PITHAPUR RAJAH'S GOVERNMENT COLLEGE (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 under CBCS

Meeting Minutes/Resolutions

Convened on 31 August 2023

AY 2023-24

DEPARTMENT OF CHEMISTRY

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (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.1/A.C./BOS/2023-24, Dated: 29.08.2023

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

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

ORDERS:

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

S. No	Name of the Person	Designation
1	V. Sanjeeva Kumar	Chairman & Lecturer Incharge
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. B. Ramesh Babu Founder & M.D., BogaR laboratories, Peddapuram.	Representative from Industry
6	T. V. V. Satyanarayana	Member
7	P. Vijay Kumar	Member
8	V. Ram babu	Member
9	G. Pavani	Member
10	Dr. N. Bujji Babu	Member
11	Dr. Ch. Praveen	Member
12	V. Venkateswara Rao	Member
13	U.S.N. Prasad	Member
14	K.N.S. Swamy	Member
15	S. Vijaya Lakshmi	Member
16	T. Pawan Kumar	Member
17	P. Devi Sunanda	Member
18	V. Durga Bhavani	Member
19	P.R Ravi Varma	Member
29	V. Priyanka	Member
30	Ch. Veni	Student Alumni Member
31	Syamala, I MCCS	Student Member
32	P. Abhishek Nageswara Rao, II B.Sc BZC	Student Member
33	Y. Kasi Viswanath, III B.Sc MPC	Student Member

The above members are requested to attend the BoS meeting on 31-08-2023 and share their valuable reviews, and suggestions on the following functionaries.

- Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council.
- Suggested methodologies for innovative teaching and evaluation techniques.
- Suggest the panel of Names to the academic council for appointment of Examiners.
- 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 31 August 2023 through offline at P.R. Govt. College (A), Kakinada, at 10.00 AM.

Venue: LCD-I, Dt: 31-08-2023, Thursday – 11.00 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; Industrialist Dr. B. Ramesh Babu, Founder & M.D., BogaR laboratories, Peddapuram; 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 Chemistry Department and student alumni attended the meeting.

Agenda:

1. To discuss introduction of Single major system as B.Sc Chemistry (Hons), B.Sc Organic Chemistry (Hons), B.Sc Analytical Chemistry (Hons) from the academic year 2023-24.
2. To discuss 4th year B.Sc Honors to the students who were admitted in the academic year 2020-21.
3. To discuss the Semester System and revised Choice Based Credit System (CBCS) being implemented for the past 03 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 2023-24.
5. Grant of Extra credits for Online SWAYAM MOOCs etc.
6. Syllabus, Model Question Papers and Model Blue Prints, POs, PSOs & COs mapping for I, II, III, IV, V, VII and VIII Semesters.
7. Teaching learning methodology by 60:40 (External: Internal) ratio for the present 4th year B.Sc Honors (2020-21 AB) Students and 50:50 (External: Internal) ratio I I I & III 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 it shall be approved in the BOS.

9. Minimum of 60% integration of ICT into transaction of curriculum.
10. Remedial coaching for slow learners and project works, research, Conferences, 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 2023-24.
14. To discuss and resolve the minor modifications/refinement if any, in the VII Semester.
15. Any Other Proposal with the Permission of the Chairman.

Signatures of the members who attended the Board of studies in Chemistry on 31.08.2023 at 11.00am

Mode of Conduct of meeting: Offline/ Online

NAME	SIGNATURE	CONTACT NO.
V. Sanjeeva Kumar	V. P	9849324968
Dr. K. Jhansi Lakshmi	K. Jhansi	9441256409
Dr. B. Ramesh Babu		9701712028
Dr. D. Chenna Rao	31/8/2023	9560740108
U. Sai Krishna	U. Sai Krishna	9347334702
T. V. V. Satyanarayana	T. V. V. Satya	9490876913
P. Vijay Kumar	Vijay	9652023082
V. Ram babu	31/8	9948485537
G. Pavani		9912526493
Dr. N. Bujji Babu	31/8	9441394792
Dr. Ch. Praveen	31/8/23	9491855518
V. Venkateswara Rao	31/8/23	9885165588
U.S.N. Prasad	31/8/23	6300882584
K.N.S. Swamy		9908900962
S. Vijaya Lakshmi	31/08/23	9133941966
T. Pawan Kumar		8125885572.
P. Devi Sunanda		6340449647
V. Durga Bhavani	31/8/23.	8919214774.
P.R Ravi Varma	31/8/23	6281382803
V. Priyanka	31/8/23	9390862627
Ch. Veni		9391487476
B. Syamala	A. Syamala	6300192786
P. Abhishek Nageswara Rao		9248366649
Y. Kasi Viswanath		9603235120

ADDITIONS/DELETIONS IN COURSES

CHEMISTRY 2023-24

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	NIL	NIL
II	IV & IV	NIL	NIL
II	IV & V	NIL	NIL
III	V & VIA	Retrosynthesis of Aspirin , Barton reaction, $NaBH_4$(Mechanism), mCPBA	Retrosynthesis of cyclohexene , DDQ
III	V & VIIA	Fragmentation patterns in Butane and Pentanamine, Types of Solvent extraction- Continuous and Counter current extraction techniques	Application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base & amp; neutral. Coumarin
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 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 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 paper is 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)	Objective Questions (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 following structure.

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 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 **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	**Cultural activity**	*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*

SEMESTER-I

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

Multidisciplinary Courses Offered for B.A./B.Com./BBA/BCA Majors

w.e.f. AY 2023-24

SEMESTER-I

PRINCIPLES OF CHEMICAL SCIENCES

Credits: 2 2 hrs/week

I. Course Outcomes: At the end of the course the student will be able to-

1. Understand the structure of atom.
2. Identify the isotopes and isobars.
3. Define acids and bases and predict the nature of salts.
4. Explain ionic and covalent bonding.
5. Describe the importance of Chemistry in daily life.

II. Syllabus:

Unit I: Matter, Atoms, Molecules & Nuclear Chemistry

Classification of matter, Dalton atomic theory, Thomson Model, Rutherford Model, Bohr's model of atom, quantum numbers, electronic configuration, Aufbau Principle, Pauli's exclusion principle, Hund's rule. Isotopes-Isobars, Nuclear decay, Band of Stability, Nuclear Reaction types, Nuclear Applications.

Unit II: Elements, Classification and Chemical Bonding

Classification of elements, Periodic Classification of elements based on electronic configuration, classification into types, classification into metals, non-metals and metalloids, periodic properties-atomic radii, ionisation enthalpy, electronegativity, Octet rule, ionic bond properties of Ionic compounds-covalent bond, properties of covalent molecule.

Unit III: Acids, Bases, Salts, Chemistry in Daily life

Definition, types and properties of Acids, Bases, Salts, strength of acids and bases, pH, Importance of Chemistry in daily life. (food, drugs, textiles, preservatives, soaps and detergents.)

III. List of Reference Books:

1. Inorganic Chemistry by Puri and Sharma
2. Basic concepts of Inorganic Chemistry by D.N.Singh

IV. Co-curricular activities:

Projects on Importance of Chemistry in food, drugs, textiles, preservatives, soaps and detergents.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA
SEMESTER-I
MULTY DISCIPLINARYCOURSE: PRINCIPLES OF CHEMICAL SCIENCES
MODEL PAPER

MAX.MARKS: 50 MARKS

SECTION - A

Answer any three of the following questions **3 x 10 = 30M**

1.Write the postulates of Rutherford model and Bohr's model of an atom?

2.Explain quantum numbers and their significance?

3.Write an essay on the classification of elements based on their electronic configuration?

4.What is Periodicity? How the following properties vary in a group and in a period explain

i) I.E ii) Atomic radius iii) E.N

5.Write the daily life applications of chemistry in following aspects

i) Foods ii) Drugs iii) Preservatives.

SECTION -B

Answer any four questions in the following. **4 X 5 = 20M**

6. Differentiate isotopes and isobars with at least two examples.
7. Explain the types of nuclear reactions and its applications
8. what is octet rule? Explain its significance and limitations.
9. Write any five differences between ionic compounds and covalent compounds.
10. Define pH? calculate the pH of 0.01M HCl.
11. Explain strength of acids and bases by using ionization concept Explain the importance of chemistry in textile industry.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A), KAKINADA
SEMESTER-I
MULTY DISCIPLINARYCOURSE: PRINCIPLES OF CHEMICAL SCIENCES
MODEL PAPER

MAX.MARKS: 50 MARKS

SECTION - A

Answer any three of the following questions **3 x 10 = 30M**

1. Unit - 1
2. Unit - 2
3. Unit - 3
4. Unit - 1
5. Unit - 2

SECTION -B

Answer any four questions in the following. **5 X 10 = 50M**

6. Unit - 1
7. Unit - 1
8. Unit - 2
9. Unit - 2
10. Unit - 3
11. Unit - 3

I -SEMESTER

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

Hours: 5hrs/week Credits: 4

Course Objective:

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

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

Learning outcomes:

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

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

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

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

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

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

UNIT I: ESSENTIALS OF MATHEMATICS: 9hrs

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus- Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of

angles Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems Statistical Measures: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS: 9hrs

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: : 9hrs

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

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY: 9hrs

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.

2. Elementary Trigonometry by H.S.Hall and S.R.Knight

3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd. 4.Basic Statistics by B.L.Agarwal, New age international Publishers

5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman

6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker

7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.

8. Physics for Technology and Engineering" by John Bird

9. Chemistry in daily life by Kirpal Singh

10. Chemistry of bio molecules by S. P. Bhutan

11. Fundamentals of Computers by V. Raja Raman

12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties 2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyze the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS:

1. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.

Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.

Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modeling

Present students with real-world problems that require mathematical modeling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of

2. your college network) and prepare a report covering network architecture.

3. Identify the types of malwares and required firewalls to provide security.

4. Latest Fraud techniques used by hackers.

I - SEMESTER

COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Hours: 5 hrs/week Credits: 4

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.

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

3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.

3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics.Gain knowledge of different types of transmission media, such as wired (e.g.,

copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS 9hrs

Straight Lines: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS: 9hrs

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY: 9hrs

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

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY 9hrs

Mathematical Modelling applications in physics and chemistry Application of Renewable energy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science 9hrs

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications

2. Calculus by Thomas and Finny, Pearson Publications

3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.

4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle

5. "Energy Storage: A Nontechnical Guide" by Richard Baxter

6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara

7. "Biophysics: An Introduction" by Rodney Cotterill

8. "Medical Physics: Imaging" by James G. Webster

9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas

10. Nano materials and applications by M.N.Borah

11. Environmental Chemistry by Anil.K.D.E.

12. Digital Logic Design by Morris Mano

13. Data Communication & Networking by Bahrouz Forouzan.

STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analyzing rates of change or optimizing functions.

3: Integration Exploration

Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or

integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry

4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.

They will consider factors such as energy generation, energy storage, efficiency,

sustainability, materials design, biomedical applications, or technological advancements.

2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field.

3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.

Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.

Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.

Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.

For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.

Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.

Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.

They will discuss the accuracy and limitations of their model, propose improvements, and

interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.

Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices.

Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

1. Students must be able to convert numbers from other number system to binary number systems

2. Identify the networking media used for your college network

3. Identify all the networking devices used in your college premises.

SEMESTER-II

CHEMISTRY MAJOR

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

Course Objectives:

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

Course Outcomes:

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

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill Developement		Employability		Entrepreneurship	

Syllabus:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Reference books

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

WebLinks:

Course outcome & Program outcome mapping

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

Weightage to content

Semester -II

Course - 3

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

P.R. GOVERNMENT COLLEGE (A), KAKINADA

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

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

Section -I

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

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

Part – A

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

Part - B

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

Section II

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

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

SEMESTER-II

COURSE 3: GENERAL AND INORGANIC CHEMISTRY

Practical Credits: 1 2 hrs/week

Practical- I Qualitative Analysis of SIMPLE SALT

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

I. Course outcomes:

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

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

Laboratory course syllabus: Analysis of SIMPLE SALT 50 M

I.

