

# **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.GOV.T.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 techniques/ 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<br>(Regd. No. 2190214)       | Student member |
| 24. K. Pushpa Kumari, II MPC TM<br>(Regd. No. 2190229)      | Student Member |
| 25. Surimilli Kishore Kumar, II MCCS<br>(Regd. No. 2191320) | Student Member |
| 26. Akula Mounika, II MPC EM<br>(Regd. No. 2190103)         | Student Member |
| 27. Bandaru Srinivasu, II MPC EM<br>(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
2. Dr. K. Deepti,
3. Dr. Ch. V. N. S. Vara Prasad,
4. Dr. K. Jhansi Lakshmi
5. Dr. K. Raghavachari
6. Sri D. Rama Rao
7. Sri V. Mallikarjuna Sarma
8. Dr. V. Narayana Rao
9. Sri U. Sai Krishna
10. Dr. D. S. V. N. M. Rama Murthy
11. Sri K. Babu Rao
12. Smt. S. Swarna Latha
13. Miss. M. S. T. B. V. Ratnam
14. Miss. G. Rama Lakshmi.
15. Mr. B. V. Siva Kumar
16. Miss. S. G. Kalyani
17. G. Sandhya
18. P. K. M. S. Devi
19. J. Aruna Kalyani (MPC EM)
20. Sankar Rao (MPC EM)
21. A. Sravani Devi (MBC)

Chairman & Lecturer in Charge

University representative

Adikavi Nannaya University

Rajamahendravaram

Managing partner

DAS Pharma Ltd, Kakinada

Subject expert

Lecturer in Chemistry,

Ideal Degree College, Kakinada

Retired Head of the Chemistry Department

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Student Member

Student Member

Student Member

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

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

<b>Month</b>	<b>Activity proposed</b>	<b>Faculty member in charge</b>
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 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 Hydrology, 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% weightage 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.
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

### 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
		VII (A)*	Elective	100	03
			Practical - VII A	50	02
			Elective	100	03
			Practical - VII B	50	02
	VI	VII (B)*	Elective	100	03
			Practical - VII C	50	02
		VII (C)*	Elective	100	03
			Practical - VII C	50	02
		VIII (A)**	<b>Cluster Electives - I :</b>		
			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)**	<b>Cluster Electives - II ::</b>		
			VIII-B-1	100	03
			VIII- B-2	100	03
			VIII-B-3	100	03
			Practical	50	02
			Practical	50	02
			Project	50	02
		VIII (C)**	<b>Cluster Electives - III ::</b>		
			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	<b>MOOC Course</b>	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	<b>NCC</b>	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	<b>Sports</b>	Intercollegiate selection	2
		South zone selection	3
		All India participation	4
		Winning medals in all India competitions	5
4	<b>NSS</b>	40% attendance in regular NSS activities	1
		50% attendance with Community Service	2
		Conduct of survey/ Youth exchange/ RD	3
5	<b>JKC</b>	Enrollment and training	1
		Campus recruitment local level	2
		MNCs/ reputed companies	3
6	<b>Community service</b>	Participation in community service by departments (outreach programmes)	2
7	<b>Cultural activity</b>	Winning medals at state level-2,	2
		District level-1	1
8	<b>COP/Add on Course</b>	Pass in Certificate Exam-1,	1
		Diploma-2	2
9	<b>Support services</b>	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 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. Bonding 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 topics 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 leadership quality by participation in extension programs and group projects etc

**P.R.GOVERNMENT COLLEGE (AUTONOMOUS)-KAKINADA**  
**III YEAR: SEMESTER-V**  
**Paper – V: (INORGANIC, PHYSICAL & ORGANIC CHEMISTRY)**

**OBJECTIVES:**

1. Gains knowledge crystal field splitting energies.
2. Knowledge of spectral data of complexes.
3. Synthesis of Heterocyclic compounds.
4. Applications of Thermodynamics’.

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

**INORGANIC CHEMISTRY**

**UNIT – I**

**Coordination Chemistry:**

**8h**

IUPAC nomenclature - bonding theories - Review of Werner's theory and Sedgwick's concept of EAN rule, - Valence bond theory - geometries of coordination numbers 4-tetrahedral and square planar and 6-octahedral and its limitations, crystal field theory - splitting of d-orbitals in octahedral, tetrahedral and square-planar complexes - low spin and high spin complexes - factors affecting crystal-field splitting energy, merits and demerits of crystal-field theory. Isomerism in coordination compounds - structural isomerism and stereo isomerism, stereochemistry of complexes with 4 and 6 coordination numbers.

**UNIT-II**

**1. Spectral and magnetic properties of metal complexes:**

**4h**

Types of magnetic behavior, spin-only formula, calculation of magnetic moments, experimental determination of magnetic susceptibility-Gouy method.

