# Pithapur Rajah's Government College (Autonomous)
# Kakinada

**Affiliated to Adikavi Nannaya University**

**NAAC Accredited with "A" Grade (3.17 CGPA)**

# DEPARTMENT OF CHEMISTRY

# B. Sc. Chemistry Syllabus
# Under CBCS

## Board of Studies
## 2020 – 21

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**P. R. Govt. College (A), Kakinada**

**Recommended Composition of the Board of Studies of Chemistry**

**And it's Functions of an Autonomous College**

**June-2020-21**

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## I Composition

1. **Head of the Department concerned (Chairman):**

   Dr. T. Vara Prasad, M.Sc., M.Ed., M.Phil., Ph.D.

2. **The entire faculty of each specialization.**

   1. Dr. D.Rama Rao, M.Sc., B. Ed., M.Phil., Ph.D.
   2. Sri V.Mallikarjuna Sarma,MSc, M.Phil,NET
   3. Dr.V.Narayana Rao M.Sc, Ph.D
   4. Sri U.Sai Krishna M.Sc,NET
   5. Sri. K Baburao M. Sc., M.Phil.
   6. Smt. S Swarna Latha M.Sc.

3. **ONE experts in the subject from outside the college to be nominated by the Academic Council**
   a. Dr. K. Jhansi Lakshmi, Principal, Ideal Degree College, Kakinada
4. **One expert to be nominated by the Vice-Chancellor from a panel of six recommended by The College Principal**
   a. Dr. K. Deepthi, Adikavi Nannaya University, Rajahmundry
5. **One representative from industry/ Corporate Sector/ allied area relating to Placement.**
   a. Dr. Ch. V. N. S. Vara Prasad, Managing partner, DAS Pharma Ltd, Kakinada
6. **One postgraduate meritorious alumnus to be nominated by the Principal.**

**The chairman, Board of Studies, may with the approval of the Principal of the College, Co-opt.**

a. Dr.K.Raghavachari M.Sc., M.Phil, Ph.D.

**Term**

The term of the nominated members shall be two years.

## II. Meeting

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

## III. Functions

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

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

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

**DEPARTMENT OF CHEMISTRY,**

**Minutes of board of studies (BOS) meeting 2020-21 on 20. 06. 2020 at 10.30 am**

**Agenda**

- Online BOS.
- Approve Syllabus for III, IV, V and VI Semesters, Same Syllabus Will be Followed Intoto I and II Semester (I Year UG) After getting the APSHE Guidelines.
- Grant of Extra credits for Certain activities.
- Syllabus, Model Question Papers and Model Blue Prints for III, IV, V and VI Semesters.
- Internal and External Exams to be Assessed in the Ratio for III, IV, V and VI Semesters.
- Department action plan for 2020-21.
- Any Other Proposal with the Permission of the Chairman.

**Resolutions:**

The board of studies meeting was held online through Video Conference by Google Meet by the Chemistry Department on 20. 06. 2020 at 10.30 am under the chairmanship of Dr. T.Vara Prasad, in charge of the department. The principal, Dr. Chappidi Krishna, Dr.K.Deepthi, University Nominee., Dr. K. Jhansi Lakshmi, Head in Chemistry and Principal, Ideal College, Kakinada and all members of the faculty of chemistry and student representatives attended the meeting. The following agenda items are discussed and resolutions are made.

1. It is resolved to continue choice-based credit system in the chemistry combination programmes as per the directions of the CCE, Hyderabad to the first year and second year and second year and final year students w.e.f. 2019-20.

2. Resolved to follow 60%-40% external and internal w.e.f. 2017-2018 admitted batch and it continued in second and third year.

3. It is resolved to allot 50 marks project work for final year students in chemistry preferably in cluster paper C - 3 practicals, w.e.f 2019-20 in accordance with APSCHE.

4. It is resolved to conduct departmental activities such as OZONE DAY, CHEM FEST, CHEMISTRY DAY and SCIENCE DAY.

5. It is resolved to offer Subject Electives and clusters A, B and C in the V and VI Semester Respectively as per the guidelines of AKNU

6. It is resolved to implement the recommended pedagogy for the first semester 2020-21

7. Resolved to conduct practical examinations semester wise.

8. It is resolved to organize guest lectures by eminent professors.

9. Resolved to implement pass minimum for internal assessment for CBSE pattern students as the pattern is learner oriented.