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

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

Co-curricular activities and Assessment Methods

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

SCHEME OF VALUATION

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

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

CourseOutcomes:

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

Course with focus on Skill Development/Employability/Entrepreneurship modules

SkillDevelopment		Employability		Entrepreneurship	

Syllabus:

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

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

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

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

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

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

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

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

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

Separation of lanthanides by ion exchange method.

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

Unit – V Radioactivity 9 h

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

Textbooks:

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

Reference books

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

WebLinks:

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

Course outcome & Program outcome mapping

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

Weightage to contentSemester -II
Course - 4

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

P.R. GOVERNMENT COLLEGE (A), KAKINADA

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

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

Section – 1

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

Part –A

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

2.write a short note on

a) Oxo acids of Sulphur

b) classification of oxides based on chemical properties.

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

Part – B

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

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

6.explain the following

a) Soddy- Fajan's displacement law.

b) law of Radioactivity

Section – II

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

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

SEMESTER-II

COURSE 4: ORGANIC CHEMISTRY

Practical Credits: 1 2 hrs/week

Preparation of Inorganic compounds:

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

Learning Out comes:

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

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

Lab References:

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

Co-Curricular Activities:

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

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

b) Suggested Co-Curricular Activities

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

SCHEME OF VALUATION

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

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

ORGANIC CHEMISTRY MAJOR

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

Course Objectives:

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

Course Outcomes:

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

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill Developement		Employability		Entrepreneurship	

Syllabus:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Reference books

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

WebLinks:

Course outcome & Program outcome mapping

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

Weightage to content

Semester -II

Course - 3

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

P.R. GOVERNMENT COLLEGE (A), KAKINADA

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

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

Section -I

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

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

Part – A

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

Part - B

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

Section II

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

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

SEMESTER-II

COURSE 3: GENERAL AND INORGANIC CHEMISTRY

Practical Credits: 1 2 hrs/week

Practical- I Qualitative Analysis of SIMPLE SALT

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

I. Course outcomes:

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

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

Laboratory course syllabus: Analysis of SIMPLE SALT 50 M

I.

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

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

Co-curricular activities and Assessment Methods

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

SCHEME OF VALUATION

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

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A) KAKINADA DEPARTMENT OF CHEMISTY	Program & Semester I B.Sc. (II Semester)			
Course Code CHE-4	TITLEOFTHECOURSE **COURSE 4: ORGANIC CHEMISTRY**				
Teaching	HoursAllocated:45 (**Theory**)	L	T	P	C
Pre-requisites	Nature of bonds, Field effects, aromaticity, alicyclic compounds.	45	10	30	3+1

CourseOutcomes:

On Completion of the course, the students will be able to	
CO1	In depth understanding of Structural theory in Organic chemistry
CO2	Understand and explain preparations and properties of Acyclic hydrocarbons
CO3	Learn and identify Aromaticity character of Organic compounds with reference to the benzene in a mechanistic and synthesis path.
CO4	To understand and apply the basic principles of alicyclic chemistry for structure and reactivity of cyclopropane cyclobutane, cyclopentane and cyclohexane

Course with focus on Skill Development/Employability/Entrepreneurship modules

SkillDevelopment		Employability		Entrepreneurship	

Syllabus:
UNIT-I

STRUCTURAL THEORY IN ORGANIC CHEMISTRY

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like H_2O, NH_3 & $AlCl_3$).

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, carbanions..

Types of Organic reactions : Addition - electrophilic, nucleophilic and free radical.

Substitution - electrophilic, nucleophilic and free radical. Elimination- Examples.

UNIT-II

ACYCLIC HYDROCARBONS

Alkenes - Preparation of alkenes. Properties: Addition of hydrogen - heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti - Markonikov's addition). Dienes - Types of dienes, reactions of conjugated dienes - 1,2 and 1,4 addition of HBr to 1,3 - butadiene and Diel's - Alder reaction.

UNIT-III

Alkynes - Preparation by dehydrohalogenation of dihalides, dehalogenation of tetra halides, Properties; Acidity of acetylenic hydrogen (formation of Metal acetylides). Preparation of higher acetylenes, Metal ammonia reductions, Physical properties. Chemical reactivity - electrophilic addition of X_2, HX, H_2O (Tautomerism), Oxidation with $KMnO_4$, OsO_4, reduction and Polymerisation reaction of acetylene

UNIT-IV

ALICYCLIC HYDROCARBONS (CYCLOALKANES)

Nomenclature, Preparation by Freunds method, Wislicenus method. Properties - reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes - Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

UNIT-V:

BENZENE AND ITS REACTIVITY

Concept of aromaticity - aromaticity (definition), Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions - General mechanism of electrophilic substitution, mechanism of nitration, Friedel Craft's alkylationand acylation. Orientation of aromatic substitution - Definition of 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) Halogenation. (Explanation by taking minimum of one example from each type)

Textbooks:

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

Reference books

S.NO	AUTHOR	TITLE	PUBLISHER
1	Morrisson and Boyd	Organic Chemistry	Oxford University Press
2	I L Finar Vol I	A Text Book of Organic chemistry	
3	Jonathan Clayden, Nick Greeves and	Organic Chemistry	Oxford University Press

WebLinks:

Course outcome & Program outcome mapping

On Completion of the course, the students will be able to	
CO1	In depth understanding of Structural theory in Organic chemistry
CO2	Understand and explain preparations and properties of Acyclic hydrocarbons
CO3	Learn and identify Aromaticity character of Organic compounds with reference to the benzene in a mechanistic and synthesis path.
CO4	To understand and apply the basic principles of alicyclic chemistry for structure and reactivity of cyclopropane cyclobutane, cyclopentane and cyclohexane

CO-PO Mapping: **1: Low =1 ; 2: M**

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:

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PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

Weightage to contentSemester -II
Course - 4

S.No	CourseContent	Long Answer	ShortAnswer	Totalmarks	As per Blooms Taxonomy
1	STRUCTURAL THEORY IN ORGANIC CHEMISTRY	2	1	25	Understanding, Application
2	ALKENES	1	2	20	Remembering, Understanding
3	ALKYNES	1	1	15	Analysizing & Creation
4	CYCLO ALKANES	1	1	15	Evaluation, Understanding
5.	BENZENE AND IT'S REACTIVITY	1	2	20	Understanding, Application
	TOTAL	**6**	**7**	**95**	

P.R. GOVERNMENT COLLEGE (A), KAKINADA

I YEAR B.Sc (Examination at the end of II semester)
(COURSE – 4 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. Explain different types of organic reactions.
2. Write about inductive effect and its applications.
3. Elaborate the mechanism of markonikoff and anti markonikoff addition of HBr to propene.

Part-B

4. Explain the following
   a) Reduction of 2-butyne with metal ammonia
   b) Oxidation of acetylene with $KMnO_4$
5. Write any two preparation methods of cyclo alkanes? Explain the stability of cyclo alkanes with Baeyer's strain theory
6. Discuss the mechanism of electrophilic substitution reactions of benzene
   a) Nitration and b) Friedel - Craft alkylation

Section - II

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

7. Why 2- butene is more stable than 1- butene? Explain.
8. Write about Diels Alder reaction
9. Explain acidity of alkyne.
10. Draw the conformational structures of n - butane and cyclohexane.
11. Define aromaticity with suitable examples.
12. How methoxy group effects the incoming electrophile in Benzene towards electrophilic substitution reaction?
13. Write the major product when HCl is added to 1,3 -butadiene.

SEMESTER-II

COURSE 4: ORGANIC CHEMISTRY

Practical Credits: 1 2 hrs/week

Organic Functional Group Reactions

(At the end of Semester)

Reactions of the following functional groups present in organic compounds (at least **4**)Alcohols, phenols, aldehydes, ketones, carboxylic Acids and Amines

Learning Out comes:

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

1.

Lab References:

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

Co-Curricular Activities:

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

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

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

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

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

5. Unit tests (IE).

b) Suggested Co-Curricular Activities

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

SCHEME OF VALUATION

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

Systematic analysis of each component which involves following	
a. Preliminary Tests (State, Colour, Odour)	03 marks
b. Ignition test	02 marks
c. Detection of the functional group (Preliminary & Confirmation)	02+03 marks
Total Four compounds (4 X 10)	40M
d. Viva voce	05M
e. Record	05M
TOTAL	**50 marks**

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

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

First internship (After 1st year examinations): Community Service Project

To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project.

Learning outcomes:

- To facilitate an understanding of the issues that confronts the vulnerable /marginalized sections of the society.
- To initiate team processes with the student groups for societal change.
- To provide students an opportunity to familiarize themselves with urban / rural community they live in.
- To enable students to engage in the development of the community.
- To plan activities based on the focused groups.
- To know the ways of transforming the society through systematic programme implementation.

Assessment Model:

There will be only internal evaluation for this internship. Each faculty member is to be assigned with 10 t0 15 students depending upon availability of the faculty members. The faculty member will act as a faculty-mentor for the group and is in-charge for the learning activities of the students and also for the comprehensive and continuous assessment of the students.

The assessment is to be conducted for 100 marks. The number of credits assigned is 4. Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

Each student is required to maintain an individual logbook, where he/she is supposed to record day to day activities. The project log is assessed on an individual basis, thus allowing for individual members within groups to be assessed this way. The assessment will take into consideration the individual student's involvementin the assigned work.

While grading the student's performance, using the student's project log, the following should be taken into account -

a. The individual student's effort and commitment.
b. The originality and quality of the work produced by the individual student.
c. The student's integration and co-operation with the work assigned.
d. The completeness of the logbook.

The assessment for the ***Community Service Project implementation*** shall include the following components and based on the entries of Project Log and Project Report:

a. Orientation to the community development
b. Conducting a baseline assessment of development needs
c. Number and Quality of Awareness Programmes organised on beneficiaryprogrammes and improvement in quality of life, environment and social consciousness, motivation and leadership, personality development,etc.
d. Number Quality and Duration of Intervention/service Programmes (Prevention or promotion programs that aim to promote behavioural change in defined community contexts to address social problems) organised.
e.Followup Programmes suggested (Referral Services, Bringing Community Participation)
f. Developing short and mid-term action plans in consultation with local leadership and local government officers.

The **Project Report** should contain

a) Introduction, scope, objectives, and methodology
b) Project specifications (area / background of the work assigned).
c) Problems identified.
d) Analyses of the problems
e) Community awareness programmes conducted w.r.t the problems and their outcomes.
f) Intervention/service programmes taken up
g) Short-term and long term action plan for implementation
h) Recommendations and conclusions.
i) References

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

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

For Example:

II MPC-EM

S.No.	Name of the Student	Class & Year of Study	Register Number	Project Log	Project Implementation	Project Report	Presentation	Total
				(20)	(30)	(25)	(25)	(100)

Signature of Project Mentor **Signature of Nominated faculty** **Signature of HOD/ In-Charge**

SEMESTER-III

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA	Program & Semester			
Course Code **CHE-III**	TITLE OF THE COURSE **ORGANIC CHEMISTRY & SPECTROSCOPY**	II B.Sc. (III Semester)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites	Types of Organic Reactions, Reaction Intermediates, Molecular Energy levels, Symmetry rules, Resonance.	60	10	30	4+1

Course Objectives:

1. Mechanism of Nucleophilic substitution reactions
2. Stereo chemical aspects of Nucleophilic Substitution reactions
3. Mechanisms of some important named reactions related to Alcohols, Phenols, Carbonyl compounds, Carboxylic Acids.
4. Preparations and synthetic applications of Active Methylene compounds.
5. UV, IR & NMR spectroscopic techniques and their applications.

