.; Holler, F. J.; Crouch, S.(2006),Principles of Instrumental Analysis, Cengage Learning.

Christian, G.D. (2004), Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.

**CO-PO Mapping:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Handle analytical data |
| CO2 | Understand basic components of IR, FTIR, UV-Visible and Mass spectrometer. |
| CO3 | Interpret of IR, FTIR, UV-visible spectra and their applications. |
| CO4 | Understand the use of single and double beam instruments. Learn elemental analysis, Electro analytical Methods, Radio chemical Methods, X-rayanalysis and electron spectroscopy |

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3; 4: No Correlation = 0**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 2 |
| CO2 | 1 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) :Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as,

being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**

**Semester -VII**

**Paper-XB**

**INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | **Introduction to analytical methods of data analysis and Electroanalytical Methods** | 1 | 1 | 15 | Understanding, Application |
| 2 | **Molecular spectroscopy** | 2 | 2 | 30 | Remembering, Understanding |
| 3 | **UV-Visible/ Near IR Spectroscopy** | 2 | 2 | 30 | Analyzing & Creation |
| 4 | **Mass spectroscopy** | 1 | 2 | 20 | Evaluation, Understanding |
| 5 | **Elemental analysis** | 2 | 1 | 25 | Application & Creation |
| | **TOTAL** | **8** | **8** | **120** | |

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**IV YEAR B.Sc (Examination at the end of V semester)**
**(INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS)**
**Paper-XB**
**MODELPAPER**

**Duration: 2.30hrs.** **Max.Marks:60**

## SECTION-I

**Answer any FOUR of the following questions. Each question carries FIVE marks**
**4 X 5=20Marks**

1. Write the differences between Potentiometry and voltammetry.
2. Explain scattering with suitable daily life examples.
3. Discuss the issues of quality control.
4. Define fluorescence and photo acoustic.
5. Write a short note on fluorescent tags.
6. How to make liquids and solids into ions by laser desorption
7. write the differences between atomic absorption and atomic emission
8. How to separate the ions on the basis of mass to charge ratio?

## SECTION-II

**Answer the following questions. Each section part Each question carries TEN marks** **4X10=40Marks**

9.(a) write a brief note on classification of analytical methods and instrumental methods.

(OR)

(b). write about the interpretation of spectrum and advantages of Fourier transform infrared spectroscopy (FTIR).

10.(a) Discuss the special problems for portable instrumentation and rapid detection.

(OR)

(b). write a short note on the following (I)wavelength dispersion (ii) Detection of signals.

11(a) Explain the practical differences between the single beam and double beam instruments.

(OR)

(b) Define the following with suitable examples

i) time of flight ii) electric quadrupole iii) Resolution.

12.(a) Describe the getting sample into gas phase.

(OR)

(b).write about (i) Errors due to molecular and ionic species (ii)detection of radiation

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

Instrumental Methods of Chemical Analysis

**Course learning outcomes**

By the end of the course students will be able to

1. Determine the isoelectric pH of a protein
2. Identify the functional groups present in organic compounds
3. Estimate the amount of chloride and iodide present in the solution
4. Recognize the quality of water

**Syllabus**

1. Determination of the isoelectric pH of a protein.
2. Titration curve of an amino acid
3. IR absorption spectra (study of aldehydes and ketones)
4. Potentiometric titration of a chloride-iodide mixture
5. Potentiometric Titration of Metal Ions in Ethanol
6. Estimation of Alkalinity, BOD and COD

**Co-Curricular Activities: Mandatory:(Lab/field training of students by teacher:**

(lab:10+field:05):

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of organic compounds using spectroscopic data.
2. **For Students:** Student shall visit a related industry/chemistry laboratory in universities/ research organizations/private sector facility and observes the synthetic reactions and obtain spectral data for interpretation of the synthetic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

3. Max. marks for Fieldwork/project work Report:05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

## Lab References:

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | Skoog, D. A.; Holler, F. J.; Crouch | Principles of Instrumental Analysis | Cengage Learning |
| 2 | Christian, G.D | Analytical Chemistry, 6th Edition | John Wiley & Sons, New York |

Co-Curricular Activities:

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

1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of involves identification and conformation of cationsand anions containing one less familiar cation and one interfering anion.
2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max marks for Field work/project work Report: 05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

## SCHEME OF VALUATION

Practical Paper – XB: **INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**

| | | |
|---|---|---|
| a. | Procedure | 10 marks |
| b. | Equation & Titration | 10 marks |
| c. | Tabular column | 10 marks |
| d. | Calculation &Report | 10 marks |
| e. | Record | 05 marks |
| f. | Viva voce | 05 marks |
| | **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code **CHE-XIB** | TITLE OF THE COURSE **ANALYSIS OF DRUGS, FOODS, DAIRY PRODUCTS &BIO-CHEMICAL ANALYSIS** | IV B.Sc. (VII Semester) | | | |
| Teaching | Hours Allocated: 60 (**Theory**) | L | T | P | C |
| Pre-requisites | Active Pharma Ingradients<br>Excipients<br>Major and Minor food components | 60 | 10 | 30 | 4+1 |

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Explain the principles of formulation and application of Drugs. |
| CO2 | Acquire a critical knowledge on synthetic techniques of drugs. |
| CO3 | Demonstrate the skills in analysis of Foods, Dairy Products. |
| CO4 | Comprehended the applications of Bio-Chemical Analysis. Acquire a critical knowledge on analysis of Foods, Dairy Products |

**Course with focus on employability/entrepreneurship/SkillDevelopment modules**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Skill Development | | | Employability | | | Entrepreneurship | |

**UNIT- I** **15 hours**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis) Analysis of anlgesics and antipyretics like aspirin and paracetamol Analysis of anti-materials like choloroquine.

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

Anti-tuberculous drug- isoniazid.

**UNIT- II** **10 hours**

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis)

Analysis of antihistamine drugs and sedatives like: allegra, Zyrtec (citirizine), alprazolam, trazodone, lorazepem, ambien (zolpidem), diazepam,

**UNIT- III** **10 hours**

Analysis of anti-epileptic and anti-convulsant drugs like phenobarbital and phenacemide. Analysis of drugs used in case of cardiovascular drugs: atenolol, Norvasc (amlodipine), Analysis of Lipitor (atorvastatin) a drug for the prevent in of product in of cholesterol.

Analysis of diuretics like: furosemide (Lasix), triamterene

Analysis of prevacid (lansoprazole) a drug used for the prevention of production of acids in stomach.

**UNIT- IV** **15 hours**

Analysis of Milk and milk products: Acidity, total solids, fat, total nitrogen, protenines, lactose, phosphate activity, casein, choride. Analysis of food materials- Preservatives: Sodium carbonate, sodium benzoate sorbic acid Coloring matters, - Briliant blue FCF, fast green FCF, tertrazine, erytrhosine, sunset yellow FCF.

Flavoring agents - Vanilla, diacetyl, isoamyl acetate, limonene, ethylpropionate , allyl hexanoate and Adulterants in rice and wheat, wheat floo0r, sago, coconut oil, coffee powder, tea powder, milk..

**UNIT-V** **10 hours**

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

**Suggested Co-Curricular Activities**

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

**Text Books:**

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.

**References Books:**

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Text book of practical organic chemistry- A.I. Vogel.