10. It is resolved to maintain status quo for same question paper pattern in I, II, III years.

11. It is resolved to encourage students enroll in MOOCS Online Programmes and give extra credits for students after successful completion of the courses.

12. It is resolved that if there is any change in the syllabus in the first year as prescribed by APSCHE, Vijayawada in this academic year, the same syllabus will be adopted as such.

11. Resolved to submit proposals to conduct a faculty development program in instrumentation techiniques/ advanced topics with the assistance of the industry representatives and university representatives.

12. Resolved to assist the orphan children of below two years age being taken by department of women and child welfare as an extension activity with the funds contributed by the faculty members of the department.

13. Resolved to change the syllabus components in semester **I** to Semester **II** and vice versa. Sly semester **III** to **IV** and vice versa on par with the affiliating university.

14. It is proposed to give 33.3% weightage competitive exam questions pertaining to the syllabus prescribed

- 20. Resolved to reduce the intake of B.Sc. MPC TM students from 60 to 30 w.e.f from 2019-20.
- 21. Resolved to increase the intake of B.Sc. MPC EM students from 30 to 60 w.e.f. from 2019-20
- Resolved to take girls students also for admissions into B.Sc. MCPC w.e.f. from 2019-20.

**The Following Paper Setter Are Recommended.**.

1. Dr. G. Nagarjuna, SRR CVR GDC, Vijayawada.
2. Dr. B. Mallikarjun, Govt. College (A), Rajamahendravaram.
3. Dr. G. Venkatarao, GDC, Vijayawada
4. Shri B. Venkatarao, GDC, Ramachandrapuram
5. Dr. Ramachandra Rao, Y.N.College,Narasapuram
6. Dr. T. Narasimha Murthy, GDC, Mandapeta.
7. Smt. G. Tejaswini, SVD GDC (W), Nidadavole.
8. Dr. M. Trinadh, GDC (A), Rajahmundry.
9. Sri. M. Sudhakara Rao, ASNM Govt. College (A), Palakol.
10. Sri. V. Satyanarayana, Govt. Arts College, Rajahmundry.
11. Sri. V Rambabu, GDC, Perumallapuram
12. Sri V. Sanjeev Kumar, GDC, Mandapeta.
13. Dr. K. Ravindra Babu, Govt.Arts College, Rajahmundry.
14. Sri T. V. V. Satyanarayana, GDC, Ramachandrapuram
15. Sri V. Sridhar, GDC, Nidadavol

## Signatures of the members who attended the

## Board of studies in Chemistry on 20. 06. 2020 at 10.00am

**Mode of Conduct of meeting: Online video conference through Google Meet**

| | |
|---|---|
| 1. Dr. T. Vara Prasad | Chairman & Lecturer in Charge |
| 2. Dr. K. Deepthi, | University representative<br>Adikavi Nannaya University<br>Rajamahendravaram. |
| 3. Dr. Ch. V. N. S. Vara Prasad, | Managing partner,<br>DAS Pharma Ltd, Kakinada |
| 4. Dr. K. Jhansi Lakshmi | Subject expert<br>Lecturer in Chemistry,<br>Ideal Degree College, Kakinada |
| 5. Dr. K. Raghavachari | Retired Head of the Chemistry Department |
| 6. Sri D. Rama Rao | Member |
| 7. Sri V. Mallikarjuna Sarma | Member |
| 8. Dr.V.Narayana Rao | Member |
| 9. Sri U.Sai Krishna | Member |
| 10. Sri K. Babu Rao | Member |
| 11. Smt. S. Swarna Latha | Member |
| 12. M.S.T.B.V.Ratnam | Member |
| 13. G. Rama Lakshmi | Member |
| 14. G. Sandhya | Member |
| 15. P. K. M. S. Devi | Member |
| 16. M. Siva Sankar | Member |
| 17. T. S. S. Lakshmi | Member |
| 18. T. Pavan Kumar | Member |
| 19. S. Vijaya Lakshmi | Member |
| 20. B. S. V. A. L. Jyothi Sree | Member |
| 21. K. N. S. Swami | Member |