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Acquire knowledge on different preparation methods of alkyl and aryl halogen compounds & Understand the nucleophilic substitution reactions– SN1, SN2, SNAr mechanisms with stereo chemical aspects
CO2	Comprehend the mechanism of different reactions of alcohols, phenols, Carbonyl compounds and Carboxylic acids in synthetic organic chemistry
CO3	Understand the Preparations and synthetic applications of Active methylene compounds.
CO4	Understand UV, IR & NMR spectroscopic techniques and their applications.

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development			Employability			Entrepreneurship	

UNIT I:

1. **Chemistry of Halogenated Hydrocarbons:**

Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– S_N1, SN^2 and mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis.

Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Additional Input: Applications of Diazonium salts,

2. **Alcohols & Phenols**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation of Diols by Periodic Acid and lead Tetra acetate, Pinacol- Pinacolone Rearrangement;

Phenols: Preparation and Properties; Acidity and Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism.

Additional Input: Distinguish methods of 1°, 2°, 3° alcohols.

UNIT II:

Carbonyl Compounds:

Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Cannizzaro, Claisen-Schmidt, Perkin, and Wittig reaction, Beckmann rearrangement & Haloform Reaction oxidations and reductions (Baeyer Villiger oxidation, Clemmensen, wolf –kishner, with $LiAlH_4$&$NaBH_4$). Addition Reactions of α, βunsaturated carbonyl compounds: Michael Addition.

Additional Input: Crossed Aldol condensation, Selectivity of $LiAlH_4$ & $NaBH_4$

UNITIII:

1. **Carboxylic Acids and their Derivatives:**

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength. Preparation and Reactions of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl Group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions. Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and

esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt- Eistert synthesis, halogenation by Hell-Volhard- Zelinsky reaction.

2. **Active Methylene Compounds:**

Keto-enol tautomerism. Preparation and Synthetic Applications Diethyl malonate and ethyl acetoacetate.

SPECTROSCOPY 30h(2h /w)

UNITIV:

Molecular Spectroscopy: Interaction of electromagnetic radiation with molecules and various types of spectra. Morse Potential curve

Vibrational Spectroscopy: Classical Equation of Vibration, computation of force constant, Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

Electronicspectroscopy: Energy levels of molecularorbitals (σ, π, n) .Selection rulesforelectronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. Bathochromic and hypsochromic shifts. Beer- Lambert's law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, Factors effecting chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants.

Additional Input: Fermi resonance, Fundamental Frequencies, overtones and hot bands. and coupling constant.

UNITV:

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Application ofelectronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α, β –unsaturated compounds.

IR Spectral interpretation of alkanes, alkenes, Aromatic Hydrocarbons and simple alcohols

(inter and intramolecular hydrogen bonding),aldehydes, ketones and carboxylic acids amines.

Applications of NMR with suitable examples –ethylbromide, ethanol, acetaldehyde,1,1,2-tribromoethane, ethylacetate and Acetophenone.

Textbooks:

1. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford University press
2. Elementary organic spectroscopy by Y.R. Sharma
3. Spectroscopy by Jag Mohan

Reference books:

1. Reaction Mechanism in Organic Chemistry by S.M. Mukherjee and S.P. Singh, Revised edition, Trinity Press
2. A Text Book of Organic Chemistry by Bahl and Arunbahl
3. A Text book of Organic chemistry by IL Finar Vol I
4. Organic chemistry by Bruice
5. Organic chemistry by Clayden
6. Spectroscopy by William Kemp
7. Spectroscopy by Pavia
8. Organic Spectroscopy by J.R.Dyer
9. Mann, F.G. &Saunders ,B.C. Practical Organic Chemistry, Pearson Education (2009)
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster.
11. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
12. Ahluwalia, V.K. &Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis

Web links:

1. https://www.youtube.com/watch?v=JlxM1QsvdUU&list=PLBWC8FLcfD-Dama4OPQUcTfydQp09mXAL

2. https://www.youtube.com/watch?v=0fKpYsV_F9o&list=PL88zE4oO5RTHRh817Cm8Yugh-qqhKVqcg

3. https://www.youtube.com/watch?v=IgT0mIIwd9I&list=PL2-xuUUvX2qvFISUfBmWXgsj8KqT_v95g

4. https://www.youtube.com/watch?v=Uy7MeQ_DYNc&list=PLeMMHhzzYaoDRq7HR1GeYz4spJT_jj8JS

5. https://www.youtube.com/watch?v=1ApGSzDdQnM

6. https://www.youtube.com/watch?v=aJHErmj7Z6A&list=PLYXnZUqtB3K9MmJeTRJh9e9fcdq3lhA-b

CO-PO Mapping:

On Completion ofthecourse,thestudentswillbeableto	
CO1	Acquire knowledge on different preparation methods of alkyl and aryl halogen Compounds & Understand the nucleophilic substitution reactions– SN^1, SN^2, SN^{Ar} mechanisms with stereo chemical aspects
CO2	Comprehend the mechanism of different reactions of alcohols, phenols, Carbonyl compounds and Carboxylic acids in synthetic organic chemistry
CO3	Understand the Preparations and Gains Knowledge about synthetic applications of Active methylene compounds.
CO4	Understand UV, IR & NMR spectroscopic techniques and their applications.

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

WEIGHTAGETOTHECOURSECONTENT

Second Year Semester - III

ORGANICAND SPECTROSCOPY III

S.No	CourseContent	Long Answer	ShortAnswer	Totalmarks	As per Blooms Taxonomy
1	Chemistry of Halogenated compounds, Aryl Halides and Alcohols and Phenols	2	2	30	1. Understanding 2. Application 3. Evaluation
2	Carbonyl Compounds	1	2	20	1. Remembering 2. Understanding 3. Application
3	Carboxylic Acids & Their Derivatives, Active methylene compounds	1	1	15	1. Knowledge 2.Comprehension
4	Spectroscopy	1	2	20	1. Understanding 2. Evaluation 3.Analyzing
5	Application of Spectroscopy to Simple Organic Molecules	1	1	15	1. Understanding 2.Application 3. Creation
	Total	6	7	100	

***

P.R.GOVERNMENT COLLEGE, KAKINADA

MODEL PAPER FOR SEMESTER – II

Paper III (ORGANIC CHEMISTRY & SPECTROSCOPY)

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

PART-A **4X 5=20Marks**

Answer any Four of the following questions. Each carries FIVE marks

1. How would you demonstrate the differences between nucleophilic substitution and elimination reactions?
2. How can you distinguish of primary, secondary, and tertiary alcohols?
3. How would you generalize wolf kishner and Clemenson reduction?
4. What action would you take to perform haloform reaction in ethyl alcohol and acetophenone.
5. How would you explain spin spin coupling and chemical shift?
6. Discuss fingerprint region?
7. What can you infer from the effect of hydrogen bonding on vibrational frequency?

PART-B

Answer any THREE questions choosing at least one question form each section.

Each carries TEN marks **3X10=30Marks**

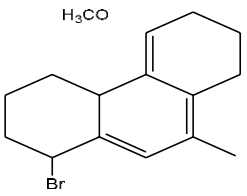
SECTION-I

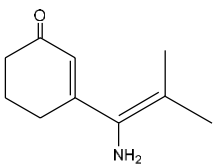
1. How could you verify S_N1 & S_N2 reactions? Explain their mechanism with an example?
2. Suggest the mechanism of (i) Reimer – Tieman reaction

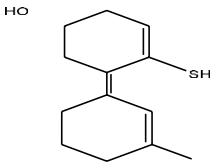
   (ii) Williamson ether synthesis.
3. Elaborate the mechanism of Aldol condensation & Cannizaro reaction.

SECTION-II

4. What is Chemical shift, Discuss the factors that effect chemical shift
5. What criteria would you use to explain Absorption laws and electronic transitions.
6. How would you calculate λ_{max} for the following compounds?







Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy	% of added/deleted
I	1. Applications of Diazonium salts. 2. Distinguish methods of various alcohols	SNi- Mechanism	Application Understanding	2%
II	1. Crossed Aldol condensation. 2. Selectivity of LiAlH4 & NaBH4	------	Application Analysis	2%
III	1. Active Methylene Compounds: Keto- enol tautomerism. Preparation 2. Synthetic Applications Diethyl malonate and ethyl acetoacetate	Typical Reactions of dicarboxylic acids and unsaturated carboxylic acids ------	Knowledge Comprehension	4%
IV	Types of molecular vibration. Functional group and fingerprint region	Rotation spectroscopy. Harmonic and anharmonic oscillator& Selection rules for vibrational transitions. Applications of NMR with suitable examples – ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate and acetophenone.	Under standing Evaluation Analysing	2%
V	1.Applications of NMR with suitable examples ethyl bromide, ethanol, acetaldehyde, 1,1,2-	Types of molecular vibration. 1.Types of molecular	Understanding Application Creation	2%

	tribromo ethane, ethyl acetate and acetophenone.	vibrations. 2.Functional group and fingerprint region		

LABORATORYCOURSE-III 30hrs(2h/w)

Practical Paper-III (At the end of Semester-III)

Organic Preparations and IR Spectral Analysis Lab: 50 Marks

Course Outcomes

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

Organic preparations: 30M

i. Acetylationofoneofthefollowing compounds:

Amines (aniline) and phenols (β-naphthol, salicylicacid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzoylation of amine (aniline)

a. Nitration of any one of the following: Acetanilide/nitrobenzene by conventional method

b. Salicylicacid by green approach (using Ceric Ammonium Nitrate).

IR Spectral Analysis: 10M

IR Spectral Analysis of the following functional groups with examples

a) Hydroxylgroups
b) Carbonylgroups
c) Aminogroups
d) Aromatic groups

SCHEME OF VALUATION

S.NO	DISCRIPTION	MARKS
1	**Organic Preparations**	**30**
	i. Reaction with Mechanism	10
	ii. Procedure	10
	iii. Recrystallization	05
	iv. Report	05
2	**Interpretation of IR Spectra of given Organic Compounds**	**10**
3	**Record**	**05**
4	**Viva**	**05**

SEMESTER-IV

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE Kakinada	Program & Semester II B.Sc. (IV Semester)			
Course Code CHE-IV	TITLE OF THE COURSE **INORGANIC, ORGANIC & PHYSICAL CHEMISTRY**				
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
	Organometallic Chemistry, Carbohydrates, Heterocyclic compounds, Nitrogen Compounds, Photochemistry & Thermodynamics	60	10	30	4+1

Course Objectives:

1. Organometallic Chemistry
2. Carbohydrate and Heterocyclic compounds
3. Nitrogen based organic compounds
4. Photochemistry & Thermodynamics

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Identify the importance of metals in organometallic Chemistry
CO2	Acquire knowledge on carbohydrate Chemistry & Heterocyclic compounds
CO3	Understand the importance of structure, preparation and chemical applications in respect of Nitrogen based organic compounds
CO4	Comprehend the concepts and applications of Photochemistry & Thermodynamics

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development			Employability			Entrepreneurship	

UNIT-I: Organometallic Compounds: 15 h

Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal Carbonyls: 18 electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. Synthetic applications of any two organometallic compounds.

UNIT- II: Carbohydrates

Classification of Carbohydrates. Monosaccharides: Constitution and absolute configuration glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth Projection; Interconversions of aldoses and ketoses, Ketoses to aldoses, Kiliani-Fischer synthesis and Ruff degradation.

UNIT-III: **Amino acids and proteins:**

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 and Alanine) by following methods: a) Gabriel Phthalimide synthesis. b) Strecker's synthesis. Physical properties: Zwitter ion structure, Isoelectric point. - peptide bond (amide linkage).

Heterocyclic Compounds:

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation using Paul-Knorr synthesis. Properties: electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity – Aromaticity Chichibabin reaction, Comparison of basicity of Pyrrole and Pyridine.