**CO-PO Mapping:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Explain the principles of formulation and application of Drugs. |
| CO2 | Acquire a critical knowledge on synthetic techniques of drugs. |
| CO3 | Demonstrate the skills in analysis of Foods, Dairy Products. |
| CO4 | Comprehended the applications of Bio-Chemical Analysis. Acquire a critical knowledge on analysis of Foods, Dairy Products |

**1: Low =1 ; 2: Moderate = 2 ; 3: High = 3; 4: No Correlation = 0**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 2 |
| CO3 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 1 | 3 | 2 |
| CO4 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 2 | 2 | 2 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge :** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving :** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) :Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning :** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**

**Semester -VII**

**Paper-XIB**

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

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | UNIT - I | 2 | 2 | 30 | Understanding, Application |
| 2 | UNIT – II | 1 | 1 | 15 | Remembering, Understanding |
| 3 | UNIT – III | 2 | 2 | 30 | Analyzing & Creation |
| 4 | UNIT – IV | 2 | 2 | 30 | Evaluation, Understanding |
| 5 | UNIT - V | 1 | 1 | 15 | Application & Creation |
| | **TOTAL** | **8** | **8** | **120** | |

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**IV YEAR B.Sc (Examination at the end of V semester)**

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

**Paper-XIB**

**MODELPAPER**

**Duration: 2.30hrs.** **Max.Marks:60**

## SECTION-I

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

**4 X 5=20Marks**

1. Define analgesics and antipyretics with suitable examples.
2. What are antihistamine drugs and mention their role.
3. write a short note on cardiovascular drugs.
4. what are flavoring agents used in our daily products.
5. How to calculate the total fat percentage in the milk.
6. write about blood composition.
7. Identify the differences between bacteriostatic and bactericidal.
8. what is prevacid and how it is useful for the prevent the production of acid in stomach.

## SECTION-II

**Answer the following questions. Each section part Each question carries TEN marks**

**4X10=40Marks**

9. Describe the structure of anti-malarial drug chloroquine.

(OR)

10. write about the following drugs used in the treatment of infections

A) pencil B) Antituberculosis drug

11. Explain the structure of following

A) Alprazolam B) Diazepam.

(OR)

12. Write a brief note on anti - epileptic and anti - convulsant drugs.
13. How lipitor is used in the prevention of production of cholesterol.

(OR)

14. Write a brief note on adulterants in Rice, wheat flour and coffee powder.
15. what are the general preservatives and coloring matters used for food materials.

(OR)

16. Write about estimation of blood cholesterol, glucose and enzymes in the blood.

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

Spectroscopy of Organic Compounds

**Learning Outcomes:**

By the end of the course students will be able to

1. Identify the functional groups present in the molecules
2. Apply data to in identification of the molecule
3. Describe principles involved in Spectroscopic methods
4. Predict number of signals, splitting patterns in the proton NMR of a compound
5. Develop ability in the combined use of mass spectrometry and spectroscopic techniques for structure elucidation

**Practical Syllabus**

Problems involving individual spectral methods – UV, IR, PMR and Mass

Problems involving combined any two of UV, IR, PMR and Mass

Problems involving combined any three of UV, IR, PMR and Mass

Problems involving all four UV, IR, PMR and Mass spectral data.

**Lab References:**

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | JagMohan | Organic Spectroscopy | |
| 2 | J.R.Dier | Combined Problems | |

Co-Curricular Activities:

**Co-Curricular Activities**

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

**For Teacher:** Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of comprehensive product development programs to meet new product criteria and timing. Acquire skills in the preparation of Drugs, foods and Dairy Products, carry out food testing with the knowledge of testing food adultration and learn the procedure of synthesis of drugs.

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

a). Max marks for Fieldwork/project work Report: 05. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

**SCHEME OF VALUATION**

Practical Paper – IXA :: SPECTROSCOPY IN ORGANIC COMPOUNDS

| | | |
|---|---|---|
| a. | UV- $\lambda_{Max}$ Calculation | 10 marks |
| b. | Given IR Values | 10 marks |
| c. | Draw the NMR Spectra | 10 marks |
| d. | Mass Fragmentations | 10 marks |
| e. | Record | 05 marks |
| f. | Viva voce | 05 marks |
| | **TOTAL** | **50 marks** |

| | PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code **CHE-XIIB** | TITLE OF THE COURSE **INDUSTRIAL CHEMICALS AND ENVIRONMENT** | IV B.Sc. (VII Semester) | | | |
| Teaching | Hours Allocated: 60 (**Theory**) | L | T | P | C |
| Pre-requisites | Basic Knowledge on Handling Of Hazardous chemicals, And knowing about Different segments on Environment | 60 | 10 | 30 | 4+1 |

**Course Outcomes:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Identify the importance of Manufacture of Inorganic Chemicals |
| CO2 | Acquire knowledge on production, uses, storage and hazards of Industrial Gases. |
| CO3 | Understand the importance of Environment. |
| CO4 | Understanding about water pollution and its effects. Acquire knowledge on Energy and its effects on Environment |

**Course with focus on employability/entrepreneurship/SkillDevelopment modules**

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

**Unit-I** **10 Hours**

**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.

**Unit-II** **10 Hours**

**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

**Industrial Metallurgy:** Preparation of metals (ferrous and nonferrous) and ultrapure metals for semi-conductor technology.

**Unit-III** **15 hours**

**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 photo chemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO2, CO2, CO, NOx, H2S and other foul smelling gases. Methods of estimation of CO, NOx, SOx 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.

**Unit-IV** **15 hours**

**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 wastewater, industrial water and domestic water.

**Unit-V** **10 hours**

**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. **Biocatalysts:** Introduction to biocatalysts: Importance in ―Green Chemistry and Chemical Industry.

**Suggested Co-Curricular Activities**

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

**Text Books:**

**1.** J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

**2.** S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

**3.** K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.

4. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.

**References Books:**

E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.

R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, WileyPublishers, 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.

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).

**CO-PO Mapping:**

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Identify the importance of Manufacture of Inorganic Chemicals |
| CO2 | Acquire knowledge on production, uses, storage and hazards of Industrial Gases. |
| CO3 | Understand the importance of Environment. |
| CO4 | Understanding about water pollution and its effects. Acquire knowledge on Energy and its effects on Environment. |

**1: Low =1; 2: Moderate = 2; 3: High = 3; 4: No Correlation = 0**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 |
| CO4 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 1 |

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analyzing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) :Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**Weightage to content**

**Semester -VII**

**Paper-XIIB**

**INDUSTRIAL CHEMICALS AND ENVIRONMENT**

| S.No | Course Content | Long Answer | Short Answer | Total marks | As per Blooms Taxonomy |
|---|---|---|---|---|---|
| 1 | **Inorganic Chemicals** | 2 | 1 | 25 | Understanding, Application |
| 2 | **Industrial Gases** | 2 | 1 | 25 | Remembering, Understanding |
| 3 | **Environment and its segments** | 2 | 2 | 30 | Analyzing & Creation |
| 4 | **Water Pollution** | 1 | 2 | 20 | Evaluation, Understanding |
| 5 | **Energy & Environment** | 1 | 2 | 20 | Application & Creation |
| | **TOTAL** | **8** | **8** | **120** | |

**PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA**

**IV YEAR B.Sc (Examination at the end of V semester)**

**(INDUSTRIAL CHEMICALS AND ENVIRONMENT)**

**Paper-XIIB**

**MODELPAPER**

**Duration: 2.30hrs.** **Max.Marks:60**

## SECTION-I

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

**4 X 5=20Marks**

1. What are the applications potash alum, chrome alum?
2. 10. How inert gases like Helium, Neon, Argon are useful as industrial gases?
3. How domestic appliance causing Ozone layer depletion?
4. How Biogeochemical cycles of carbon, nitrogen and Sulphur helpful inn balancing the Ecosystem?
5. How industrial waste management decreases the water pollution?
6. How water quality parameters are useful in our day to day life?
7. Importance of bio catalysis in Green Chemistry?
8. What are the measures to protect Sources of energy: Coal, petrol and natural gas?