22. P. Sai Kalyani — Member

23. B. Vijaya Durga, II MPC TM (Regd. No. 2190214) — Student member

24. K. Pushpa Kumari, II MPC TM (Regd. No. 2190229) — Student Member

25. Surimilli Kishore Kumar, II MCCS (Regd. No. 2191320) — Student Member

26. Akula Mounika, II MPC EM (Regd. No. 2190103) — Student Member

27. Bandaru Srinivasu, II MPC EM (Regd. No. 2190104) — Student Member

**Signatures of the members who attended the**

**Board of studies in Chemistry on 20. 06. 2020 at 10.00am**

**Mode of Conduct of meeting: Online video conference through Google Meet**

| NAME | SIGNATURE | CONTACT NO. |
|---|---|---|
| Dr. T. Vara Prasad | | |
| Dr. K. Deepthi, | | |
| Dr.Ch. V. N. S. Vara Prasad | | |
| Dr. K. Jhansi Lakshmi | | |
| Dr. K. Raghavachari | | |
| Dr. D. Rama Rao | | |
| Sri V. Mallikarjuna Sarma | | |
| Dr.V. Narayana Rao | | |
| Sri U.Sai Krishna | | |

On line Video Conference Through Google Meet

## Signatures of the members who attended the

## Board of studies in Chemistry on 20-6-20 at 10.00am

| | | |
|---|---|---|
| 1 | Dr. T Vara Prasad | Chairman & Lecturer in Charge |
| 2 | Dr. K. Deepti, | University representative<br>Adikavi Nannaya University<br>Rajamahendravaram |
| 3 | Dr.Ch. V. N. S Vara Prasad, | Managing partner,<br>DAS Pharma Ltd, Kakinada |
| 4 | Dr. K. Jhansi Lakshmi | Subject expert<br>Lecturer in Chemistry,<br>Ideal Degree College, Kakinada |
| 5 | Dr.K.Raghavachari | Retired Head of the Chemistry Department |
| 6 | Sri D. Rama Rao | Member |
| 7 | Sri V. Mallikarjuna Sarma | Member |
| 8 | Dr.V.Narayana Rao | Member |
| 9 | Sri U.Sai Krishna | Member |
| 10 | Dr.D.S.V.N.M.Rama Murthy | Member |
| 11 | Sri K.Babu Rao | Member 20/6/2020 |
| 12 | Smt.S.Swarna Latha | Member |
| 13 | Miss. M.S.T.B.V.Ratnam | Member |
| 14 | Miss.G.Rama Lakshmi. | Member |
| 15 | Mr.B.V.Siva Kumar | Member |
| 16 | Miss.S.G.Kalyani | Member |
| 17 | G.Sandhya | Member |
| 18 | P.K.M.S.Devi | Member |
| 19 | J.Aruna Kalyani (MPC EM) | Student Member |
| 20 | Sankar Rao (MPC EM) | Student Member |
| 21 | A.Sravani Devi ( MBC) | Student Member |

## ACTION PLAN BOS MEETING -CHEMISTRY HELD ON 20. 06. 2020.

### 1. Department activities for 2020-21 academic year. Annexure I

| Month | Activity proposed | Faculty member in charge |
|---|---|---|
| July-20 | Departmental staff meeting to review results and class work allotment | Dr.T. Vara Prasad |
| July - 20 | Preparation of curricular plans, time-tables etc., | All Faculty Members |
| Aug - 20 | Remedial coaching classes for II & III year supplementary exams | All Faculty Members |
| | Bridge classes for I year students | All Faculty Members |
| Aug-20 | Student awareness programmes on ragging& eve teasing - consequences , self- discipline, career guidance, higher education opportunities etc., | All Faculty Members |
| August-20 | Conference on prospects in pharmaceutical Industries | Dr.T. Vara Prasad |
| | Study tour / Field trips | |
| Sept-20 | Ozone day | All Faculty Members |
| Oct-20 | MOLE Day | Dr. D.Ramarao |
| | Faculty development program | V.Mallikarjuna Sarma |
| Nov-20 | National Education Day – Outreach Program to nearby school | |
| Dec-20 | World AIDS Day | All Faculty Members |
| | Chemistry day & Chem fest | V.Mallikarjuna Sarma |
| Jan-21 | 10 days coaching for PG entrance examinations in chemistry<br>Study tour / Field trips | V.Mallikarjuna Sarma |
| Feb-21 | NATIONAL SCIENCE DAY | All Faculty Members |
| March-21 | Consumer awareness day | Dr.T. Vara Prasad |

### 2. Organizing National/ State level seminars/Workshops/ Conferences/ Training programs etc., with topics and other details.