Unit-4 Nitrogen Containing Functional Groups:

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

Amines: Introduction, classification, importance and general methods of preparation. Properties: Basicity of amines- Effect of substituent, solvent and steric effects. Distinguish between Primary, secondary and tertiary amines using Nitrous Acid. Separation of primary, secondary and tertiary amines by Hinsberg method. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann- Bromamide Reaction, Carbylamine Reaction. Bromination of aniline

Unit-5: Photochemistry & Thermodynamics

Photochemistry: 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 process- hydrogen- chlorine and hydrogen- bromine reaction. Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics: The first law of thermodynamics-statement and Equation, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Kirchoff's equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes.

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	Nil	Nil	NA
2	Nil	Nil	NA
3	Nil	Nil	NA
4	Nil	Nil	NA
5	Nil	Nil	NA

Code	Meaning	Description
K1	Remembering	Describe, relate,tell,find
K2	Understanding	Out line, expect, credit

K3	Applying	Illustrate, complete, solve
K4	Analyse	Compare,explain,categorise
K5	evaluating	Prioritize,rate,justify
K6	create	Imagine, desine,plan—

Reference & Text books

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

Web Links:

1. https://www.youtube.com/watch?v=MgEfDgnaBmE
2. https://www.youtube.com/watch?v=kykIqN07wwg
3. https://www.youtube.com/watch?v=MgEfDgnaBmE
4. https://www.youtube.com/watch?v=61t_hi3c7lo

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	1	2	2	2	2	1	2	2	2
CO2	2	3	3	3	3	2	2	2	2	2	2	2	2
CO3	2	3	3	3	3	2	2	2	2	2	2	2	2
CO4	2	1	1	2	2	2	1	1	1	2	2	2	2
Avg.	2	2.5	2.2	2.7	2.2	2	1.7	1.7	1.7	1.7	2	2	2

Low =1; Moderate = 2 ; High = 3 ; No Correlation = 0

PO1: Knowledge in Chemistry: Apply the basic knowledge of chemistry to the solution of simple to complex problems in chemistry.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze simple to complex problems reaching substantiated conclusions using fundamental principles of chemistry.

PO3: Design/development of solutions: Design solutions for simple to complex problems and designing novel routes for the synthesis of bioactive / active pharmaceutical ingredients.

PO4: Conduct investigations of complex problems: Use fundamental research-based knowledge and available research methods including design of experiments, analysis and interpretation of data, and synthesis of the organic molecules.

PO5 : Modern tool usage: Create, select, and apply appropriate techniques, resources, and IT tools for modeling and interpretation of simple to complex organic molecules.

PO6 : The Chemist & Society: Applying the contextual knowledge to assess societal, health, safety, legal and cultural issues.

PO7: Environment and sustainability: Understand the importance of synthetic organic chemistry for various solutions in societal and environmental context and demonstrate the knowledge and need for sustainable development.

PO8 : Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science-based practice.

PO9 : Communication: Communicate effectively on complex Chemical activities with the Chemistry community and with society at large, such as, being able to comprehend and write effective reports, design documentation and make effective presentations

PO10: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSO-1: To identify, formulate and analyze the problems in Chemistry by using principles of Organic,Inorganic and Physical Chemistry fundamentals

PSO-2: Applying Chemistry knowledge to design a system, analyze and interpret data to obtain valid conclusions

PSO-3: Use of various Simulation tools such as CDD Vault, Dotmatics, schrodinger etc for Molecular design and analysis of various systems

Weightage to content
Semester -IV
Paper-IV

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	Organometallic Compounds	1	2	20	Understanding, Application
2	Carbohydrates	2	1	25	Remembering, Understanding
3	Heterocyclic compounds & Aminoacids	1	2	20	Application & Creation
4	Nitro compounds & Amines	1	1	15	Remembering, Understanding
5	Photochemistry & Thermodynamics	1	1	15	Application & Creation
	TOTAL	**6**	**7**	**95**	

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

II YEAR B.Sc (Examination at the end of IV semester)
(INORGANIC, ORGANIC & PHYSICALCHEMISTRY): Paper-IV
MODEL PAPER

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

Section -I

Answer any THREE questions choosing at least one from each part. Each question carries TEN marks. **3 X 10 = 30 Marks**

PART-A

1. Explain the classification of organometallic Compounds based on the nature of bonds?
2. Support the open chain structure of Glucose with relevant chemical reactions
3. How will you interconvert Glucose to Fructose and Fructose to Glucose

PART-B

4. Give the synthesis of Glycine and Alanine by Gabriel -Pthalimide and Strecker synthesis.
5. Discuss the separation of mixture of Amines by using Hinsberg reagent and Nitrous acid
6. Define Carnot Theorem and explain Carnot's cycle.

Section-II

Answer any four of the following questions. Each question carries FIVE marks. **4x5=20 Marks**

7. Brief 18 electron rule. Give an example
8. Define Epimers and Anomers and give an example for each
9. Write a note on Zwitterion and Isoelectric point
10. Explain why Electrophilic substitution reactions takes place at 2 or α position but not at 3 or β position in 5-membered Heterocyclic compounds
11. Give the mechanism of Nef and Mannich reactions.
12. Derive Cp – Cv = R
13. Write the preparative methods of nickel carbonyl

LABORATORY COURSE

Practical Syllabus Paper – IV
(At the end of semester IV)
Paper Title: Organic Qualitative analysis: 30 hrs (2 h / W) :: Max.Marks:50

Course Outcomes:

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

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 one derivative. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

SCHEME OF EVALUATION

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

	P R Govt College (A), Kakinada	Program & Semester			
Course Code CHE-V	TITLE OF THE COURSE INORGANIC & PHYSICAL CHEMISTRY	II B.Sc. (IV Semester)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Knowledge of Inorganic Complexes - Concept of Isomerism- Concept of Substitution reactions -Concept of Phase and how a Phase depends on Temperature, pressure, and concentration - Laws of Electrochemistry-Concept of Rate of a reaction, Order of a reaction, molecularity of a reaction.	60	10	30	4+1

Course Objectives:

- Introduction of Coordination Chemistry (CC)
- Theories in Coordination Chemistry
- Reactivity of Coordination Compounds
- Stability of Coordination Compounds
- Bio -inorganic Chemistry
- Phase rule
- Electro chemistry (conduct metric & Potentiometric titrations)
- Chemical Kinetics

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

On Completion of the course, the students will be able to	
CO1	Understanding the structure and reactivity of coordination compounds wrt bonding theories like VBT &CFT.
CO2	Apply the Knowledge of coordination chemistry in various applications such as catalysis, materials science, medicine, and organometallic chemistry.
CO3	Understanding the role of inorganic elements in biological systems: This includes understanding the properties and functions of metal ions and other inorganic elements in biological systems, including enzymes, proteins, and other biomolecules.
CO4	Understanding the fundamental principles of Phase Rule and applying the phase rule in the purification of metals and change of MPs and BPs of various metal compositions
CO5	Understanding the fundamental principles and applications of Electrochemistry in designing various electrochemical cells and measuring the emf of the cells.
CO6	Understanding the fundamental principles of Chemical Kinetics: This includes understanding the concept of reaction rate, order and molecularity of a reaction, rate laws, and reaction mechanisms

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

Skill Development		Employability		Entrepreneurship	

INORGANIC CHEMISTRY

UNIT I:

Coordination Chemistry:

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy.

Additional Input: Comparison of CFSE for Octahedral and Tetrahedral complexes.

UNIT II:

1. Inorganic Reaction Mechanism:

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

3. Bioinorganic Chemistry:

Metal ions present in biological systems, classification of elements according to their action in biological systems. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd, and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Hemoglobin

Additional Input: Geochemical effect on the distribution of metals, Sodium / K– pump, and Myoglobin.

PHYSICAL CHEMISTRY

UNIT-III:

Phase rule:

Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverization of lead ii) NaCl-Water system, freezing mixtures.

UNIT IV:

Electrochemistry:

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

Additional Input: Applications of EMF measurements - Potentiometric titrations.

UNIT V:

Chemical Kinetics:

The concept of reaction rates. Effect of temperature, pressure, catalyst, and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first, and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of the order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Additional Input: Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions.

REFERENCE BOOKS:

1. Textbook of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D. Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu, and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P.W. & Paula, J.de Atkin's Physical Chemistry Ed., Oxford UniversityPress 10^{th} Ed(2014)
11. Castellan, G.W. Physical Chemistry, 4thEd.Narosa(2004)
12. Mortimer, R. G. Physical Chemistry3rdEd. Elsevier : NOIDA ,UP(2009).

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, materials science, medicine, and organometallic chemistry.
CO3	Understanding the role of inorganic elements in biological systems: This includes understanding the properties and functions of metal ions and other inorganic elements in biological systems, including enzymes, proteins, and other biomolecules.
CO4	Understanding the fundamental principles of Phase Rule and applying the phase rule in the purification of metals and change of MPs and BPs of various metal compositions

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	3	2	3	1	2	2	2	2	1	2	2	2
CO2	2	3	3	3	3	2	2	2	2	2	2	2	2
CO3	2	3	3	3	3	2	2	2	2	2	2	2	2
CO4	2	1	1	2	2	2	1	1	1	2	2	2	2
Avg.	2	2.5	2.2	2.7	2.2	2	1.7	1.7	1.7	1.7	2	2	2

Low =1 Moderate = 2 High = 3 No Correlation = 0

POGRAMME OUTCOMES:

PO1: Knowledge: Graduates should have a thorough understanding of the fundamental principles of Inorganic chemistry, including the properties and behavior of complexes, and their chemical reactions,

PO2: Critical Thinking: Graduates should be able to analyze and interpret scientific data, formulate hypotheses, design experiments to test those hypotheses, and draw conclusions based on their findings.

PO3: Laboratory Skills: Graduates should be able to perform experiments using modern laboratory techniques, including safety protocols, and understand the principles behind those techniques.

PO4: Communication: Graduates should be able to communicate scientific concepts and research findings effectively in both written and oral formats to both scientific and non-scientific audiences.

PO5: Research: Graduates should be able to engage in research activities, including literature reviews, experimental design, data collection and analysis, and interpretation of results.

PO6: Professionalism: Graduates should be able to work collaboratively in teams, demonstrate ethical behavior in their work, and understand the broader societal implications of their work.

PO7: Demonstrate knowledge of the fundamental principles of chemistry, including its various sub-disciplines such as organic chemistry, inorganic chemistry, physical chemistry, and analytical chemistry.

PO8: Apply the scientific method to investigate and solve problems related to chemistry.

PO9: Use laboratory techniques and equipment to carry out experiments and analyze data related to chemical systems.

PO10: Develop critical thinking and problem-solving skills that can be applied to real-world scenarios in the field of chemistry.

PSO-1: To have a firm foundation in the fundamentals/concepts/theories and their applications in Inorganic reaction mechanisms

PSO-2: To understand the principle of electrochemistry, and apply them in cell construction.

PSO-3: To acquaint with safety measures in the laboratory and develop skills in the proper handling of chemicals and apparatus/instruments and carry out experiments, record the observations, and present the inference/results

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	NIL	NIL	NA
2	NIL	NIL	NA
3	NIL	NIL	NA
4	NIL	NIL	NA
5	NIL	NIL	NA

WEIGHTAGE TO THE COURSE CONTENT
Second Year Semester - IV

INORGANIC AND PHYSICAL CHEMISTRY -V

Sl. No.	COURSE CONTENT	Long answer questions	Short answer questions	Total Marks
1	UNIT – I Coordination Chemistry:	1	2	20
2	UNIT-II Inorganic Reaction Mechanism and Bio inorganic Chemistry	2	1	25
3	UNIT – III Phase rule:	1	1	15
4	UNIT – IV Electrochemistry:	1	1	20
5	UNIT – V Chemical kinetics	1	2	15
Total		6	7	95

P. R. GOVERNMENT COLLEGE, KAKINADA

MODEL PAPER FOR SEMESTER – IV

(CHEMISTRY)

Paper V (INORGANIC & PHYSICAL CHEMISTRY)

Duration: 2hrs. Max. Marks: 50

Section -I

Answer any THREE questions by choosing at least ONE from Each Part. Each question carries TEN marks 3 X 10 = 30 Marks

PART- A

1. Discuss the salient features of crystal field theory. Explain the Crystal field splitting of d- orbitals in Octahedral, complexes.
2. Explain the mechanism of ligand substitution reactions with examples
3. Explain the determination of the composition of the complex by the job's method.

