PITHAPUR RAJAH'S GOVERNMENTCOLLEGE (AUTONOMOUS)
KAKINADA - 533 001, AP.

Affiliated to Adikavi Nannaya University

NAAC Accredited with "A" Grade (3.17 CGPA)

BOARD OF STUDIES OF CHEMISTRY

B.Sc. 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 normsof the UGC Autonomous guidelines.

S. No	Name of the Person	Designation
1	V. Sanjeeva Kumar	Chairman & Lecturer In charge
2	Dr. K. Jhansi Lakshmi ASD Govt. Degree College for Women (Autonomous) Kakinada	University Nominee
3	Dr. D. Chenna Rao Lecturer in Chemistry, Govt. Degree College, Yeleswaram	Subject Expert -I
4	U. Sai Krishna 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 ORGANICS HYDERABAD.	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 valuable reviews, 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 throughoffline/ online at 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. Jhansi Lakshmi, 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. OrganicChemistry (Hons), B.Sc. Analytical Chemistry (Hons) from the academic year 2024-25. & V ,VI semesters of CBCS System
2. To discuss 4th year B.Sc. Honours to the students who were admitted in the academicyear 2021-22.
3. To discuss the Semester System and revised Choice Based Credit System (CBCS)being implemented for the past 04 years, i.e., w.e.f. 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 mappingfor I, II, III, IV, V, VII and VIII Semesters.
7. Teaching-learning methodology by 50:50 (External: Internal) ratio I, II, I I I & IV Year Students commenced w.e.f. 2021-22.
8. Minimum attendance of 75% for both I mid-term examination, and II mid- term examination under CIA component shall be the benchmark for attendance and itshall be approved in the BOS.

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 honours course i.e, BSc., Pharmaceutical Chemistry for the AY 24-25

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.	9849324968
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	P. Vijay	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	KNS Swamy	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* *1*
8	**COP/Add on Course**	*Pass in Certificate Exam-1,* *Diploma-2*	*1* *2*
9	**Support services**	*Lead India, Health club, RRC and Eco Club etc.,participation in various programmes*	*1*

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTY	Program & Semester			
Course Code CHE-5	TITLEOFTHECOURSE **COURSE 5: FUNDAMENTALS IN ORGANIC CHEMISTRY**	II B.Sc. (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

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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 Kakinada	Program & Semester II B.Sc. Chemistry Hons (III Semester)			
Course Code CHE-VI	TITLE OF THE COURSE **ORGANIC CHEMISTRY** **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) Kakinada DEPARTMENT OF CHEMISTRY	Program & Semester II B.Sc. (III Semester)			
Course Code CHE-7	TITLEOFTHECOURSE PHYSICAL CHEMISTRY – I (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% >2%	10 M 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).

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTY	Program & Semester Minor Chemistry II B.Sc. (III Semester)			
Course Code CHE-2	TITLE OF THE COURSE **COURSE 2: FUNDAMENTALS IN ORGANIC CHEMISTRY**				
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 on fundamental concepts learnt
CO2	Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
CO3	Learn and identify many organic reaction mechanisms
CO4	Correlate and describe the stereo-chemical properties of organic compounds and reactions

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill Development		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 - 2

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 – 2 Fundamentals in 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

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SEMESTER-III

COURSE 2: 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