**(Mandatory for each Department)**

i) Staff development program
ii) Training in the use of HPLC
iii) Awareness on OZONE protection
iv) National Chemistry day
v) Chem. fest
vi) National Science day 2021
vii) Guest lectures
viii) National seminar in chemistry
ix) Training in Soil analysis
x) Training in water analysis

3. **Change of modules in the syllabus content.**

   Syllabus changed for first and second years as per university regulations. CBCS introduced for final year w.e.f. 2018-19.

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

   **I. Study visits to: Rs, 50,000**

   1. Visakha Steel Plant, Visakhapatnam
   2. Hetero Laboratories, Nakkapally
   3. Dr. Reddy's Laboratories, Yanam.
   4. National Institute of Hydrololgy, Kakinada.
   5. SAR Chandra Environ Solutions, Kakinada.
   6. ONGC mini refinery, Tatipaka.
   7. Soil analysis laboratory, Samalkot.
   8. IICT,HYD
   9. Venky parenterals, Yanam

   **II.**

   1. Sophisticated version UV-Visible spectrophotometer- 5.0 lakhs
   2. Other equipment 1.0 lakhs

5. **Plan for organizing subject oriented community outreach programs & allocation of necessary funds. (Mandatory for each Department)**

   i) Adoption of village Rs. 20,000

   ii) Medical Awareness programs Rs. 10,000

6. **Instituting of new medals/incentives/prizes etc., from alumni, philanthropists, parents, faculty etc., - Strategies to be recommended**
7. **Introduction of new programs –PG/UG/Diploma and certificate courses.**

8. **Any other program that enhances the learning capacity of students and their employable & knowledge skills.**

   Training in the use of instruments like AAS, UV-Vis, HPLC, flame photometer, uranium analyzer, soil and water analysis projects, air quality projects.

9. **Change in internal assessment exams for conducting II mid Semester by way of Project work/Assignment.**

   Not possible as the number of students is more. However it is proposed to give 33.3% weitage for competitive exam questions pertaining to the syllabus prescribed.

**10. Proposed panel of examiners/paper setters & other experts/nominees for BOS deliberations.**

**Chemistry:**

1. Dr. G. Nagarjuna, SRR CVR GDC, Vijayawada.
2. Dr. B. Mallikarjun, Govt. College (A), Rajamahendravaram.
3. Dr. G. Venkatarao, GDC, Vijayawada
4. Shri B. Venkatarao, GDC, Ramachandrapuram
5. Dr. Ramachandra Rao, Y.N.College,Narasapuram
6. Dr. T. Narasimha Murthy, GDC, Mandapeta.
7. Smt. G. Tejaswini, SVD GDC (W), Nidadavole.
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10. Sri. V. Satyanarayana, Govt. Arts College, Rajahmundry.
11. Sri. V Rambabu, GDC, Perumallapuram
12. Sri V. Sanjeev Kumar, GDC, Mandapeta.
13. Dr. K. Ravindra Babu, Govt.Arts College, Rajahmundry.
14. Sri T. V. V. Satyanarayana, GDC, Ramachandrapuram
15. Sri V. Sridhar, GDC, Nidadavol