**ORGANIC CHEMISTRY**

**UNIT-III**

**Nitro hydrocarbons:**

**3h**

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

**UNIT – IV**

**Nitrogen compounds:**

**10h**

Amines (Aliphatic and Aromatic): Nomenclature, Classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods – 1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction.

Physical properties and basic character - Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline - comparative basic strength of aniline, N-methylaniline and N,N-dimethyl aniline (in aqueous and non-aqueous medium), steric effects and substituent effects. Chemical properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation e) Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitution of Aromatic amines – Bromination and Nitration. Oxidation of aryl and Tertiary amines, Diazotization.

### **Heterocyclic Compounds:**

**8h**

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

## **PHYSICAL CHEMISTRY**

### **UNIT- V**

#### **Thermodynamics:**

**12h**

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

#### **List of Reference Books**

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

**Weightage to Content**  
**Fifth semester**  
**Paper-V**

S.No	Course Content	Long Answer	Short Answer(SA)	Total marks
	<b>Inorganic Chemistry</b>			
1	Coordination Chemistry	3	2	40
2	Spectral and magnetic Properties		1	5
	<b>Organic Chemistry</b>			
1	Nitro hydro Carbons	1		10
2	Nitrogen Compounds	1	1	15
3	Heterocyclic compounds	1	1	15
	<b>Physical Chemistry</b>			
1	Thermodynamics	3	3	45
	<b>TOTAL</b>	<b>9</b>	<b>8</b>	<b>130</b>

**P.R.COLLEGE (A), KAKINADA**  
**III YEAR BSC-(Examination at the end of V semester)**  
**MODEL PAPER**  
**(Inorganic, Organic & Physical chemistry)**  
**Paper-V**

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**Time: 2 1/2Hrs**

**Max.Marks:60**

**Answer any FOUR questions choosing at least one question from each section**

**SECTION-I**

**4x10=40M**

1. Write the salient features of Crystal field theory and explain the crystal field splitting of d-orbitals in octahedral complexes.
2. Explain the Formation of  $[\text{Fe}(\text{CN})_6]^{4-}$  and  $[\text{Fe}(\text{CN})_6]^{3-}$  on the basis of Valence bond theory.
3. Explain about the optical isomerism in complex compounds having coordination numbers 4 and 6.

**SECTION-II**

4. Write note on
  - a) Nef reaction
  - b) Michael reaction
  - c) Mannich reaction
5. What are Amines? How the primary amines are prepared. Give the separation of amines by Hinsberg Method.
6. Give any two methods of preparation of Pyrrole. Explain why electrophilic substitution in Furan takes place at 2-position rather than 3-position.

**SECTION-III**

7. State and explain 1<sup>st</sup> law of thermodynamics
8. Derive Kirchhoff's equation and mention its units.
9. Show that  $PV^{\gamma} = \text{Constant}$

#### SECTION-IV

**Answer any Five questions**

**4x5=20M**

10. Explain the factors affecting crystal field splitting energy.
11. Explain EAN rule with two examples.
12. What are low spin and high spin complexes- Give examples.
13. How is furan prepared? Give its Diels – Alder reaction.
14. Write about alkylation and acylation reactions of aniline
15. Prove that  $C_p - C_v = R$
16. Write about Entropy
17. State and explain Joule- Thomson Effect
18. Discuss Chichibabin reaction.



**DEPARTMENT OF CHEMISTRY SEMESTER-V**

**PAPER-III**

**QUESTION BANK**

**ESSAY QUESTIONS:**

1. Explain the Geometry and Magnetic Properties of

- a)  $[\text{Co}(\text{NH}_3)_6]^{+3}$    b)  $[\text{Fe}(\text{CN})_6]^{+3}$    c)  $[\text{Fe}(\text{CN})_6]^{-3}$    d)  $[\text{Cr}(\text{NH}_3)_6]^{+3}$    e)  $[\text{Fe}(\text{CN})_6]^{-4}$   
f)  $[\text{Zn}(\text{NH}_3)_6]^{+2}$    g)  $[\text{Ni}(\text{CO})_4]$    h)  $[\text{Cu}(\text{NH}_3)_4]^{+2}$    i)  $[\text{Ni}(\text{CN})_4]^{-2}$    j)  $[\text{CO F}_6]^{-3}$

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, Tetrahedral and Square planar complexes.

3. Describe the geometrical isomerism in compounds with coordination number 4 & 6

4. Explain the different types of Structural isomerism exhibited by complexes with examples.

5. Preparation and properties of Nitro alkanes.

6. Write note on

- a) Nef   b) Michael C) Mannich   d) Schmidt   e) Gabriel phthalamide reaction.