## SECTION-II

**Answer the following questions. Each section part Each question carries TEN marks**

**4X10=40Marks**

9. What are the analysis & hazards in handling the following chemicals

A) Hydrochloric acid B) Sulfuric acid

(OR)

10. What are the analysis & hazards in handling the following chemicals

A) Nitric acid B) Caustic soda

11. What are the Storage and hazards in handling of the following gases

A) Oxygen B) Nitrogen

(OR)

12. What are the Storage and hazards in handling of the following gases

A) Carbon monoxide B) Sulphur dioxide

13. What are the types & sources of severe Air pollutants causing air pollution

(OR)

14. What is Air pollution? What are the control measures of air pollution

15. Explain Water treatment and purification methods (reverse osmosis, electro dialysis, ion exchange)

(OR)

16. Define Nuclear Pollution. Explain Disposal of nuclear waste, nuclear disaster and its management

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

**INDUSTRIAL CHEMICALS &ENVIRONMENT**

**Learning Outcomes:**

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

Perform Determination of DO, COD and BOD

Learn the procedure for measurement of chloride, sulphate and salinity of water

Estimation of total alkalinity of water

Acquire skills in determination of dissolved gases like O2, CO2, SPM etc.

**Practical Syllabus:**

1. Determination of Dissolved Oxygen (DO) 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 (Ag NO3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO3 2-, HCO3 -) using double titration method.
7. Measurement of dissolved CO2.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

## Lab References:

| S.NO | AUTHOR | TITLE | PUBLISHER |
|---|---|---|---|
| 1 | E. Stocchi | Industrial Chemistry, Vol-I, | Ellis Horwood Ltd.UK. |
| 2 | R.M. Felder, R.W. | Elementary Principles of Chemical Processes, | WileyPublishers, New Delhi. |
| 3 | J. A. Kent: Riegel's | Handbook of Industrial Chemistry | CBS Publishers, New Delhi |
| 4 | S. S. Dara | A Textbook of Engineering Chemistry | S. Chand & Company Ltd. NewDelhi |
| 5 | K. De, | Environmental Chemistry | New Age International Pvt., Ltd, New Delhi. |
| 6 | S. M. Khopkar, | Environmental Pollution Analysis | Wiley Eastern Ltd, New Delhi |

Co-Curricular Activities:

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

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of organic compounds using spectroscopic data.
2. **For Students:** Student shall visit a related industry/chemistry laboratory in universities/ research organizations/private sector facility and observes the synthetic reactions and obtain spectral data for interpretation of the synthetic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max. marks for Fieldwork/project work Report:05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

**SCHEME OF VALUATION**

Practical Paper – XII B: **INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**

| | | |
|---|---|---|
| a. | Procedure | 10 marks |
| b. | Principle &Titration | 10 marks |
| c. | Tabular forms (Known & Unknown) | 10 marks |
| d. | Calculation | 6 Marks |
| e. | Report | 4 Marks |
| f. | Record | 05 marks |
| g. | Viva voce | 05 marks |
| | **TOTAL** | **50 marks** |

# SEMESTER-VIII

# B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

| | P R Govt College (A), Kakinada | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code 21-A | B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure<br>TITLE OF THE PAPER<br>Inorganic Chemistry: Metal Cluster, Electronic spectra of Complex compounds and Bio- inorganic chemistry | IV B.Sc. (VIII Semester) | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites | Theories of bonding and metal structures | 60 | 10 | 30 | 4+1 |

Course Objectives:

- Non-metal cages and metal clusters
- Organo metallic chemistry of transition metals
- Reaction mechanism of transition metal complexes
- Term symbols and Electronic spectra
- Bio-inorganic chemistry and Magnetic properties of complexes

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understanding the structure and reactivity of Nonmetal cages and metal clusters. |
| CO2 | Apply the Knowledge of organometallic chemistry in various applications such as catalysis, materials science. |
| CO3 | Understanding the fundamental principles and Reaction mechanism of transition metal complexes. |
| CO4 | Understanding the role of inorganic elements in biological systems: This includes understanding the properties and functions of metal ions and other inorganic elements in biological systems, including Hemoglobin, Myoglobin, Chlorophyll, Vitamin B12. |

Course with a focus on employability/entrepreneurship / Skill Development modules

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

## Syllabus

### Unit-I:

Non-metal cages and metal clusters: 9Hours

Structure and bonding in phosphorous- oxygen, phosphorous -Sulphur cages; structure and bonding in higher boranes with (special reference to B12 icosahedra). Carboranes, metalloboranes, metallocarboranes. Classification- LNCs and HNCs, Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in dinuclear[Re2Cl8] 2- ion, trinuclear[Re3Cl9], tetranuclear W4(OR)16, hexanuclear[Mo6Cl8] 4+ and [Nb6Cl12] 2-.

### Unit-II:

Organo metallic chemistry of transition metals: 9Hours

Classification and electron counting rules, hapticity, synthesis, structure and bonding of Ferrocene, dibenzene chromium, cycloheptatriene and tropylium complexes of transition metals. Reactions of organo metallic compounds- oxidative addition, reductive elimination, insertion and elimination. Applications of organo metallic compounds-Catalytic hydrogenation, Hydro formylation.

### Unit-III:

Reaction mechanism of transition metal complexes: 9Hours

Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis - conjugate base (CB) mechanism. Direct and indirect evidences in favour of CB mechanism. Anation reactions. Reactions without metal-ligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Trans effect on substitution reactions in square planar complexes. Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus – Hush equation, inner sphere mechanism.

### Unit-IV:

Term symbols and Electronic spectra: 9Hours

Term symbols and their derivation. Microstates, Hunds rules to predict ground terms and ground states. List of ground energy and higher energy terms from d1 to d9 configurations; Electronic spectra of transition metal complexes: Spectroscopic terms. Selection rules, Slator– Condon parameters, Racah parameters, Term separation energies for dn configurations. Correlation diagrams and Orgel diagrams. Tanabe- Sugano diagrams for d1 tod9 configurations. Calculations of Dq, B and β parameters. Charge transfer spectra.

### Unit-V:

Bio-inorganic chemistry and Magnetic properties of complexes: 9Hours

Bio-inorganic chemistry: Storage and transport of dioxygen by Hemoglobin and Myoglobin, Chlorophyll, Vitamin B12 and its importance. Magnetic properties of transition metal complexes: Orbital and spin contribution, spin-orbit coupling and magnetic moments. Types of magnetism, factors affecting on Paramagnetism, Dia, ferro and Antimagnetism.

## Suggested Co- Curricular Activities

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

## List of Textbooks:

1) Inorganic Chemistry by Huheey. Harper and Row.
2) Concise inorganic chemistry by J.D. Lee ,ELBS.
3) Inorganic chemistry, K.F.Purcell and J.C.Kotz, Holt Saunders international
4) Organo metallic chemistry by R.C.Mehrotra and A.Singh.NewAge International.
5) Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern V.