## Structure of Chemistry Syllabus under CBCS

| YEAR | SEMESTER | PAPER | TITLE | MARKS | CREDITS |
|---|---|---|---|---|---|
| I | I | I | Inorganic and Organic Chemistry | 100 | 03 |
| | | | Practical – I | 50 | 02 |
| | II | II | Physical and General Chemistry | 100 | 03 |
| | | | Practical – II | 50 | 02 |
| II | III | III | Inorganic and organic Chemistry | 100 | 03 |
| | | | Practical – III | 50 | 02 |
| | IV | IV | Spectroscopy and Physical Chemistry | 100 | 03 |
| | | | Practical – IV | 50 | 02 |
| III | V | V | Inorganic ,Organic and Physical Chemistry | 100 | 03 |
| | | | Practical – V | 50 | 02 |
| | | VI | Inorganic ,Organic and Physical Chemistry | 100 | 03 |
| | | | Practical – VI | 50 | 02 |
| | * Any one Paper from VII A, B and C<br><br>** Any one cluster from VIII, A, B and C | VII (A)* | Elective | 100 | 03 |
| | | | Practical - VII A | 50 | 02 |
| | | VII (B)* | Elective | 100 | 03 |
| | | | Practical - VII B | 50 | 02 |
| | | VII (C)* | Elective | 100 | 03 |
| | | | Practical - VII C | 50 | 02 |
| | | VIII (A)** | **Cluster Electives - I :** | | |
| | | | VIII-A-1 | 100 | 03 |
| | | | VIII-A-2 | 100 | 03 |
| | | | VIII-A-3 | 100 | 03 |
| | | | Practical | 50 | 02 |
| | | | Practical | 50 | 02 |
| | | | Project | 50 | 02 |
| | | VIII (B)** | **Cluster Electives - II ::** | | |
| | | | VIII-B-1 | 100 | 03 |
| | | | VIII- B-2 | 100 | 03 |
| | | | VIII-B-3 | 100 | 03 |
| | | | Practical | 50 | 02 |
| | | | Practical | 50 | 02 |
| | VI | | Project | 50 | 02 |
| | | VIII (C)** | **Cluster Electives - III ::** | | |
| | | | VIII-C-1 | 100 | 03 |
| | | | VIII-C-2 | 100 | 03 |
| | | | VIII-C-3 | 100 | 03 |
| | | | Practical | 50 | 02 |
| | | | Practical | 50 | 02 |
| | | | Project | 50 | 02 |

# 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 | **Cultural activity** | *Winning medals at state level-2,*<br>*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* |

## OBJECTIVES

- **Objectives**
  **The students can obtain the knowledge in the following topics and come to know how chemistry is essential in daily life.**

CO 1. Preparation, properties and applications of some special compounds of s and p block elements.

CO 2. Structural theory of Organic compounds.

CO 3. Preparation, properties and applications of alkenes, alkynes and cycloalkanes.

CO 4. Benzene structure and its reactivity.

CO 5. Identification of some cations and anions in the unknown salt.

- **By the end of II semester, each and every I degree chemistry student can obtain the knowledge in the following topics and come to know how chemistry is essential in daily life.**

CO 1. Features involved in gaseous state, liquid state and solid state and their applications.

CO 2. Importance of colloids and adsorption.

CO 3. Chemical bonding between molecules through M.O. theory.

CO 4. Identification of some cations and anions in the unknown mixture.

CO 5. Basic knowledge and Importance of of Stereochemistry.

- **By the end of III semester, each and every II degree chemistry student can attain the knowledge in the following topics and come to know their role in serving the society through chemistry.**

CO 1. Properties of d and f block elements.

CO 2. Boding nature of the metals.

CO 3. Preparation, properties and applications of halogen compounds, hydroxyl compounds, carbonyl Compounds and carboxylic acids.

CO 4. Importance and synthetic applications of active methylene compounds.

CO 5. Estimation of Fe (II) and Cu (II) in the unknown material through practical.

CO 6. Reactions of some functional groups like phenols, carboxylic acids, aldehydes, ketones, amines and Amides.

- **By the end of IV semester, each and every II degree chemistry student can attain the knowledge in the following topicss and come to know their role in serving the society through chemistry.**

CO 1. Different types of Electronic transitions present in Organic molecules..

CO 2. Identification of Functional groups using IR spectrum.

CO 3. Analysis of Cr and Mn using spectrophotometer.

CO 4. Structural identifications of organic compounds using $H^1$-NMR

CO 5. Different aspects of electrochemistry.

CO 6. Identification of functional group present in the given organic compound by IR spectral analysis.

CO 7. Importance of conductometric techniques by doing strength of acids and bases.

- **By the end of V semester, each and every III degree chemistry student can obtain the knowledge in the following topics and come to know how to serve the society by becoming a chemist.**

CO 1. Involved theories and properties of coordination compounds.