PART- B

4. Explain the phase diagram of the Pb-Ag system.
5. Define transport number? Determine the Trans port number by Hittorf's method.
6. Define Second order reaction? Derive rate Constant of Second order reaction. Write the units

Section- II

Answer any Four of the following questions. Each question carries FIVE marks4 X 5 = 20 Marks

7. Explain High spin and Low spin complexes with examples
8. Define Stereoisomerism? Give two examples
9. What is the Trans effect? Write its applications?
10. What are congruent and incongruent melting point-Give one example each?
11. Explain Kohlrausch's law of independent migration of ions.
12. Write any three factors affecting the rate of reaction
13. Write differences between Order of reaction and Molecularity.

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

Practical Paper-V (At the end of Semester IV)

(Paper-5) Conductometric and Potentiometric Titrimetric lab: 50 Marks Course

Outcomes:

1. Use glassware, equipment, and chemicals and follow experimental procedures in the laboratory
2. Apply concepts of electrochemistry in experiments
3. Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

Conductometric and Potentiometric Titrimetry: **50 M**

2. Conductometric titration- Determination of concentration of HCl solution using standard NaOH solution.
3. Conductometric titration- Determination of concentration of CH3COOH Solution using standard NaOH solution.
4. Conductometric titration- Determination of concentration of CH3COOH and HCl in a mixture using standard NaOH solution.
5. Potentiometric titration- Determination of Fe (II) using standard K2Cr2O7 solution.
6. Determination of rate constant for acid-catalyzed ester hydrolysis.

SCHEME OF VALUATION FOR LABORATORY: 50 M

Procedure:	10 M
Formula and Tabulation:	10M
Calculation, Graph,	10M
Result <2%	10M
>2%	05M
Record ;	05M
Viva :	05M

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NDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

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

Second Internship (After 2nd year examinations): Apprenticeship / Internship / On the job training / In-house Project / Off-site Project

To make the students employable, an Apprenticeship / Internship / On the job training / In-house Project / Off-site Project shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years.

Learning outcomes

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

Assessment Model

There will be only internal evaluation for this internship. Each faculty member is to be assigned with 10 t0 15 students depending upon availability of the faculty members. The faculty member will act as a faculty-mentor for the group and is in- charge for the learning activities of the students and also for the comprehensive and continuous assessment of the students.

The assessment is to be conducted for 100 marks and the credits assigned are 4. Later as per the present practice the marks are converted into grades and grade points to include finally in the SGPA and CGPA.

The weightings shall be:

Project Log	20%
Project Implementation	30%
Project report	25%,
Presentation	25%

Each student is required to maintain an individual logbook, where he/she is supposed to record day to day activities. The project log is assessed on anindividual basis, thus allowing for individual members within groups to be assessed this way.The assessment will take into consideration the individual student's involvement in the assigned work.

While grading the student's performance, using the student's project log, the following should be taken into account -

a. The individual student's effort and commitment.
b. The originality and quality of the work produced by the individual student.
c. The student's integration and co-operation with the work assigned.
d. The completeness of the logbook.

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

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

The Project Report should contain

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

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

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

For Example:

II MPC-EM

S.No.	Name of the Student	Class & Year of Study	Register Number	Project Log	Project Implementation	Project Report	Presentation	Total
				(20)	(30)	(25)	(25)	(100)

Signature of Project Mentor **Signature of Nominated faculty** **Signature of HOD/ In-Charge**

SEMESTER-V

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

Course Objectives:

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

Course Outcomes:

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

Course with focus on Skill Development/Employability/Entrepreneurship modules

Skill De velopment		Employability		Entrepreneurship	

Syllabus:

UNIT-I Pericyclic reactions: 15 h

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

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

UNIT-II Organic photochemistry: 9h

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

UNIT-III Retrosynthesis 12 h

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

Unit-4: Synthetic Reactions 12 h

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

Unit-5: Reagents in Organic Chemistry 12h

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

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

Additions and Deletions

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

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

Textbooks:

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

Reference books

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

WebLinks:

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

Course outcome & Program outcome mapping

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

CO-PO Mapping:

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

Weightage to content

Semester -V

Paper-6A

SYNTHETIC ORGANIC CHEMISTRY

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

P.R. GOVERNMENT COLLEGE (A), KAKINADA

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

(Synthetic Organic Chemistry)

Paper-6A

MODELPAPER

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

SECTION-I

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

PART-A

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

PART- B

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

SECTION-II

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

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

LABORATORY COURSE

Practical Paper – 6A :: Synthetic Organic Chemistry

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

Learning Out comes:

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

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

Practical (Laboratory) Syllabus

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

Lab References:

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

Co-Curricular Activities:

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

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

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

Max marks for Fieldwork/project work Report:05.

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

Unit tests (IE).

a) Suggested Co-Curricular Activities

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

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

SCHEME OF VALUATION

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

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

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

Course Objectives:

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

CourseOutcomes:

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

Coursewithfocusonemployability/entrepreneurship/SkillDevelopment modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

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

A brief introduction to analysis of organic compounds

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

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

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

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

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

Unit-4: Separation techniques-1 12h

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

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

Unit-5: Separation techniques-2 12h

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

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

Textbooks:

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

Referencebooks

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

WebLinks:

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

Course outcome & Program outcome mapping

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

CO-POMapping:

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

Weightage to content
Semester -V
Paper-7A

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

P.R. GOVERNMENT COLLEGE(A),KAKINADA

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

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

Section -I

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

Part – A

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

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

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

Part – B

4. Explain Batch and Counter current extraction techniques.

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

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

Section -II

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

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

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

LABORATORY COURSE

Practical Paper – 7A:: Analysis of Organic Compounds

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

Learning Outcomes:

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

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

Practical (Laboratory) Syllabus:

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

SCHEME OF VALUATION

Practical Paper – 7 A:: Analysis of Organic Compounds

(at the end of semester V)

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

References:

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

Co-CurricularActivities

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

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

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

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

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

5. Unit tests(IE).

b) Suggested Co-Curricular Activities

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

B.VOC

HORTICULTURE&AQUACULTURE

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

Course Objectives:

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

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

Course with focus on employability / entrepreneurship / Skill Development modules

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT-I Introduction **12 h**

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

UNIT- II Air Pollution **12 h**

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

UNIT – III Water pollution **14 h**

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

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

UNIT-IV Chemical Toxicology **10 h**

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

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

Ecosystem

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

Biodiversity

Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity –biodiversity at national, global and regional level.

1. Text books

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

2. Reference books

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

Web Links:

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

Weightage to content

Semester -V

Paper-6D

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

P.R. COLLEGE (A), KAKINADA

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

(Environment Chemistry)

Paper-6D

MODEL PAPER

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

PART- A

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

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

PART- B

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

1. Explain the toxicity of Lead and Mercury.

   (OR)

   Describe various effects of human activities on environment

2. Explain the classification of air pollution?

   (OR)

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

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

   (OR)

   Explain any two water quality parameters.

4. Explain Nitrogen and Phosphorus cycle.

   (OR)

   Define Biodiversity and explain level and types of Biodiversity

LABORATORY COURSE

Practical Paper – 6D :: Environmental Chemistry

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

I Lab work-Skills Outcomes:

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

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

II. Practical (Laboratory) Syllabus

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

a) Permanent hardness b) Temporary hardness

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

III. **Co-Curricular Activities:**

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

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

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

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

b) Suggested Co-Curricular Activities:

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

SEMESTER-VI

APPRETICESHIP

NDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

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

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

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

Learning outcomes

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

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

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

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

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

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

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

The Project Report should contain

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

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

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

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

A. Monthly Reports submitted by the student

B. Final Project Report

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

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

Example:

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

SEMESTER-VII

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

Course Outcomes:

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

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development			Employability			Entrepreneurship	

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

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

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

Unit-II: Structure and Bonding: 12Hours

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

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

Unit-III: Metal–ligand bonding: 12Hours

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

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

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

Unit- V: Group theory 12Hours

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

Suggested Co-Curricular Activities

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

Text books:

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

8. Quantum Chemistry, R.K. Prasad.

Reference books:

1. Inorganic Chemistry, Atkins, ELBS.

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

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

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

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

CO-PO Mapping:

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

Weightage to content

Semester -VII

Paper-VIIIA

ADVANCE STUDIES IN COMPLEXES AND GROUP THEORY

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

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

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

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

SECTION-I

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

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

SECTION-II

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

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

(OR)

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

(OR)

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

(OR)

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

(OR)

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

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

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

Learning Outcomes:

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

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

Syllabus:

I. Synthesis of Inorganic Metal Complexes:

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

(i) Tetra ammine copper (II) sulphate monohydrate

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

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

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

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

Cations:

Ammonium (NH_4^+)

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

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

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

4th group: Zn, Mn, Co, Ni

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

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

Lab References:

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

Co-Curricular Activities:

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

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

SCHEME OF VALUATION

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

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

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

Course Outcomes:

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

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development			Employability			Entrepreneurship	

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

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

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

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

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

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

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

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

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

Basic Principles, Comparison of NMR & ESR. Determination of 'g' value, Factors affecting the 'g' value. Isotropic and Anisotropic constants. Splitting, hyperfine splitting coupling constants. Line width, Zero field splitting, and Kramer degeneracy. Crystal field splitting, Crystal field effects.

Applications: Detection of free radicals; ESR spectra of (a) Methyl radical (CH3·), (b) Benzene anion (C6H6-).

UNIT-V MASS SPECTROMETRY **12 hours**

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

Suggested Co-Curricular Activities

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

Suggested Text Books:

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

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

References:

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

Course Outcomes:

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

Weightage to content

Semester -VII

Paper-IXA

SPECTROSCOPY OF ORGANIC COMPOUNDS

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

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

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

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

SECTION-I

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

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

SECTION-II

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

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

(OR)

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

(OR)

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

(OR)

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

(OR)

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

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

Spectroscopy of Organic Compounds

Learning Outcomes:

By the end of the course students will be able to

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

Practical Syllabus

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

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

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

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

Lab References:

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

Co-Curricular Activities:

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

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

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

SCHEME OF VALUATION

Practical Paper – IXA : SPECTROSCOPY IN ORGANIC COMPOUNDS

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

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

Course Outcomes:

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

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development		Employability		Entrepreneurship	

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

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

Unit –II: Molecular spectroscopy 14 hours

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

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

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

Emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and double beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

Unit–IV: Mass spectroscopy 12 hours

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

Unit – V: Elemental analysis 12 hours

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

Suggested Co-Curricular Activities

Training of students by related industrial experts.

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

Visits of abilities, firms, research organizations etc.

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

Suggested Text Books:

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

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

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

Reference Books:

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

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

CO-PO Mapping:

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

Weightage to content

Semester -VII

Paper-XB

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

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

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

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

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

SECTION-I

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

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

SECTION-II

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

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

(OR)

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

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

(OR)

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

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

(OR)

(b) Define the following with suitable examples

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

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

(OR)

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

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

Instrumental Methods of Chemical Analysis

Course learning outcomes

By the end of the course students will be able to

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

Syllabus

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

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

(lab:10+field:05):

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

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

Lab References:

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

Co-Curricular Activities:

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

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

SCHEME OF VALUATION

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

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

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

Course Outcomes:

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

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development			Employability			Entrepreneurship	

UNIT- I **15 hours**

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

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

Anti-tuberculous drug- isoniazid.

UNIT- II **10 hours**

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

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

UNIT- III **10 hours**

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

Analysis of diuretics like: furosemide (Lasix), triamterene

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

UNIT- IV **15 hours**

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

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

UNIT-V **10 hours**

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

Suggested Co-Curricular Activities

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

Text Books:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.