7. Explain Hinsberg method of separation of primary, Secondary, Tertiary Amines.

8. Write about Hoffmann bromide reaction with mechanism.

9. Preparations and properties of Amines.

10. Preparations and properties of pyrrole, Furan, Thiophene

11. State and explain first law of thermodynamics.

12. State and explain Second law of thermodynamics.

13. Explain Joule- Thomson effect

14. Show that  $PV^{\gamma}$  constant

15. Derive Kirchhoff's equation. Mention its applications.

16. Explain Carnot cycle.

17. Show that  $C_P - C_V = R$

### SHORTANSWERS:

1. Explain Werner theory of complex compounds.
2. Effective atomic number (EAN)
3. Explain High spin and Low spin complexes with examples.
4. What is a chelating? Give two examples.
5. What is meant by crystal field stabilization energy?
6. Explain the electronic absorption spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  ion
7. Preparation of Pyrrole, Furan, Thiophene (Paul-knorr synthesis)
8. Explain why electrophilic substitution reaction in furan takes place 2-position rather than 3-position.
9. Discuss the aromatic character of pyrrole, Furan, Thiophene
10. Write about a) Diels-Alder reaction      b) Chichibabin reaction
11. Acidic and basic nature of pyrrole
12. Basic nature of pyridine.
13. Explain why pyridine is more basic than pyrrole.
14. Basic nature of amines.
15. Write about the concept of Entropy
16. Write briefly about enthalpy.
17. Explain the concept of internal energy.
18. Carbyl amine test.
19. Furan exhibits acidity. Why?
20. Explain Diazotization reaction.

**LABORATORY COURSE – V**  
**Practical Paper – V Organic Chemistry**  
**(at the end of semester V)**  
**30 hrs (2 h / W)**  
**Organic Qualitative Analysis: 50M**

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.

**P.R.GOVERNMENT COLLEGE (AUTONOMOUS)-KAKINADA**  
**THIRD YEAR 2019-20**  
**SEMESTER-V**  
**Paper - VI (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)**

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**OBJECTIVES:**

1. Gains knowledge Labile and Inert complexes
2. Knowledge of Biological significance of inorganic elements.
3. Structure of Carbohydrates.
4. Synthesis of Amino acids.

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

**INORGANIC CHEMISTRY**

**UNIT-I**

**1. Reactivity of metal complexes: 4h**

Labile and inert complexes, ligand substitution reactions - SN1 and SN2, substitution reactions of Square planar complexes - Trans effect and applications of Trans effect.

**2. Stability of metal complexes: 4h**

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.

**3. Bioinorganic chemistry: 4h**

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and Cl<sup>-</sup>.

Metalloporphyrins – Structure and functions of hemoglobin, and Chlorophyll.

**ORGANIC CHEMISTRY**

**UNIT-II**

**Carbohydrates: 10h**

Mono saccharides: (+) Glucose (aldohexose) - Evidence for cyclic structure of glucose (some negative aldehydes tests and muta rotation) - Proof for the ring size (methylation, hydrolysis and oxidation reactions) - Pyranose structure (Haworth formula and chair conformational formula). (-) Fructose (ketohexose) - Evidence of 2 - ketohexose structure (formation of pentaacetate, formation of cyanohydrin its hydrolysis and reduction by HI). Cyclic structure for fructose (Furanose structure and Haworth formula) - osazone formation from glucose and fructose – Definition of anomers with examples. Interconversion of Monosaccharides: Aldopentose to Aldohehexose (Arabinose to D- Glucose, D-Mannose) (Kiliani - Fischer method)

Epimers, Epimerisation - Lobry de bruyn van Ekenstein rearrangement. Aldohexose to Aldopentose (D-Glucose to D- Arabinose) by Ruff degradation. Aldohexose to Ketohexose [(+) Glucose to (-) Fructose] and Ketohexose to Aldohexose (Fructose to Glucose)

## **Amino acids and proteins**

**9h**

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Malonic ester synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

## **PHYSICAL CHEMISTRY**

### **UNIT-III**

#### **1. Chemical kinetics**

**8h**

Rate of reaction - Definition of order and molecularity. Derivation of rate constants for first, second, and zero order reactions and examples. Derivation for half-life times. Methods to determine the order of reactions. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy.