CO 2. Preparation and properties of nitrogen compounds.

CO 3. Importance, preparations, properties and medicinal uses of heterocyclic compounds.

CO 4. Structural elucidation of glucose and fructose.

CO 5. Importance of Amino acids and Proteins.

CO 5. Determination of Rate of the reactions through chemical kinetics.

CO 6. Some photochemical reactions photophysical processes.

CO 7. Importance of thermo dynamical aspects.

CO 8. Identification of functional group present in the given organic compound by following organic qualitative analysis.

CO 9. Determination of surface tension and viscosity of some liquids.

- **By the end of VI semester, each and every III degree chemistry student can get the knowledge in the following topics depending on their choice/interest and come to know how to serve the society by becoming a chemist.**

CO 1. Various types of instrumental techniques like IR and NMR spectroscopies.

CO 2. Different aspects of Environmental Chemistry.

CO 3. Importance of green chemistry.

CO 4. Analyses of drugs, dairy products

CO 6. Importance of petrochemicals.

CO 7. Preparation of some organic compounds.

CO 8. Synthesis of organic compounds using green synthesis.

CO 9. Hands on experience in operating colorimeters, pH meters and potentiometers.

CO 10. Submission of a project work.

## OUT COMES

**After completion of B.Sc. course the students will be able to:**

1. Acquire comprehensive knowledge in physical inorganic and organic chemistry.
2. Acquire experimental skills in chemical analysis.
3. Apply their knowledge and understanding in new situations.
4. Have industrial exposure by visiting nearby industry plants.
5. Achieve good ranks in PG entrance examinations.
6. Acquire employable skills and become industry ready persons.
7. Get motivation for research by carrying out projects.
8. Gain leader ship quality by participation in extension programs and group projects etc

**P.R.GOVERNMENT COLLEGE (AUTONOMOUS)-KAKINADA**
**SECOND YEAR 2019-20**
**SEMESTER-IV**
**CHEMISTRY PAPER-IV**
**SPECTROSCOPY & PHYSICAL CHEMISTRY**
**60hrs (4hrs/week)**

**OBJECTIVES:**

1. Understands heterogeneous equilibria and the application of phase rule

2. Gains knowledge of principles of electrolysis and galvanic cells.

3. Understands the application of colligative properties in the determination of molecular weight.

4. Understands the application of spectrophotometry and spectroscopic interpretations.

**SPECTROSCOPY** 6 hrs

**UNIT-I**

General features of absorption-Beer-Lambert's law and its limitations. Transmittance, Absorbance and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert's law for quantitative analysis of (i) Chromium in $K_2Cr_2O_7$ (ii) Manganese in $MnSO_4$

**Electronic Spectroscopy:** 8 hrs

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Energy levels of molecular orbitals ($\sigma$, $\pi$, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore and auxochrome

**UNIT-II**

**Infrared spectroscopy:** 8 hrs

Different regions in infrared radiations. Modes of vibrations in diatomic and poly atomic molecules. Characteristic absorption bands of various functional groups. Interpretation of spectra-Alkanes, Aromatic alcohols, carbonyls and amines with one example to each

**Proton magnetic resonance spectroscopy ($^1$H-NMR) :** 8 hrs

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

**PHYSICAL CHEMISTRY** 30hrs (2hrs/week)

**UNIT-III**

**Dilute Solutions:** 10 hrs

Colligative properties, Raoult's law, relative lowering of vapour pressure, its relation to molecular weight of non-volatile solute. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and

Depression in freezing point. Experimental methods of determination. Osmosis, osmotic pressure, experimental determination. Theory of dilute solutions. Determination of molecular weight of non-volatile solute from osmotic pressure. Abnormal Colligative properties-
Vant Hoff's factor

**UNIT-IV**

**Electrochemistry-I** 10 hrs

Specific conductance, equivalent conductance. Variation of equivalent conductance with dilution. Migration of ions, Kohlrausch's law. Arrhenius theory of electrolyte dissociation and its limitations. Ostwald's dilution law. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Definition of transport number, determination by Hittorfs method. Application of conductivity measurements – conductometric titrations.