References Books:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Text book of practical organic chemistry- A.I. Vogel.

CO-PO Mapping:

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

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

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

Weightage to content

Semester -VII

Paper-XIB

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

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	UNIT - I	2	2	30	Understanding, Application
2	UNIT – II	1	1	15	Remembering, Understanding
3	UNIT – III	2	2	30	Analyzing & Creation
4	UNIT – IV	2	2	30	Evaluation, Understanding
5	UNIT - V	1	1	15	Application & Creation
	TOTAL	**8**	**8**	**120**	

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

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

(ANALYSIS OF DRUGS, FOODS, DAIRY PRODUCTS &BIO-CHEMICAL ANALYSIS)

Paper-XIB

MODELPAPER

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

SECTION-I

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

4 X 5=20Marks

1. Define analgesics and antipyretics with suitable examples.
2. What are antihistamine drugs and mention their role.
3. write a short note on cardiovascular drugs.
4. what are flavoring agents used in our daily products.
5. How to calculate the total fat percentage in the milk.
6. write about blood composition.
7. Identify the differences between bacteriostatic and bactericidal.
8. what is prevacid and how it is useful for the prevent the production of acid in stomach.

SECTION-II

Answer the following questions. Each section part Each question carries TEN marks

4X10=40Marks

9. Describe the structure of anti-malarial drug chloroquine.

(OR)

10. write about the following drugs used in the treatment of infections

A) pencil B) Antituberculosis drug

11. Explain the structure of following

A) Alprazolam B) Diazepam.

(OR)

12. Write a brief note on anti - epileptic and anti - convulsant drugs.
13. How lipitor is used in the prevention of production of cholesterol.

(OR)

14. Write a brief note on adulterants in Rice, wheat flour and coffee powder.
15. what are the general preservatives and coloring matters used for food materials.

(OR)

16. Write about estimation of blood cholesterol, glucose and enzymes in the blood.

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

Spectroscopy of Organic Compounds

Learning Outcomes:

By the end of the course students will be able to

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

Practical Syllabus

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

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

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

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

Lab References:

S.NO	AUTHOR	TITLE	PUBLISHER
1	JagMohan	Organic Spectroscopy	
2	J.R.Dier	Combined Problems	

Co-Curricular Activities:

Co-Curricular Activities

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

For Teacher: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of comprehensive product development programs to meet new product criteria and timing. Acquire skills in the preparation of Drugs, foods and Dairy Products, carry out food testing with the knowledge of testing food adultration and learn the procedure of synthesis of drugs.

For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the preparation of Cosmeceuticals and Pharmaceutical. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher.

a). Max marks for Fieldwork/project work Report: 05. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

Unit tests (IE).

SCHEME OF VALUATION

Practical Paper – IXA :: SPECTROSCOPY IN ORGANIC COMPOUNDS

a.	UV- λ_{Max} Calculation	10 marks
b.	Given IR Values	10 marks
c.	Draw the NMR Spectra	10 marks
d.	Mass Fragmentations	10 marks
e.	Record	05 marks
f.	Viva voce	05 marks
	TOTAL	**50 marks**

	PITHAPUR RAJAH'S GOVERNMENT COLLEGE KAKINADA	Program & Semester			
Course Code **CHE-XIIB**	TITLE OF THE COURSE **INDUSTRIAL CHEMICALS AND ENVIRONMENT**	IV B.Sc. (VII Semester)			
Teaching	Hours Allocated: 60 (**Theory**)	L	T	P	C
Pre-requisites	Basic Knowledge on Handling Of Hazardous chemicals, And knowing about Different segments on Environment	60	10	30	4+1

Course Outcomes:

On Completion of the course, the students will be able to	
CO1	Identify the importance of Manufacture of Inorganic Chemicals
CO2	Acquire knowledge on production, uses, storage and hazards of Industrial Gases.
CO3	Understand the importance of Environment.
CO4	Understanding about water pollution and its effects. Acquire knowledge on Energy and its effects on Environment

Course with focus on employability/entrepreneurship/SkillDevelopment modules

Skill Development		Employability		Entrepreneurship	

Unit-I **10 Hours**

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

Unit-II **10 Hours**

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene

Industrial Metallurgy: Preparation of metals (ferrous and nonferrous) and ultrapure metals for semi-conductor technology.

Unit-III **15 hours**

Environment and its segments

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. **Air Pollution:** Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photo chemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO2, CO2, CO, NOx, H2S and other foul smelling gases. Methods of estimation of CO, NOx, SOx and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

Unit-IV **15 hours**

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for wastewater, industrial water and domestic water.

Unit-V **10 hours**

Energy & Environment

Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management. **Biocatalysts:** Introduction to biocatalysts: Importance in ―Green Chemistry and Chemical Industry.

Suggested Co-Curricular Activities

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

Text Books:

1. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

2. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

3. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.

4. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.

References Books:

E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.

R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, WileyPublishers, New Delhi.

J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.

S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.

K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.

S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.

S.E. Manahan, Environmental Chemistry, CRC Press (2005).

G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).

A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Identify the importance of Manufacture of Inorganic Chemicals
CO2	Acquire knowledge on production, uses, storage and hazards of Industrial Gases.
CO3	Understand the importance of Environment.
CO4	Understanding about water pollution and its effects. Acquire knowledge on Energy and its effects on Environment.

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

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

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

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

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

Weightage to content

Semester -VII

Paper-XIIB

INDUSTRIAL CHEMICALS AND ENVIRONMENT

S.No	Course Content	Long Answer	Short Answer	Total marks	As per Blooms Taxonomy
1	**Inorganic Chemicals**	2	1	25	Understanding, Application
2	**Industrial Gases**	2	1	25	Remembering, Understanding
3	**Environment and its segments**	2	2	30	Analyzing & Creation
4	**Water Pollution**	1	2	20	Evaluation, Understanding
5	**Energy & Environment**	1	2	20	Application & Creation
	TOTAL	**8**	**8**	**120**	

PITHPUR RAJAH'S GOVERNMENT COLLEGE (A), KAKINADA

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

(INDUSTRIAL CHEMICALS AND ENVIRONMENT)

Paper-XIIB

MODELPAPER

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

SECTION-I

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

4 X 5=20Marks

1. What are the applications potash alum, chrome alum?
2. 10. How inert gases like Helium, Neon, Argon are useful as industrial gases?
3. How domestic appliance causing Ozone layer depletion?
4. How Biogeochemical cycles of carbon, nitrogen and Sulphur helpful inn balancing the Ecosystem?
5. How industrial waste management decreases the water pollution?
6. How water quality parameters are useful in our day to day life?
7. Importance of bio catalysis in Green Chemistry?
8. What are the measures to protect Sources of energy: Coal, petrol and natural gas?

SECTION-II

Answer the following questions. Each section part Each question carries TEN marks

4X10=40Marks

9. What are the analysis & hazards in handling the following chemicals

A) Hydrochloric acid B) Sulfuric acid

(OR)

10. What are the analysis & hazards in handling the following chemicals

A) Nitric acid B) Caustic soda

11. What are the Storage and hazards in handling of the following gases

A) Oxygen B) Nitrogen

(OR)

12. What are the Storage and hazards in handling of the following gases

A) Carbon monoxide B) Sulphur dioxide

13. What are the types & sources of severe Air pollutants causing air pollution

(OR)

14. What is Air pollution? What are the control measures of air pollution

15. Explain Water treatment and purification methods (reverse osmosis, electro dialysis, ion exchange)

(OR)

16. Define Nuclear Pollution. Explain Disposal of nuclear waste, nuclear disaster and its management

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

INDUSTRIAL CHEMICALS &ENVIRONMENT

Learning Outcomes:

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

Perform Determination of DO, COD and BOD

Learn the procedure for measurement of chloride, sulphate and salinity of water

Estimation of total alkalinity of water

Acquire skills in determination of dissolved gases like O2, CO2, SPM etc.

Practical Syllabus:

1. Determination of Dissolved Oxygen (DO) in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (Ag NO3 and potassium chromate).
6. Estimation of total alkalinity of water samples (CO3 2-, HCO3 -) using double titration method.
7. Measurement of dissolved CO2.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

Lab References:

S.NO	AUTHOR	TITLE	PUBLISHER
1	E. Stocchi	Industrial Chemistry, Vol-I,	Ellis Horwood Ltd.UK.
2	R.M. Felder, R.W.	Elementary Principles of Chemical Processes,	WileyPublishers, New Delhi.
3	J. A. Kent: Riegel's	Handbook of Industrial Chemistry	CBS Publishers, New Delhi
4	S. S. Dara	A Textbook of Engineering Chemistry	S. Chand & Company Ltd. NewDelhi
5	K. De,	Environmental Chemistry	New Age International Pvt., Ltd, New Delhi.
6	S. M. Khopkar,	Environmental Pollution Analysis	Wiley Eastern Ltd, New Delhi

Co-Curricular Activities:

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

1. **For Teacher:** Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of organic compounds using spectroscopic data.
2. **For Students:** Student shall visit a related industry/chemistry laboratory in universities/ research organizations/private sector facility and observes the synthetic reactions and obtain spectral data for interpretation of the synthetic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max. marks for Fieldwork/project work Report:05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

SCHEME OF VALUATION

Practical Paper – XII B: **INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**

a.	Procedure	10 marks
b.	Principle &Titration	10 marks
c.	Tabular forms (Known & Unknown)	10 marks
d.	Calculation	6 Marks
e.	Report	4 Marks
f.	Record	05 marks
g.	Viva voce	05 marks
	TOTAL	**50 marks**

SEMESTER-VIII

B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

	P R Govt College (A), Kakinada	Program & Semester			
Course Code 21-A	B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure TITLE OF THE PAPER Inorganic Chemistry: Metal Cluster, Electronic spectra of Complex compounds and Bio- inorganic chemistry	IV B.Sc. (VIII Semester)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Theories of bonding and metal structures	60	10	30	4+1

Course Objectives:

- Non-metal cages and metal clusters
- Organo metallic chemistry of transition metals
- Reaction mechanism of transition metal complexes
- Term symbols and Electronic spectra
- Bio-inorganic chemistry and Magnetic properties of complexes

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

On Completion of the course, the students will be able to	
CO1	Understanding the structure and reactivity of Nonmetal cages and metal clusters.
CO2	Apply the Knowledge of organometallic chemistry in various applications such as catalysis, materials science.
CO3	Understanding the fundamental principles and Reaction mechanism of transition metal complexes.
CO4	Understanding the role of inorganic elements in biological systems: This includes understanding the properties and functions of metal ions and other inorganic elements in biological systems, including Hemoglobin, Myoglobin, Chlorophyll, Vitamin B12.

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

Skill Development		Employability		Entrepreneurship	

Syllabus

Unit-I:

Non-metal cages and metal clusters: 9Hours

Structure and bonding in phosphorous- oxygen, phosphorous -Sulphur cages; structure and bonding in higher boranes with (special reference to B12 icosahedra). Carboranes, metalloboranes, metallocarboranes. Classification- LNCs and HNCs, Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in dinuclear[Re2Cl8] 2- ion, trinuclear[Re3Cl9], tetranuclear W4(OR)16, hexanuclear[Mo6Cl8] 4+ and [Nb6Cl12] 2-.

Unit-II:

Organo metallic chemistry of transition metals: 9Hours

Classification and electron counting rules, hapticity, synthesis, structure and bonding of Ferrocene, dibenzene chromium, cycloheptatriene and tropylium complexes of transition metals. Reactions of organo metallic compounds- oxidative addition, reductive elimination, insertion and elimination. Applications of organo metallic compounds-Catalytic hydrogenation, Hydro formylation.

Unit-III:

Reaction mechanism of transition metal complexes: 9Hours

Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis - conjugate base (CB) mechanism. Direct and indirect evidences in favour of CB mechanism. Anation reactions. Reactions without metal-ligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Trans effect on substitution reactions in square planar complexes. Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus – Hush equation, inner sphere mechanism.