## Reference books:

1) Inorganic reaction mechanism by Basolo and Pearson, Wiley Eastern
2) Bioinorganic Chemistry by K.Hussan Reddy
3) Biological Aspects of inorganic chemistry by A.W. Addiso, W.R.Cullen, D.Dorphin and G.J.James. Weliey Interscience.
4) Photo chemistry of coordination compounds by V.Balzani and V. Carassiti. Academic Press.
5) Text book of Coordination chemistry by K.Soma Sekhara Rao and K.N.K.Vani, Kalyani Publishers.

| Unit No | Additions | Deletions | Remarks as per Blooms Taxonomy |
|---|---|---|---|
| 1 | NIL | NIL | NA |
| 2 | NIL | NIL | NA |
| 3 | NIL | NIL | NA |
| 4 | NIL | NIL | NA |
| 5 | NIL | NIL | NA |
| | | | |

CO-PO Mapping:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understanding the structure and reactivity of Nonmetal cages and metal clusters. |
| CO2 | Apply the Knowledge of organometallic chemistry in various applications such as catalysis, materials science. |
| CO3 | Understanding the fundamental principles and Reaction mechanism of transition metal complexes. |
| CO4 | Understanding the role of inorganic elements in biological systems: This includes understanding the properties and functions of metal ions and other inorganic elements in biological systems, including Hemoglobin, Myoglobin, Chlorophyll, Vitamin B12. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 |
| CO3 | 3 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 2 |
| CO4 | 3 | 1 | 1 | 1 | 3 | 2 | 1 | 3 | 2 | 1 |

Low =1 Moderate = 2 High = 3 No Correlation = 0

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) : Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**WEIGHTAGE TO THE COURSE CONTENT**

**Semester - VIII**

## Metal Cluster, Electronic spectra of Complex compounds and Bio- inorganic chemistry

| Sl. No. | COURSE CONTENT | Long answer questions | Short answer questions | Total Marks |
|---|---|---|---|---|
| 1 | UNIT – I | 2 | 2 | 30 |
| 2 | UNIT-II | 2 | 2 | 30 |
| 3 | UNIT – III | 1 | 1 | 15 |
| 4 | UNIT – IV | 1 | 2 | 20 |
| 5 | UNIT – V | 2 | 1 | 25 |
| Total | | 8 | 8 | 120 |

P. R. GOVERNMENT COLLEGE, KAKINADA

MODEL PAPER FOR SEMESTER – VIII

# Metal Cluster, Electronic spectra of Complex compounds and Bio- inorganic chemistry

Duration: 21/2 hrs. Max. Marks: 60

---

## Section -I

**Answer any FOUR questions. Each question carries FIVE marks 4 X 5 = 20 Marks**

PART- A

1. Write a short note on metalloboranes
2. Write the applications of organometallic compounds
3. Explain about oxidative addition
4. Explain about Outer sphere mechanism
5. What are the term symbols and give example.
6. Explain the charge transfer spectra
7. Write the importance of Vitamin- $B_{12}$
8. Write about the classification of LNCs and HNCs

## Section- II

**Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks**

9. Explain the structure and bonding dinuclear compounds $(Re_2Cl_8)^{2-}$ and trinuclear $(Re_3Cl_9)$

(or)

Explain the types of magnetism and what factors influence on para, dia and ferro magnetism

10. Write Wade's and Lauher's rules with example

(or)

Explain the structure and bonding of Ferrocene

11. Write the factors effecting the substitution reactions in octahedral complexes

(or)

Explain the Orgel diagram with $d^1$- configuration

12. Explain the storage and transport of dioxygen by haemoglobin

(or)

Write about oxidative addition and reductive elimination of organo metallic componds

Course 21A: INORGANIC CHEMISTRY PRACTICALS –II

## Learning Outcomes:

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

1) List out, identify and handle various equipment in Chemistry lab.

2) Learn the concepts and procedures of preparation of standard solutions, primary and secondary standards.

3) Demonstrate skills in Volumetric and gravimetric determinations.

4) Acquire skills in standardizing and determination of different metal ions.

5) Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria.

## Practical Syllabus:

Quantitative analysis –
Volumetric:
1) Determination of Ferric iron by photochemicalreduction
2) Determination of Nickel by EDTA
3) Determination of Calcium and Magnesium in a mixture by EDTA
4) Determination of Ferrocyanide by Ceric sulphate
5) Determination of Copper(II) in presence of iron(III)

### Gravimetric:

1) Determination of Zinc as Zinc pyrophosphate
2) Determination of Nickel from a mixture of Copper and Nickel.

## Suggested Co-Curricular Activities

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

1) For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of determination of cations by volumetric and gravimetric determinations.
2) For Students: Student shall visit a related industry/ chemistry laboratory in universities/ research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand-written field work/project work report not exceeding10 pages in the given format to the teacher.
3) Max marks for Field work / project work Report:05.
4) Suggested Format for Fieldwork/project work: Title page, student details, index page,details of place visited, observations, findings, and acknowledgements.
5) Unit tests (IE).

## Reference books:

1) Vogel's text book of quantitative chemical analysis, 5th edition by G.H. Jeffery et al.

*******

# B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

| | P R Govt College (A), Kakinada | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code<br>22-A | B.Sc. HONOURS CHEMISTRY: MAJOR<br>w.e.f AY 2023-24 Course structure<br>**TITLE OF THE PAPER**<br>*Modern Organic synthesis and Natural products* | IV B.Sc.-<br>VIII Semester | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites | Basics in organic chemistry | 60 | 10 | 30 | 4+1 |

Course Objectives:

- Reactive intermediates, Reactive Species and Protecting groups
- Addition Reactions
- Molecular Rearrangements
- Steroid hormones
- Flavonoids and Isoflavonoids

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand various types of reaction intermediates and the bonding present in various organic compounds. They will be able to know how to protect various functional groups in organic synthesis. |
| CO2 | Apply the Knowledge of addition reactions and molecular rearrangements in various organic reactions. |
| CO3 | Inculcate knowledge on isolation, structure and synthesis of Steroid hormones. |
| CO4 | The students will be able to gain knowledge on Flavonoids and Iso flavonoids. |

Course with a focus on employability/entrepreneurship / Skill Development modules

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

## Syllabus:

UNIT – I Reactive intermediates, Reactive Species and Protecting groups: 9 hours

Reactive intermediates : Generation, Structure, Stability, Detection and Reactivity of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Arynes. Reactive Species: Generation and reactivity of Electrophiles, Nucleophiles, Dienophiles, Ylids, Enophiles. Protecting groups: Protection of carbonyl, Hydroxyl, carboxylic acid and amine groups.

UNIT-II Addition Reactions 9 Hours

Addition to Carbon – Carbon Multiple Bonds: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration. Addition to Carbon - Hetero Multiple Bonds: Steric course of addition reactions to C=O and C=N, Knoevenagel, Claisen- Schmidt, Dieckman and Stobbe condensations, Wittig, Grignard, Mannich and Michael reaction.

UNIT-III

Molecular Rearrangements 9 Hours

Types of molecular rearrangements, migratory aptitude; Rearrangements to electron deficient carbon: Wagner-Meerwein, Dienone–Phenol, Arndt Eistert synthesis; Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Schmidt rearrangements; Rearrangements to electron deficient oxygen: Baeyer-villiger, Benzil-Benzilic acid and Favorskii rearrangements.