**UNIT-V**

**1. Electro chemistry-II** 4 hrs

Single electrode potential, sign convention, Reversible and irreversible cells, Nernst equation. Reference electrode, Standard Hydrogen electrode, Calomel electrode, Indicator electrode, metal-metal ion electrode, inert electrode, Determination of EMF of cell, Applications of EMF measurements-Potentiometric titrations.

**2. Phase rule** 6 hrs

Gibbs Phase rule, Concept of phase, components, degrees of freedom. Phase equilibrium of one component system-water system. Phase equilibrium of two component system. Solid-liquid equilibrium. Simple eutectic diagram of Pb-Ag system, simple eutectic diagram, desilverisation of lead, NaCl-water system, Freezing mixtures.

**List of Reference Books**


1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J.R.Dyer
4. Modern Electrochemistry by J.O.M.Bockris and A.K.N.Reddy
5. Advanced Physical Chemistry by Atkins
6. Introduction to Electrochemistry by S.Glasstone
7. Elementary Organic spectroscopy by Y.R.Sharma
8. Spectroscopy by P.S.Kalsi

## CHEMISTRY SEMESTER- IV: Paper-IV
## Weightage to content

| S.No | Course content | Essay | Short questions | Total no.of questions | Total No. of Marks allotted to each Unit |
|---|---|---|---|---|---|
| | **SPECTROSCOPY** | | | | |
| 1 | UNIT-I | 2 | 2 | 4 | 30 |
| 2 | UNIT-II | 2 | 2 | 4 | 30 |
| | **PHYSICAL CHEMISTRY** | | | | |
| 3 | UNIT-III | 1 | 1 | 2 | 15 |
| 4 | UNIT-IV | 1 | 1 | 2 | 15 |
| 5 | UNIT-V | 2 | 2 | 4 | 30 |
| | **TOTAL** | **8** | **8** | **16** | **120** |

## LABORATORY COURSE-IV
## Practical Paper-IV Physical Chemistry and IR Spectral Analysis

(At the end of semester IV)

30 hrs (2hrs/w)

**I. Physical Chemistry** **30 marks**

1. Critical Solution Temperature: Phenol-Water system
2. Effect of NaCl on critical solution temperature in Phenol-water system
3. Determination of concentration of HCl conductometrically using standard NaOH solution.
4. Determination of concentration of acetic acid conductometrically using standard NaOH Solution.
5. Determination of Fe (II) by Potentiometric titration using $K_2Cr_2O_7$

**II. IR Spectral Analysis (Demonstration)**

**5marks**

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups, b) Carbonyl groups, c) Amino groups d) Aromatic groups

## SCHEME OF VALUATION FOR SEMESTER-IV CHEMISTRY LABORATORY COURSE PHYSICAL CHEMISTRY & IR SPECTRAL ANALYSIS

**Max. Marks: 35** **Time: 3hrs**

For Record - 5 marks
For Practical - 25 marks

Splitting of Practical Marks for Physical Chemistry:

i) Procedure in first five minutes : 5M
ii) Tabulation of the readings 5 M
iii) Calculation : 5 M
iv) For result : 10 M( Error <10% : 10 M,10-15%: 8M, >20% : 5M)

**SEMESTER-IV Chemistry model question paper 2019-20**

**SPECTROSCOPY & PHYSICAL CHEMISTRY**

(Revised Question paper w.e.f.2018-19)

Time: 2½ hrs Marks:60

Answer **two** questions from SECTION-A, **two** questions from SECTION-B. Each question carries 10 marks.

**SECTION-A** (Spectroscopy) 2X10=20M

1. Explain Single beam and double beam spectrophotometers

2. i). Explain the selection rules for electronic spectra.

(ii)What are Electronic Transitions? Explain various types of Electronic transitions.

3. Explain the interpretation of IR spectra with any five examples.

4. Explain the principle of NMR spectroscopy? Explain their examples to the following molecules i) 1, 1, 2,-tri bromo ethane ii)Toulene iii)Acetophenone

**Section –B** (Physical chemistry) 2X10=20M

5. What are the colligative properties? And determine the elevation of boiling point by Cottrel's method.

6. State the main postulates of Debye-Huckel theory of strong electrolytes. Explain 'relaxation effect' and 'electrophoretic effect' from it. Write Debye-Huckel-Onsager equation.