Unit-IV:

Term symbols and Electronic spectra: 9Hours

Term symbols and their derivation. Microstates, Hunds rules to predict ground terms and ground states. List of ground energy and higher energy terms from d1 to d9 configurations; Electronic spectra of transition metal complexes: Spectroscopic terms. Selection rules, Slator– Condon parameters, Racah parameters, Term separation energies for dn configurations. Correlation diagrams and Orgel diagrams. Tanabe- Sugano diagrams for d1 tod9 configurations. Calculations of Dq, B and β parameters. Charge transfer spectra.

Unit-V:

Bio-inorganic chemistry and Magnetic properties of complexes: 9Hours

Bio-inorganic chemistry: Storage and transport of dioxygen by Hemoglobin and Myoglobin, Chlorophyll, Vitamin B12 and its importance. Magnetic properties of transition metal complexes: Orbital and spin contribution, spin-orbit coupling and magnetic moments. Types of magnetism, factors affecting on Paramagnetism, Dia, ferro and Antimagnetism.

Suggested Co- Curricular Activities

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

List of Textbooks:

1) Inorganic Chemistry by Huheey. Harper and Row.
2) Concise inorganic chemistry by J.D. Lee ,ELBS.
3) Inorganic chemistry, K.F.Purcell and J.C.Kotz, Holt Saunders international
4) Organo metallic chemistry by R.C.Mehrotra and A.Singh.NewAge International.
5) Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern V.

Reference books:

1) Inorganic reaction mechanism by Basolo and Pearson, Wiley Eastern
2) Bioinorganic Chemistry by K.Hussan Reddy
3) Biological Aspects of inorganic chemistry by A.W. Addiso, W.R.Cullen, D.Dorphin and G.J.James. Weliey Interscience.
4) Photo chemistry of coordination compounds by V.Balzani and V. Carassiti. Academic Press.
5) Text book of Coordination chemistry by K.Soma Sekhara Rao and K.N.K.Vani, Kalyani Publishers.

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	NIL	NIL	NA
2	NIL	NIL	NA
3	NIL	NIL	NA
4	NIL	NIL	NA
5	NIL	NIL	NA

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Understanding the structure and reactivity of Nonmetal cages and metal clusters.
CO2	Apply the Knowledge of organometallic chemistry in various applications such as catalysis, materials science.
CO3	Understanding the fundamental principles and Reaction mechanism of transition metal complexes.
CO4	Understanding the role of inorganic elements in biological systems: This includes understanding the properties and functions of metal ions and other inorganic elements in biological systems, including Hemoglobin, Myoglobin, Chlorophyll, Vitamin B12.

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

Low =1 Moderate = 2 High = 3 No Correlation = 0

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

WEIGHTAGE TO THE COURSE CONTENT

Semester - VIII

Metal Cluster, Electronic spectra of Complex compounds and Bio- inorganic chemistry

Sl. No.	COURSE CONTENT	Long answer questions	Short answer questions	Total Marks
1	UNIT – I	2	2	30
2	UNIT-II	2	2	30
3	UNIT – III	1	1	15
4	UNIT – IV	1	2	20
5	UNIT – V	2	1	25
Total		8	8	120

P. R. GOVERNMENT COLLEGE, KAKINADA

MODEL PAPER FOR SEMESTER – VIII

Metal Cluster, Electronic spectra of Complex compounds and Bio- inorganic chemistry

Duration: 21/2 hrs. Max. Marks: 60

Section -I

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

PART- A

1. Write a short note on metalloboranes
2. Write the applications of organometallic compounds
3. Explain about oxidative addition
4. Explain about Outer sphere mechanism
5. What are the term symbols and give example.
6. Explain the charge transfer spectra
7. Write the importance of Vitamin- B_{12}
8. Write about the classification of LNCs and HNCs

Section- II

Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks

9. Explain the structure and bonding dinuclear compounds $(Re_2Cl_8)^{2-}$ and trinuclear (Re_3Cl_9)

(or)

Explain the types of magnetism and what factors influence on para, dia and ferro magnetism

10. Write Wade's and Lauher's rules with example

(or)

Explain the structure and bonding of Ferrocene

11. Write the factors effecting the substitution reactions in octahedral complexes

(or)

Explain the Orgel diagram with d^1- configuration

12. Explain the storage and transport of dioxygen by haemoglobin

(or)

Write about oxidative addition and reductive elimination of organo metallic componds

Course 21A: INORGANIC CHEMISTRY PRACTICALS –II

Learning Outcomes:

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

1) List out, identify and handle various equipment in Chemistry lab.

2) Learn the concepts and procedures of preparation of standard solutions, primary and secondary standards.

3) Demonstrate skills in Volumetric and gravimetric determinations.

4) Acquire skills in standardizing and determination of different metal ions.

5) Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria.

Practical Syllabus:

Quantitative analysis –
Volumetric:
1) Determination of Ferric iron by photochemicalreduction
2) Determination of Nickel by EDTA
3) Determination of Calcium and Magnesium in a mixture by EDTA
4) Determination of Ferrocyanide by Ceric sulphate
5) Determination of Copper(II) in presence of iron(III)

Gravimetric:
1) Determination of Zinc as Zinc pyrophosphate
2) Determination of Nickel from a mixture of Copper and Nickel.

Suggested Co-Curricular Activities

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

1) For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of determination of cations by volumetric and gravimetric determinations.
2) For Students: Student shall visit a related industry/ chemistry laboratory in universities/ research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand-written field work/project work report not exceeding10 pages in the given format to the teacher.
3) Max marks for Field work / project work Report:05.
4) Suggested Format for Fieldwork/project work: Title page, student details, index page,details of place visited, observations, findings, and acknowledgements.
5) Unit tests (IE).

Reference books:

1) Vogel's text book of quantitative chemical analysis, 5th edition by G.H. Jeffery et al.

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B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

	P R Govt College (A), Kakinada	Program & Semester			
Course Code 22-A	B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure **TITLE OF THE PAPER** *Modern Organic synthesis and Natural products*	IV B.Sc.- VIII Semester			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Basics in organic chemistry	60	10	30	4+1

Course Objectives:

- Reactive intermediates, Reactive Species and Protecting groups
- Addition Reactions
- Molecular Rearrangements
- Steroid hormones
- Flavonoids and Isoflavonoids

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

On Completion of the course, the students will be able to	
CO1	Understand various types of reaction intermediates and the bonding present in various organic compounds. They will be able to know how to protect various functional groups in organic synthesis.
CO2	Apply the Knowledge of addition reactions and molecular rearrangements in various organic reactions.
CO3	Inculcate knowledge on isolation, structure and synthesis of Steroid hormones.
CO4	The students will be able to gain knowledge on Flavonoids and Iso flavonoids.

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

Skill Development		Employability		Entrepreneurship	

Syllabus:

UNIT – I Reactive intermediates, Reactive Species and Protecting groups: 9 hours

Reactive intermediates : Generation, Structure, Stability, Detection and Reactivity of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Arynes. Reactive Species: Generation and reactivity of Electrophiles, Nucleophiles, Dienophiles, Ylids, Enophiles. Protecting groups: Protection of carbonyl, Hydroxyl, carboxylic acid and amine groups.

UNIT-II Addition Reactions 9 Hours

Addition to Carbon – Carbon Multiple Bonds: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration. Addition to Carbon - Hetero Multiple Bonds: Steric course of addition reactions to C=O and C=N, Knoevenagel, Claisen- Schmidt, Dieckman and Stobbe condensations, Wittig, Grignard, Mannich and Michael reaction.

UNIT-III

Molecular Rearrangements 9 Hours

Types of molecular rearrangements, migratory aptitude; Rearrangements to electron deficient carbon: Wagner-Meerwein, Dienone–Phenol, Arndt Eistert synthesis; Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Schmidt rearrangements; Rearrangements to electron deficient oxygen: Baeyer-villiger, Benzil-Benzilic acid and Favorskii rearrangements.

UNIT–IV:

Steroid harmones 9Hours

Nomenclature, basic skeleton, Diel's hydrocarbon and it's stereochemistry. Isolation, structure determination and synthesis of androsterone, testosterone, oestrone and progesterone.

UNIT–V: Flavonoids and Isoflavonoids: 9 Hours

Nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids.

Suggested Co- curricular activities

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

List of Text books:

1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by JerryMarch, Mc.GrawHill and Kogakush.
2) Organic Chemistry Vol.I(SixthEd)andVol.II(Fifth Ed.) by ILFinar ELBS.
3) Organic Chemistry (fifthEd) by Morrison and Boyd, PHI, India.
4) Organic Chemistry (fifthedition) by Francis A.Carey Tata Mc Graw Hill publishing Company Limited, New Delhi.
5) Chemistry of natural products by S.V.Bhat, B.A.Nagasampangi

Reference Books:

1) Reaction Mechanism in Organic Chemistry by Mukherjee Singh.
2) A guide book to mechanism in Organic Chemistry by Peter Sykes, ELBS.
3) Chemistry of Natural products by R.S.Kalsi, Kalyani Publishers.1983.

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Understand various types of reaction intermediates and the bonding present in various organic compounds. They will be able to know how to protect various functional groups in organic synthesis.
CO2	Apply the Knowledge of addition reactions and molecular rearrangements in various organic reactions.
CO3	Inculcate knowledge on isolation, structure and synthesis of Steroid harmones.
CO4	The students will be able to gain knowledge on Flavonoids and Iso flavonoids.

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

Low =1 Moderate = 2 High = 3 No Correlation = 0

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	NIL	NIL	NA
2	NIL	NIL	NA
3	NIL	NIL	NA
4	NIL	NIL	NA
5	NIL	NIL	NA

WEIGHTAGE TO THE COURSE CONTENT
Semester - VIII

Modern Organic synthesis and Natural products

Sl. No.	COURSE CONTENT	Long answer questions	Short answer questions	Total Marks
1	UNIT – I	1	2	20
2	UNIT-II	2	2	30
3	UNIT – III	1	2	20
4	UNIT – IV	2	1	25
5	UNIT – V	2	1	25
Total		8	8	120

P. R. GOVERNMENT COLLEGE, KAKINADA
MODEL PAPER FOR SEMESTER – VIII

Modern Organic synthesis and Natural products

Duration: 21/2 hrs. Max. Marks: 60

Section -I

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

1. Write about the stability of Carbocations
2. Write a short note on Nitrenes and Arynes
3. Explain hydroboration in alkenes
4. Explain Baeyer-Villiger reaction with mechanism
5. Explain Beckmann rearrangement
6. Write nomenclature and basic skeleton of steroid harmones
7. Explain biosynthesis of Flavanoids
8. Write about wittig reaction

Section- II

Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks

9. What is protecting group, explain how carbonyl and hydroxyl groups are protected.

(or)

Explain Chemo and Regio selectivity phenomenon in addition reactions with examples

10. Explain following with mechanisms

a) Dieckmann Condensation b) Mannich and Michael reaction

(or)

Explain a) Arndt-Eistert Synthesis b) Favorskii Rearrangement

11. Explain isolation, Structure determination of Androsterone

(or)

Discuss the structure elucidation and isolation of Quercetin

12. Explain isolation, Structure determination of Progesterone

(or)

Discuss the structure elucidation and isolation of Genstein

Course 22A: ORGANIC CHEMISTRY PRACTICALS –II

Learning Outcomes:

On successful completion of this practical course, student shall be able to:
1) List out, identify and handle various equipment in Chemistry lab.
2) Learn the concepts and procedures of handling chemical reagents appropriately.
3) Demonstrate skills to perform reflux, distillation, recrystallisation and vacuum filtration.
4) Calculate theoretical yield and percent yield.
5) Dispose chemicals in a safe and responsible manner.

Syllabus:

Preparation, recrystallization, and determination of melting point & yield of the following compounds:
1) Aspirin
2) Nerolin
3) Chalcone
4) p-Nitro acetanilide
5) 2,4,6- Tribromo aniline
6) m-Dinitrobenzene
7) Phthalimide
8) Diels-Alder adduct.