UNIT–IV:

Steroid harmones 9Hours

Nomenclature, basic skeleton, Diel's hydrocarbon and it's stereochemistry. Isolation, structure determination and synthesis of androsterone, testosterone, oestrone and progesterone.

UNIT–V: Flavonoids and Isoflavonoids: 9 Hours

Nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids.

## Suggested Co- curricular activities

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

## List of Text books:

1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by JerryMarch, Mc.GrawHill and Kogakush.
2) Organic Chemistry Vol.I(SixthEd )andVol.II(Fifth Ed.) by ILFinar ELBS.
3) Organic Chemistry (fifthEd) by Morrison and Boyd, PHI, India.
4) Organic Chemistry (fifthedition) by Francis A.Carey Tata Mc Graw Hill publishing Company Limited, New Delhi.
5) Chemistry of natural products by S.V.Bhat, B.A.Nagasampangi

## Reference Books:

1) Reaction Mechanism in Organic Chemistry by Mukherjee Singh.
2) A guide book to mechanism in Organic Chemistry by Peter Sykes, ELBS.
3) Chemistry of Natural products by R.S.Kalsi, Kalyani Publishers.1983.

CO-PO Mapping:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understand various types of reaction intermediates and the bonding present in various organic compounds. They will be able to know how to protect various functional groups in organic synthesis. |
| CO2 | Apply the Knowledge of addition reactions and molecular rearrangements in various organic reactions. |
| CO3 | Inculcate knowledge on isolation, structure and synthesis of Steroid harmones. |
| CO4 | The students will be able to gain knowledge on Flavonoids and Iso flavonoids. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 3 | 2 | 3 |
| CO2 | 3 | 1 | 3 | 1 | 2 | 2 | 1 | 3 | 2 | 2 |
| CO3 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 1 | 1 |
| CO4 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 1 | 1 |

Low =1 Moderate = 2 High = 3 No Correlation = 0

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) : Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

| Unit No | Additions | Deletions | Remarks as per Blooms Taxonomy |
|---|---|---|---|
| 1 | NIL | NIL | NA |
| 2 | NIL | NIL | NA |
| 3 | NIL | NIL | NA |
| 4 | NIL | NIL | NA |
| 5 | NIL | NIL | NA |

**WEIGHTAGE TO THE COURSE CONTENT**

**Semester - VIII**

*Modern Organic synthesis and Natural products*

| Sl. No. | COURSE CONTENT | Long answer questions | Short answer questions | Total Marks |
|---|---|---|---|---|
| 1 | UNIT – I | 1 | 2 | 20 |
| 2 | UNIT-II | 2 | 2 | 30 |
| 3 | UNIT – III | 1 | 2 | 20 |
| 4 | UNIT – IV | 2 | 1 | 25 |
| 5 | UNIT – V | 2 | 1 | 25 |
| Total | | 8 | 8 | 120 |

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL PAPER FOR SEMESTER – VIII

*Modern Organic synthesis and Natural products*

Duration: 21/2 hrs. Max. Marks: 60

---

**Section -I**

**Answer any FOUR questions. Each question carries FIVE marks 4 X 5 = 20 Marks**

1. Write about the stability of Carbocations
2. Write a short note on Nitrenes and Arynes
3. Explain hydroboration in alkenes
4. Explain Baeyer-Villiger reaction with mechanism
5. Explain Beckmann rearrangement
6. Write nomenclature and basic skeleton of steroid harmones
7. Explain biosynthesis of Flavanoids
8. Write about wittig reaction

Section- II

**Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks**

9. What is protecting group, explain how carbonyl and hydroxyl groups are protected.

(or)

Explain Chemo and Regio selectivity phenomenon in addition reactions with examples

10. Explain following with mechanisms

a) Dieckmann Condensation b) Mannich and Michael reaction

(or)

Explain a) Arndt-Eistert Synthesis b) Favorskii Rearrangement

11. Explain isolation, Structure determination of Androsterone

(or)

Discuss the structure elucidation and isolation of Quercetin

12. Explain isolation, Structure determination of Progesterone

(or)

Discuss the structure elucidation and isolation of Genstein

Course 22A: ORGANIC CHEMISTRY PRACTICALS –II

## Learning Outcomes:

On successful completion of this practical course, student shall be able to:
1) List out, identify and handle various equipment in Chemistry lab.
2) Learn the concepts and procedures of handling chemical reagents appropriately.
3) Demonstrate skills to perform reflux, distillation, recrystallisation and vacuum filtration.
4) Calculate theoretical yield and percent yield.
5) Dispose chemicals in a safe and responsible manner.

## Syllabus:

Preparation, recrystallization, and determination of melting point & yield of the following compounds:
1) Aspirin
2) Nerolin
3) Chalcone
4) p-Nitro acetanilide
5) 2,4,6- Tribromo aniline
6) m-Dinitrobenzene
7) Phthalimide
8) Diels-Alder adduct.

## Suggested Co-Curricular Activities

Mandatory:(Lab/field training of student by teacher:(lab:10+field:05):

1) For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of organic synthesis and recrystallization of the organic compound
2) For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3) Max marks for Fieldwork /project work Report:05.
4) Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5) Unit tests (IE).

## Reference Books:

1) Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th& 6th Ed. (Pearson Education Asia).
2) Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G.Smith, A.R. Tatchell, 5 Ed.(Longman Scientific &Technical)

*******

# B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

| | P R Govt College (A), Kakinada | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code<br>*23-B* | B.Sc. HONOURS CHEMISTRY: MAJOR<br>w.e.f AY 2023-24 Course structure<br>TITLE OF THE PAPER<br>***Analytical Methods of Analysis*** | VI B.Sc.-<br>VIII Semester | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites | Basics on instrumentation | 60 | 10 | 30 | 4+1 |

## Course Objectives:

- Qualitative and quantitative aspects of analysis
- Optical methods of analysis
- Thermal methods of analysis
- Electro analytical methods
- Separation techniques

## Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Gain knowledge on Qualitative and quantitative aspects of analysis which helps to Perform experiment with accuracy and precision. |
| CO2 | The students will be able to Understand basic principle of instrument like Flame Photometer, UV-vis spectrophotometer. |
| CO3 | The students will be able to Ingrain knowledge on Thermal methods of analysis and Electro analytical methods. |
| CO4 | Understanding the fundamental principles of Separation techniques and applying the Knowledge on Chromatographic applications. |

Course with a focus on employability/entrepreneurship / Skill Development modules

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

## Syllabus

### Unit-I:

Qualitative and quantitative aspects of analysis: 9h

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.

### Unit-II:

Optical methods of analysis: 9 h

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection Rules. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Transmittance. Absorbance and Beer-Lambert law 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.

### Unit-III:

Thermal methods of analysis: 9 h

Theory of thermogravimetry (TG) and basic principle of instrumentation of thermal analyser. Techniques for quantitative estimation of Ca and Mg from their mixture.

### Unit-IV:

Electro analytical methods 9 h

Classification of electro-analytical 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.