7.i) Explain about Hydrogen electrode and Calomel electrode.

(ii)Write the principles and uses of Potentiometric titrations

8. Describe Pb-Ag system, with the help of phase diagram.

**SECTION-C** 4X5=20M

Answer any **four** questions. Each question carries 5 marks.

9. Explain the following (i)Transmittance and (ii)Absorbance

10. Explain (i)chromophore and (ii)Auxochrome

11. Explain absorption bands of various functional groups.

12. What is Chemical Shift? How it is calculated?

13. Define Van't Hoff factor. Explain Van't Hoff theory of dilute solutions.

14. Define specific conductance and equivalent conductance. And Explain variation of equivalent conductance with dilution.

15. Explain about Reversible and irreversible cells.

16. What is congruent and incongruent melting point-Give one example each?

**Semester-IV**

**SPECTROSCOPY & PHYSICAL CHEMISTRY**

**Question bank**

## SPECTRO PHOTOMETRY & ELECTRONIC SPECTRO SCOPY

1. Explain various types of spectrophotometers?
2. Explain Lambert's law and Lambert's – Beers law.
3. Explain a) Transmittance b) Absorbance c) Molar Absorptivity
4. Explain application of Lambert-Beer's law for quantitative analysis of Chromium in $K_2Cr_2O_7$ and Manganese in $MnSO_4$
5. Explain interaction of electromagnetic radiation with molecules.
6. Explain various types of molecular spectra.
7. Explain Energy levels of molecular orbitals
8. Explain the selection rules for electronic spectra.
9. What are Electronic Transitions? Explain various types of Electronic transitions.
10. Explain a) Chromophore b) Auxochrome.

## INFRA RED SPECTROSCOPY & PROTON MAGNETIC RESONANCE SPECTROSCOPY

**1.** Explain important spectral regions in infrared spectrum.
**2.** Explain about modes of vibrations in polyatomic molecules.
**3.** Characteristic absorption bands of various functional groups.
**4.** Explain interpretation of IR Spectra with example.
**5.** Explain the principle of NMR spectroscopy.
**6.** What are equivalent protons and Non-equivalent protons?
**7.** Explain about position of signals.
**8.** What is splitting of signals (or) Explain spin-spin Coupling?
**9.** What is Chemical shift? How it is calculated?
**10.** Explain applications of NMR with examples.
**11.** What is coupling constant?

## Dilute Solutions

1. State & derive Roult's law for the relative lowering of vapour pressure?
2. How will you determine the RLVP of a liquid by Ostwald- walker's process?
3. What is meant by Osmosis and Osmotic pressure? Describe any one method of determining the osmotic pressure of a dilute solution.
4. Define Elevation of Boiling point. Derive the relation between molecular weight of solute and Elevation of boiling point.
5. Define Depression in freezing point. Derive the relation between molecular weight of solute and Depression in freezing point.
6. Write the experimental determination methods for Elevation of Boiling point and Depression in freezing point.
7. Define Van't Hoff theory of dilute solutions.
8. Derive the relation between molecular weight of solute and osmotic pressure.

**Electro chemistry-1**

1. Define specific conductance and equivalent conductance. Explain variation of equivalent conductance with dilution.
2. Define transport number. Explain Hittorf's method for the determination of Transport numbers.
3. State and explain Kohlrausch's law of independent migration of ions.
4. Explain the Debye-Huckel-Onsager equation for strong electrolytes.
5. Explain about Conductometric titrations.
6. Explain about Migration of ions.
7. Explain Ostwald's dilution law.
8. Write Arrhenius theory of electrolytes and it's importance.

**Electro Chemistry – II**

1. State and explain Nernest equation.
2. Explain about Hydrogen electrode and Calomel electrode.
3. Write the principles and applications of potetiometric titrations.
4. What is meant by Single electrode potential? How it is determined.
5. Explain about sign conventions?
6. Explain about reversible and irreversible cells.
7. Write the applications of e.m.f measurements?

**Phase Rule**

1. State Phase rule and explain the terms in it.
2. Explain the phase diagram of water system,
3. Explain the phase diagram of Pb-Ag system
4. Explain the phase diagram of NaCl-Water system.
5. Write notes on freezing mixtures.
6. Define phase, component, number of degrees of freedom.