#### **2. Photochemistry**

**6h**

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, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, and Photosensitized reactions- energy transfer processes (simple example) – Jablonski diagram

#### **List of Reference Books**

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
4. Advanced Physical Chemistry by Atkins
6. Instrumentation and Techniques by Chatwal and Anand
8. A Textbook of Physical Chemistry by Puri and Sharma
9. Advanced physical chemistry by Gurudeep Raj

**Weightage to Content**  
**Fifth semester**  
**Paper -VI**

S.No	Course Content	Long Answer	Short Answer(SA)	Total marks
	<b>Inorganic Chemistry</b>			
1	Reactivity of Metal Complex	1	1	15
2	Stability of metal complexes	1	1	15
3	Bio inorganic Chemistry	1	1	15
	<b>Organic Chemistry</b>			
1	Carbohydrates	2	1	25
2	Amino Acids	1	1	15
	<b>Physical Chemistry</b>			
1	Chemical Kinetics	2	2	30
2	Photo Chemistry	1	1	15
	<b>Total</b>	<b>9</b>	<b>8</b>	<b>130</b>

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

**III YEAR BSC-(Examination at the end of V semester) model paper**

**(Inorganic, Organic & Physical chemistry)**

**Paper-VI**

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**Time: 2 1/2Hrs**

**Max.Marks:60M**

Answer any **FOUR** questions choosing at least one question from each section

**SECTION-I**

**4x10=40M**

1. Explain  $SN^1$  and  $SN^2$  substitution reactions in octahedral complexes.
2. Explain determination of the composition of metal complexes by job's method.
3. i). Explain the biological signification of Na, K  
ii). Explain the Structure of Chlorophyll

**SECTION-II**

4. Establish the Open chain structure of Glucose with relevant chemical equations.
5. Explain
  - i) Killiani-Fischer synthesis
  - ii) Ruff degradation
6. What are Amino Acids. Write the preparation of  $\alpha$  -amino acids from
  - i) Streckers synthesis
  - ii) Malonic ester synthesis
  - iii) Gabriel phthalamide synthesis

**SECTION-III**

7. a) Derive the rate constant for first order reaction.  
b) The rate constant for the certain first order reaction is  $1 \times 10^{-5} \text{ sec}^{-1}$ . Calculate the time taken for the 20% completion of the reaction.
8. Define the terms 'order' and 'molecularity'. Explain any two methods for the determination of order of a reaction.
9. What is meant by quantum yield? State and explain laws of photochemistry.

#### SECTION-IV

Answer any **Five** questions

4x5=20M

10. Explain Chelate effect.
11. What is trans effect. Write any two applications of Trans effect.
12. Explain muta rotation of Glucose.
13. Explain the formation of Glucozone.
14. Write a note on Isoelectric point.
15. Write about the effect of temperature on rate of a reaction.
16. Discuss about Zero order reaction.
17. Explain Jablonski diagram.
18. What are labile and inert complexes? Give examples?



**PAPER-VI**  
**QUESTION BANK**  
**ESSAY QUESTIONS**

1. Explain determination of composition of complex by job's method and mole ratio method.
2. Explain the factors effecting the stability of complexes.
3. Discuss the mechanism of  $SN^1$  and  $SN^2$  reactions in coordination complexes with examples in Octahedral complexes.
4. Explain the mechanism of ligand substitution reactions of square planar complexes.
5. Explain the structure and function of Hemoglobin and chlorophyll
6. Explain open chain and ring structure of Glucose.
7. Explain 1) Killiani fisher synthesis 2) Ruff degradation 3) Glucose to Fructose  
4) Fructose to Glucose
8. Explain the classifications of Amino Acids. Preparations and properties of amino acids.
9. Derive First order equation.
10. Derive second order equation.
11. Define order of a reaction. Explain any three methods for the determination of order of a reaction.
12. Explain Jablanski diagram of various processes occurring in the excited state.
13. What is quantum yield? Explain quantum yield of the reaction between  $H_2$  and  $Cl_2$
14. What is quantum yield? Explain quantum yield of the reaction between  $H_2$  and  $Br_2$

Short Answers

1. Trans effect and its applications.
2. Chelating effect. Give example.
3. What are labile and Inert complexes. Give examples.
4. What is spectrochemical series? Explain.
5. Explain the absorption spectrum of  $[Ti(H_2O)_6]^{+3}$  Ion
6. What are essential elements and importance of Na and K in biological systems.

7. Peptide bond.
8. Isoelectric point.
9. Zwitter ion.
10. Essential Amino acids.
11. Mutarotation.
12. Epimers and Anomers.
13. Lobry de bruyn van ekenstein rearrangement.
14. Osazones.
15. Write about Zero order reaction
16. Write about Half-life period
17. Define molecularity and order of a reaction.
18. Quantum yield.
19. Photo sensitization.
20. Fluorescence, Phosphorescence, chemiluminiscence.
21. What are the metallophorphyrine.
23. Streicker synthesis.
24. Effect of temperature on rate of a reaction.

## **LABORATORY COURSE – VI**

### **Practical Paper – VI Physical Chemistry**

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

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