### Unit-V:

Separation techniques 9 h

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by salvation 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.

| Unit No | Additions | Deletions | Remarks as per Blooms Taxonomy |
|---|---|---|---|
| 1 | NIL | NIL | NA |
| 2 | NIL | NIL | NA |
| 3 | NIL | NIL | NA |
| 4 | NIL | NIL | NA |
| 5 | NIL | NIL | NA |

## Co- Curricular Activities

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

## List of Text books:

1. Willard, H.H.(1988),Instrumental Methods of Analysis, 7th Edition, Wardsworth Publishing Company.
2. Christian, G.D.(2004),Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.
3. Harris, D. C.(2007),Quantitative Chemical Analysis,6th Edition, Freeman.

## Reference books:

1. Khopkar, S.M. (2008), Basic Concepts of Analytical Chemistry, New Age International Publisher.
2. Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005), Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd.

CO-PO Mapping:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Gain knowledge on Qualitative and quantitative aspects of analysis which helps to Perform experiment with accuracy and precision. |
| CO2 | The students will be able to Understand basic principle of instrument like Flame Photometer, UV-vis spectrophotometer. |
| CO3 | The students will be able to Ingrain knowledge on Thermal methods of analysis and Electro analytical methods. |
| CO4 | Understanding the fundamental principles of Separation techniques and applying the Knowledge on Chromatographic applications. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 3 | 3 | 2 |
| CO4 | 3 | 1 | 3 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |

Low =1 Moderate = 2 High = 3 No Correlation = 0

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) : Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

## WEIGHTAGE TO THE COURSE CONTENT
**Semester – VIII**

## *Analytical Methods of Analysis*

| Sl. No. | COURSE CONTENT | Long answer questions | Short answer questions | Total Marks |
|---|---|---|---|---|
| 1 | UNIT – I | 1 | 2 | 20 |
| 2 | UNIT-II | 1 | 2 | 20 |
| 3 | UNIT – III | 2 | 1 | 25 |
| 4 | UNIT – IV | 2 | 1 | 25 |
| 5 | UNIT – V | 2 | 2 | 30 |
| Total | | 8 | 8 | 120 |

P. R. GOVERNMENT COLLEGE,
KAKINADA MODEL PAPER FOR
SEMESTER – VIII

***Analytical Methods of Analysis***

Duration: 21/2 hrs. Max. Marks: 60

---

**Section -I**

**Answer any FOUR questions. Each question carries FIVE marks 4 X 5 = 20 Marks**

PART- A

1. Explain accuracy and precission
2. Write about confidence intervals
3. Explain single beam spectrophotometer
4. what is thermogravimetry.
5. Explain the techniques used for the determination of equivalence points
6. Explain Emission spectrophotometer
7. Define solvation and chelation
8. Write the classification of solvent extraction

**Section- II**

**Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks**

9. Define Beer – Lamberts law and explain its application

(or)

Explain basic principles of Atomic Absorption Spectrometry

10. Explain the principle and Instrumentation of Thermal Analyser

(or)

Explain the techniques for quantitative estimation of Ca and Mg in mixture

11. Explain the potentiometric titrations in detail

(or)

Explain all the possible conductometric titrations in detail

12. What is solvent extraction and explain batch and continuous extraction

(or)

Explain detailed process of counter current extraction

## Course 23B: Analytical Methods of Analysis- Practical Syllabus

## Learning Outcomes:

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

1. Separate ions using chromatography
2. Identify the ion by comparing Rf values with the literature
3. Analyze soil parameters
4. Verify Beer Lamberts law
5. Determine the carbonate and bicarbonate using pH

## Practical Syllabus:

1. Separation of mixtures by paper chromatography and reporting the Rf values of $Co^{2+}$ and $Ni^{2+}$.
2. Separation of mixtures by paper chromatography and reporting the Rf values of Amino acids present in the given mixture
3. To separate a mixture of $Ni^{2+}$ & $Fe^{2+}$ by complexation with DMG and extracting the $Ni^{2+}$ DMG complex in chloroform, and determine its concentration by spectrophotometry
4. Analysis of soil: (i) Determination of p H of soil. (ii) Estimation of calcium and magnesium (iii) Qualitative detection of nitrate and phosphate
5. Verification of Lambert-Beer's law and determination of concentration of a coloured species ($CuSO_4$, $KMnO_4$)
6. Determination of carbonate- and bicarbonate in a mixture using pH-metry

## Suggested Co-Curricular Activities

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

1. For Teacher: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of estimating the quality of soil.
2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes various measured parameters of soil analysis. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max. Marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

## Reference books:

1. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C.(1989),Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.

2. Analytical Chemistry by Gary D. Christian 6th Edition John Wiley &Sons Inc New York 1994.

*******

# B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

| | P R Govt College (A), Kakinada | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code 24-A | B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure<br>TITLE OF THE PAPER<br>VIII – SEMESTER<br>Skill Enhancement courses<br>**Pharmaceutical and Medicinal Chemistry** | VI B.Sc. (VIII Semester) | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites | Basics on pharmaceutical chemistry | 60 | 10 | 30 | 4+1 |

Course Objectives:

- Pharmaceutical chemistry
- Classification of Drugs
- Synthesis and therapeutic activity of the compounds
- Pharmacodynamics and Anesthetics Drugs
- HIV-AIDS

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understanding the basics of Pharmaceutical chemistry. |
| CO2 | Apply the Knowledge of Classification of Drugs, Pharmacodynamics and Anesthetics Drugs. |
| CO3 | Inculcate the knowledge on Synthesis and therapeutic activity of the compounds. |
| CO4 | Obtain knowledge on HIV-AIDS and preventive measures. |

Course with a focus on employability/entrepreneurship / Skill Development modules

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

## Syllabus

### Unit-I:

Pharmaceutical chemistry 9 hours

Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment), Metabolites and Anti metabolites. Nomenclature: Chemical name, Generic name and trade names with examples.

### Unit-II:

Classification of Drugs 9 hours

Classification based on structures and therapeutic activity with one example each, Administration of drugs. Absorption of drugs - factors affecting absorption of drugs, routes of administration - local, enema, oral and external, parental routes - advantages and disadvantages.

### Unit-III:

Synthesis and therapeutic activity of the compounds: 9hours

a.Chemo theraputic Drugs : l. Sulpha drugs (Sulpha methoxazole) 2.Antibiotics - βLactam Antibiotics, Macrolide Antibiotics, 3. Anti-malarial Drugs(chloroquine) b. Psychotherapeutic Drugs: 1.Anti pyrectics (Paracetamol) 2.Hypnotics, 3.Tranquilizers (Diazepam) 4.Levodopa

### Unit-IV:

Pharmacodynamics and Anesthetics Drugs: 9hours

1) Antiasthma Drugs (Salbutamol) 2) Antianginals (Glyceryl trinitrate) 3) Diuretics (Furosemide) 4) Anesthetics - general - ether, chloroform, ethyl chloride, halothane, nitrousoxide, local -esters - cocaine, benzococaine.

### Unit-V:

HIV-AIDS: 9 hours

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

| Unit No | Additions | Deletions | Remarks as per Blooms Taxonomy |
|---|---|---|---|
| 1 | NIL | NIL | NA |
| 2 | NIL | NIL | NA |
| 3 | NIL | NIL | NA |
| 4 | NIL | NIL | NA |
| 5 | NIL | NIL | NA |
| | | | |

## Suggested Co- Curricular Activities

1) Training of students by related industrial experts. 2) Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material. 3) Visits of related Industries/firms, research organizations etc. 4)

Invited lectures and presentations on related topics by field/industrial experts.

## List of Textbooks:

1) Synthetic Drugs by O.D.Tyagi & M.Yadav3.Medicinal Chemistry by Ashutoshkar 2) Medicinal Chemistry by P.Parimoo 3) Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D.Bhandenkar 4) Reference Books: 5) Medicinal Chemistry by Dr. B.V.Ramana 6) Synthetic Drugs by O.D.Tyagi & M.Yadav3.Medicinal Chemistry by Ashutoshkar 7) Medicinal Chemistry by P.Parimoo

## Reference books:

1) Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D. Bhandenkar 2) Medicinal Chemistry by Kadametal P-I &P.II 3) European Pharmacopoeia.

Course 24A. Pharmaceutical and Medicinal Chemistry- Practical Syllabus
Skill Enhancement course

CO-PO Mapping:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Understanding the basics of Pharmaceutical chemistry. |
| CO2 | Apply the Knowledge of Classification of Drugs, Pharmacodynamics and Anesthetics Drugs. |
| CO3 | Inculcate the knowledge on Synthesis and therapeutic activity of the compounds. |
| CO4 | Obtain knowledge on HIV-AIDS and preventive measures. |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |
| CO3 | 3 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 3 | 1 | 1 |

Low =1 Moderate = 2 High = 3 No Correlation = 0

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation,

derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) : Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:
**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**WEIGHTAGE TO THE COURSE CONTENT**
**Semester – VIII**

## Pharmaceutical and Medicinal Chemistry

| Sl. No. | COURSE CONTENT | Long answer questions | Short answer questions | Total Marks |
|---|---|---|---|---|
| 1 | UNIT – I | 2 | 1 | 25 |
| 2 | UNIT-II | 2 | 1 | 25 |
| 3 | UNIT – III | 2 | 2 | 30 |
| 4 | UNIT – IV | 1 | 2 | 20 |
| 5 | UNIT – V | 1 | 2 | 20 |
| Total | | 8 | 8 | 120 |

**Pithapur Rajah's Government College (A), Kakinada**

Model Paper for Semester – VIII

# Pharmaceutical and Medicinal Chemistry

Duration: 21/2 hrs. Max. Marks: 60

## Section -I

**Answer any FOUR questions. Each question carries FIVE marks 4 X 5 = 20 Marks**

1. Explain the terms Pharmacodynamics and Pharmacokinetics
2. Explain the absorption of drugs in ADME path way
3. Explain the therapeutic activity of tranquillizers
4. Explain the therapeutic activity of Levodopa
5. Explain the mode of action Chloroform
6. Explain the Adverse effects of Cocaine
7. Explain how to prevent the HIV AIDS
8. write the structures of Indinavir and Nelfinavir

Section- II

**Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks**

9. Explain metabolites and anti-metabolites with examples

(or)

Explain the ADME in pharmacokinetics

10. Explain the classification of drugs based on therapeutic activity

(or)

Explain various roots of Drug administration

11. Explain the synthesis and therapeutic activity of Chloroquin

(or)

Explain the synthesis and therapeutic activity of Paracetamol

12. Explain the synthesis and therapeutic activity of Salbutamol

(or)

What are $CD_4$ and $CD_8$ cells and explain their Importance in Immunity

## Learning Outcomes:

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

1) Learn the procedure for the synthesis of drugs. 2) Synthesis of Drugs Assisted by Microwave Oven 3) Acquire skills in Drawing structure and Reaction using Chemdraw 4) Know the reactions and mechanisms involved in synthesis of Drugs.

## Practical Syllabus:

1) Synthesis of Sulphanilamide 2) Synthesis of 7- Hydroxy -4- methyl coumarin 3) Synthesis of Chlorobutanol 4) Synthesis of Tolbutamide 07 5) Assay of Chlorpheniramine Maleate 6) Assay of Benzyl Penicillin 2 7) Synthesis of Aspirin Assisted by Microwave Oven 8) Drawing structure and Reaction using Chemdraw

## Suggested Co-Curricular Activities

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

1) For Teacher: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of comprehensive product development programs to meet new product criteria and timing. Acquire skills in the preparation of drugs and pharmaceuticals, learn the procedure of synthesis of drugs with good yield.

2) For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the preparation of Cosmeceuticals and Pharmaceutical. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher. 3) Max marks for Fieldwork/project work Report: 05. 4) Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements. 5) Unit tests (IE).

## Reference books:

1) Wilson and Giswold's Organic medicinal and PharmaceuticalChemistry. 2) Foye's Principles of MedicinalChemistry. 3) Burger's Medicinal Chemistry, Vol I to IV. 4) Introduction to principles of drug design- Smith andWilliams. 5) Remington's Pharmaceutical Sciences. 6) Martindale's extra pharmacopoeia. 7) Organic Chemistry by I.L. Finar, Vol. II. 8) The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5. 9) Text book of practical organic chemistry- A.I.Vogel.

Reference books:

1) The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5. 2) Text book of practical organic chemistry- A.I.Vogel.s

*******

# B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

| | P R Govt College (A), Kakinada | Program & Semester | | | |
|---|---|---|---|---|---|
| Course Code<br>25-B | B.Sc. HONOURS CHEMISTRY: MAJOR<br>w.e.f AY 2023-24 Course structure<br>TITLE OF THE PAPER<br>VIII – SEMESTER<br>*Skill Enhancement course*<br>**Material & Energy Balances and Utilities in Chemical Industry** | VI B.Sc.-<br>VIII Semester | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites | .<br>Basics of units and dimensions | 60 | 10 | 30 | 4+1 |

Course Objectives:

- Dimensions and units
- Material Balance without Chemical Reactions
- Energy Balance
- Utilities in Chemical Industry
- Fluid flow and Pumps Fluid flow

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Acquire knowledge on Atomic weight, Molecular weight, Equivalent Weight and Ideal gas law. |
| CO2 | The students will be able to Understanding the concept of Material Balance without Chemical Reactions. |
| CO3 | Understanding the concept of Energy Balance and applying acquiring knowledge on its applications. |
| CO4 | Obtain knowledge on Boilers, Fluid flow and Pumps Fluid flow |

Course with a focus on employability/entrepreneurship / Skill Development modules

| Skill Development | | Employability | | Entrepreneurship | |
|---|---|---|---|---|---|

Syllabus

## Unit-I: 9Hours

Dimensions and units: Basic Chemical Calculations -Atomic weight, molecular weight, equivalent weight, Mole, composition of (i) Liquid mixtures and (ii) gaseous mixtures. Ideal gas law, vapor pressure, Humidity and Saturation.

## Unit-II: 9Hours

Material Balance without Chemical Reactions: Flow diagram for material balance, simple material balance with or without recycle or by-pass for chemical engineering operations such as distillation, absorption, crystallization, evaporation and extraction. Material Balance involving chemical reactions: concept of limiting reactant, conversion, yield, selectivity and liquid phase reaction, gas phase reaction with or without recycle or by pass

## Unit-III: 9Hours

Energy Balance: Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes during phase transformation: Enthalpy of fusion, Enthalpy of vaporization, Enthalpy of condensation, Enthalpy of sublimation, Hess's law of constant, Heat Summation and its applications

## Unit-IV : 9Hours

Utilities in Chemical Industry a) Boilers: Types of boilers and their functioning b) Water: Specifications of industrial use, various water treatments. c) Steam: Generation and use. d) Air: Specification of industrial use, processing of air

## Unit-V: 9Hours

Fluid flow and Pumps Fluid flow: Fans, blowers, compressors, vacuum pump, ejectors. Pumps: Reciprocating pumps, Gear pumps, centrifugal pumps.

| Unit No | Additions | Deletions | Remarks as per Blooms Taxonomy |
|---|---|---|---|
| 1 | NIL | NIL | NA |
| 2 | NIL | NIL | NA |
| 3 | NIL | NIL | NA |
| 4 | NIL | NIL | NA |
| 5 | NIL | NIL | NA |

## Suggested Co- Curricular Activities

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

## List of Textbooks:


1. E.Stocchi:IndustrialChemistry,Vol-I,EllisHorwoodLtd.UK
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, NewDelhi.
3. P.C.Jain,M.Jain:Engineering Chemistry, Dhanpat Rai &Sons, Delhi.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut


## Reference books:


1. B.I. Bhatt and S.M. Vora: Stoichiometry, Tata McGraw-Hill publishing Company Ltd, New Delhi.
2. E.Stocchi:IndustrialChemistry,Vol-I,EllisHorwoodLtd.UK
3. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
4. J.A.Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, NewDelhi.
5. P.C.Jain, M.Jain: Engineering Chemistry, DhanpatRai & 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
8. S.C. Bhatia: Chemical Process Industries, Vol.I & II, CBS Publishers, New Delhi.
9. W. L. McCabe and J. C.Smith: Unit Operations in Chemical Engineering, Mc-Graw HillBook Company, NewYork.
10. O. P. Vermani, A. K. Narula: Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.


CO-PO Mapping:

| On Completion of the course, the students will be able to | |
|---|---|
| CO1 | Acquire knowledge on Atomic weight, Molecular weight, Equivalent Weight and Ideal gas law. |
| CO2 | The students will be able to Understanding the concept of Material Balance without Chemical Reactions. |
| CO3 | Understanding the concept of Energy Balance and applying acquiring knowledge on its applications. |
| CO4 | Obtain knowledge on Boilers, Fluid flow and Pumps Fluid flow |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 1 | 1 |

Low =1 Moderate = 2 High = 3 No Correlation = 0

**PROGRAMME OUTCOMES**

At the completion of the B.Sc. Chemistry program, the students of our Department will be able to:

**(PO1) Knowledge:** Attain in depth knowledge about the fundamental principles, essential facts, conclusions and applications of chemical and scientific theories in various domains of chemistry.

**(PO2) Critical Thinking:** Carry out experiments in the area of organic analysis, estimation, derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

**(PO3) Problem Solving:** Define the background of reaction mechanisms, complex chemical structures, instrumental method of chemical analysis, and separation techniques and apply appropriate techniques for analysing specific problems both qualitatively and quantitatively in laboratories and in industries.

**(PO4): Usage of modern tools:** Create data using modem chemical tools and ICT for modeling and analyze the data obtained from sophisticated instruments (like UV-Vis, FTIR, NMR, GCMS, Fluorescence, SEM, TEM and XRD) for chemical analysis

**(PO5) : Communication:** Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**(PO6): Life-long Learning:** Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

**(PO7) Ethical Practices and Social Responsibility:** Generate ideas and solutions for green and sustainable chemistry and approach towards planning and execution of research in frontier areas of chemical sciences.

**PROGRAM SPECIFIC OUTCOMES (PSO's)**

At the time of graduation, our under graduates would be able to:

**PSO 1-** Evaluate, analyze, interpret and effectively apply the basic laws, principles, phenomena, processes and mechanisms involved in the domain of organic, inorganic, physical and analytical Chemistry

**PSO2 -** Demonstrate the knowledge of Chemistry in the domain of research, education and perspective entrepreneurship.

**PSO3 -** Evaluate distinct problems in the field of chemical data analysis, scientific interpretation and reaction mechanisms with an understanding on basic tools to be employed.

**WEIGHTAGE TO THE COURSE CONTENT**

**Semester - VIII**

## Material & Energy Balances and Utilities in Chemical Industry

| Sl. No. | COURSE CONTENT | Long answer questions | Short answer questions | Total Marks |
|---|---|---|---|---|
| 1 | UNIT – I | 1 | 2 | 20 |
| 2 | UNIT-II | 2 | 1 | 25 |
| 3 | UNIT – III | 2 | 2 | 30 |
| 4 | UNIT – IV | 2 | 1 | 25 |
| 5 | UNIT – V | 1 | 2 | 20 |
| Total | | 8 | 8 | 120 |

**Pithapur Rajah's Government College (A), Kakinada**

Model Paper for Semester – VIII

# Material & Energy Balances and Utilities in Chemical Industry

Duration: 21/2 hrs. Max. Marks: 60

## Section -I

**Answer any FOUR questions. Each question carries FIVE marks 4 X 5 = 20 Marks**

1. Write about ideal gas law
2. Explain the concept of limiting reactant
3. Define enthalpy of fusion and enthalpy of vapourisation
4. Write the specifications of water in industrial use
5. Write about the classification of pumps
6. Explain the mole concept
7. Write about the classification of fans
8. Define enthalpy of sublimation with example

## Section- II

**Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks**

9. Explain the distinction between Atomic weight, Molecular weight and Equivalent Weight

(or)

Write about liquid and gas phase reactions with example

10. Write about distillation and crystallization processess

(or)

Explain the heat capacities of gases and gaseous mixtures.

11. Explain Hess law of summation of heat constant and its applications

(or)

Explain the types of boilers and their functions

12. Explain about the compressors and blowers.

(or)

Write about steam generation, its applications

## Course 25B: Material & Energy Balances and Utilities in Chemical Industry

### Practical Syllabus Skill Enhancement course

### Learning Outcomes:

On successful completion of this practical course, student shall be able to:
1.Carry out the Quantitative analysis of calcium in lime stone.
2.Determine the hardness of given water sample usingEDTA.
3.DetermineCODand BOD of a given water sample.
4.Find out the Percentage of available chlorine present in the bleaching powder.

### Practical Syllabus:

1. Quantitative analysis of calcium in limestone by complexometric titration.
2. Hardness of water by EDTA titration.
3. Determination of Chemical Oxygen Demand(COD)
4. Determination of Biological Oxygen Demand(BOD)
5. Percentage of available chlorine in bleaching powder

### Suggested Co-Curricular Activities

a). Mandatory:
1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of detection of N, S and halogens using thegreen procedure, preparation of TLC plates, detection of organic compounds using Rf values in TLC/paper chromatography, loading of column, selection of solvent system for column chromatography, separation of amino acids and dye mixture using chromatographic techniques.

2. For Students: Student shall visit a related industry/ chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project workreportnotexceeding10 pages in the given format to the teacher.
a. Max marks for Field work/projectworkReport:05.
b. Suggested Format for Fieldwork/project work: Title page, student details, index page,details of place visited, observations, findings and acknowledgements.
c. Unit tests(IE)

### Reference books:

1. 4.J.A.Kent:Riegel'sHandbookofIndustrialChemistry,CBSPublishers,NewDelhi.
2. 5.P.C.Jain,M.Jain:EngineeringChemistry,DhanpatRai&Sons,Delhi.
3. 6.R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, NewDelhi.
4. 7.B.K.Sharma:EngineeringChemistry,GoelPublishingHouse,Meerut 5. 8.S.C.Bhatia: Chemical Process Industries, Vol.I &II, CBS Publishers, New Delhi.

*******