Suggested Co-Curricular Activities

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

1) For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of organic synthesis and recrystallization of the organic compound
2) For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project work report not exceeding10 pages in the given format to the teacher.
3) Max marks for Fieldwork /project work Report:05.
4) Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5) Unit tests (IE).

Reference Books:

1) Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th& 6th Ed. (Pearson Education Asia).
2) Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G.Smith, A.R. Tatchell, 5 Ed.(Longman Scientific &Technical)

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B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

	P R Govt College (A), Kakinada	Program & Semester			
Course Code *23-B*	B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure TITLE OF THE PAPER ***Analytical Methods of Analysis***	VI B.Sc.- VIII Semester			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	. Basics on instrumentation	60	10	30	4+1

Course Objectives:

- Qualitative and quantitative aspects of analysis
- Optical methods of analysis
- Thermal methods of analysis
- Electro analytical methods
- Separation techniques

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

On Completion of the course, the students will be able to	
CO1	Gain knowledge on Qualitative and quantitative aspects of analysis which helps to Perform experiment with accuracy and precision.
CO2	The students will be able to Understand basic principle of instrument like Flame Photometer, UV-vis spectrophotometer.
CO3	The students will be able to Ingrain knowledge on Thermal methods of analysis and Electro analytical methods.
CO4	Understanding the fundamental principles of Separation techniques and applying the Knowledge on Chromatographic applications.

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

Skill Development		Employability		Entrepreneurship	

Syllabus

Unit-I:

Qualitative and quantitative aspects of analysis: 9h

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression. Normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Unit-II:

Optical methods of analysis: 9 h

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection Rules. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Transmittance. Absorbance and Beer-Lambert law Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs). Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal, Techniques for the quantitative estimation of trace level of metal ions from water samples.

Unit-III:

Thermal methods of analysis: 9 h

Theory of thermogravimetry (TG) and basic principle of instrumentation of thermal analyser. Techniques for quantitative estimation of Ca and Mg from their mixture.

Unit-IV:

Electro analytical methods 9 h

Classification of electro-analytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

Unit-V:

Separation techniques 9 h

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by salvation and chelation, Technique of extraction: batch, continuous and counter current extractions, Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media. Chromatography: Classification, principle and efficiency of the technique, Mechanism of separation: adsorption, partition & ion-exchange.

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	NIL	NIL	NA
2	NIL	NIL	NA
3	NIL	NIL	NA
4	NIL	NIL	NA
5	NIL	NIL	NA

Co- Curricular Activities

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

List of Text books:

1. Willard, H.H.(1988),Instrumental Methods of Analysis, 7th Edition, Wardsworth Publishing Company.
2. Christian, G.D.(2004),Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.
3. Harris, D. C.(2007),Quantitative Chemical Analysis,6th Edition, Freeman.

Reference books:

1. Khopkar, S.M. (2008), Basic Concepts of Analytical Chemistry, New Age International Publisher.
2. Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005), Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd.

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Gain knowledge on Qualitative and quantitative aspects of analysis which helps to Perform experiment with accuracy and precision.
CO2	The students will be able to Understand basic principle of instrument like Flame Photometer, UV-vis spectrophotometer.
CO3	The students will be able to Ingrain knowledge on Thermal methods of analysis and Electro analytical methods.
CO4	Understanding the fundamental principles of Separation techniques and applying the Knowledge on Chromatographic applications.

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

Low =1 Moderate = 2 High = 3 No Correlation = 0

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

WEIGHTAGE TO THE COURSE CONTENT
Semester – VIII

Analytical Methods of Analysis

Sl. No.	COURSE CONTENT	Long answer questions	Short answer questions	Total Marks
1	UNIT – I	1	2	20
2	UNIT-II	1	2	20
3	UNIT – III	2	1	25
4	UNIT – IV	2	1	25
5	UNIT – V	2	2	30
Total		8	8	120

P. R. GOVERNMENT COLLEGE,
KAKINADA MODEL PAPER FOR
SEMESTER – VIII

Analytical Methods of Analysis

Duration: 21/2 hrs. Max. Marks: 60

Section -I

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

PART- A

1. Explain accuracy and precission
2. Write about confidence intervals
3. Explain single beam spectrophotometer
4. what is thermogravimetry.
5. Explain the techniques used for the determination of equivalence points
6. Explain Emission spectrophotometer
7. Define solvation and chelation
8. Write the classification of solvent extraction

Section- II

Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks

9. Define Beer – Lamberts law and explain its application

(or)

Explain basic principles of Atomic Absorption Spectrometry

10. Explain the principle and Instrumentation of Thermal Analyser

(or)

Explain the techniques for quantitative estimation of Ca and Mg in mixture

11. Explain the potentiometric titrations in detail

(or)

Explain all the possible conductometric titrations in detail

12. What is solvent extraction and explain batch and continuous extraction

(or)

Explain detailed process of counter current extraction

Course 23B: Analytical Methods of Analysis- Practical Syllabus

Learning Outcomes:

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

1. Separate ions using chromatography
2. Identify the ion by comparing Rf values with the literature
3. Analyze soil parameters
4. Verify Beer Lamberts law
5. Determine the carbonate and bicarbonate using pH

Practical Syllabus:

1. Separation of mixtures by paper chromatography and reporting the Rf values of Co^{2+} and Ni^{2+}.
2. Separation of mixtures by paper chromatography and reporting the Rf values of Amino acids present in the given mixture
3. To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+} DMG complex in chloroform, and determine its concentration by spectrophotometry
4. Analysis of soil: (i) Determination of p H of soil. (ii) Estimation of calcium and magnesium (iii) Qualitative detection of nitrate and phosphate
5. Verification of Lambert-Beer's law and determination of concentration of a coloured species ($CuSO_4$, $KMnO_4$)
6. Determination of carbonate- and bicarbonate in a mixture using pH-metry

Suggested Co-Curricular Activities

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

1. For Teacher: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of estimating the quality of soil.
2. For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes various measured parameters of soil analysis. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max. Marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.
5. Unit tests (IE).

Reference books:

1. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C.(1989),Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.

2. Analytical Chemistry by Gary D. Christian 6th Edition John Wiley &Sons Inc New York 1994.

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B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

	P R Govt College (A), Kakinada	Program & Semester			
Course Code 24-A	B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure TITLE OF THE PAPER VIII – SEMESTER Skill Enhancement courses **Pharmaceutical and Medicinal Chemistry**	VI B.Sc. (VIII Semester)			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	Basics on pharmaceutical chemistry	60	10	30	4+1

Course Objectives:

- Pharmaceutical chemistry
- Classification of Drugs
- Synthesis and therapeutic activity of the compounds
- Pharmacodynamics and Anesthetics Drugs
- HIV-AIDS

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

On Completion of the course, the students will be able to	
CO1	Understanding the basics of Pharmaceutical chemistry.
CO2	Apply the Knowledge of Classification of Drugs, Pharmacodynamics and Anesthetics Drugs.
CO3	Inculcate the knowledge on Synthesis and therapeutic activity of the compounds.
CO4	Obtain knowledge on HIV-AIDS and preventive measures.

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

Skill Development		Employability		Entrepreneurship	

Syllabus

Unit-I:

Pharmaceutical chemistry 9 hours

Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment), Metabolites and Anti metabolites. Nomenclature: Chemical name, Generic name and trade names with examples.

Unit-II:

Classification of Drugs 9 hours

Classification based on structures and therapeutic activity with one example each, Administration of drugs. Absorption of drugs - factors affecting absorption of drugs, routes of administration - local, enema, oral and external, parental routes - advantages and disadvantages.

Unit-III:

Synthesis and therapeutic activity of the compounds: 9hours

a.Chemo theraputic Drugs : l. Sulpha drugs (Sulpha methoxazole) 2.Antibiotics - βLactam Antibiotics, Macrolide Antibiotics, 3. Anti-malarial Drugs(chloroquine) b. Psychotherapeutic Drugs: 1.Anti pyrectics (Paracetamol) 2.Hypnotics, 3.Tranquilizers (Diazepam) 4.Levodopa

Unit-IV:

Pharmacodynamics and Anesthetics Drugs: 9hours

1) Antiasthma Drugs (Salbutamol) 2) Antianginals (Glyceryl trinitrate) 3) Diuretics (Furosemide) 4) Anesthetics - general - ether, chloroform, ethyl chloride, halothane, nitrousoxide, local -esters - cocaine, benzococaine.

Unit-V:

HIV-AIDS: 9 hours

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

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	NIL	NIL	NA
2	NIL	NIL	NA
3	NIL	NIL	NA
4	NIL	NIL	NA
5	NIL	NIL	NA

Suggested Co- Curricular Activities

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

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

List of Textbooks:

1) Synthetic Drugs by O.D.Tyagi & M.Yadav3.Medicinal Chemistry by Ashutoshkar 2) Medicinal Chemistry by P.Parimoo 3) Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D.Bhandenkar 4) Reference Books: 5) Medicinal Chemistry by Dr. B.V.Ramana 6) Synthetic Drugs by O.D.Tyagi & M.Yadav3.Medicinal Chemistry by Ashutoshkar 7) Medicinal Chemistry by P.Parimoo

Reference books:

1) Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D. Bhandenkar 2) Medicinal Chemistry by Kadametal P-I &P.II 3) European Pharmacopoeia.

Course 24A. Pharmaceutical and Medicinal Chemistry- Practical Syllabus
Skill Enhancement course

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Understanding the basics of Pharmaceutical chemistry.
CO2	Apply the Knowledge of Classification of Drugs, Pharmacodynamics and Anesthetics Drugs.
CO3	Inculcate the knowledge on Synthesis and therapeutic activity of the compounds.
CO4	Obtain knowledge on HIV-AIDS and preventive measures.

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

Low =1 Moderate = 2 High = 3 No Correlation = 0

PROGRAMME OUTCOMES

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

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

(PO2) Critical Thinking: Carry out experiments in the area of organic analysis, estimation,

derivative process, inorganic semi micro analysis, preparation, Kinetic, conductometric and potentiometric experiments and spectral analysis applying the domain of critical thinking.

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

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

(PO5) : Communication: Develop Skills to evaluate, analyze and interpret the chemical information and data and to communicate effectively within the chemical community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
(PO6): Life-long Learning: Demonstrate scholarly attitude to pursue a career in the field of chemical education and research and have the zeal and vision to engage in independent and life-long learning in the broadest context of technological and social change.

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

WEIGHTAGE TO THE COURSE CONTENT
Semester – VIII

Pharmaceutical and Medicinal Chemistry

Sl. No.	COURSE CONTENT	Long answer questions	Short answer questions	Total Marks
1	UNIT – I	2	1	25
2	UNIT-II	2	1	25
3	UNIT – III	2	2	30
4	UNIT – IV	1	2	20
5	UNIT – V	1	2	20
Total		8	8	120

Pithapur Rajah's Government College (A), Kakinada

Model Paper for Semester – VIII

Pharmaceutical and Medicinal Chemistry

Duration: 21/2 hrs. Max. Marks: 60

Section -I

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

1. Explain the terms Pharmacodynamics and Pharmacokinetics
2. Explain the absorption of drugs in ADME path way
3. Explain the therapeutic activity of tranquillizers
4. Explain the therapeutic activity of Levodopa
5. Explain the mode of action Chloroform
6. Explain the Adverse effects of Cocaine
7. Explain how to prevent the HIV AIDS
8. write the structures of Indinavir and Nelfinavir

Section- II

Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks

9. Explain metabolites and anti-metabolites with examples

(or)

Explain the ADME in pharmacokinetics

10. Explain the classification of drugs based on therapeutic activity

(or)

Explain various roots of Drug administration

11. Explain the synthesis and therapeutic activity of Chloroquin

(or)

Explain the synthesis and therapeutic activity of Paracetamol

12. Explain the synthesis and therapeutic activity of Salbutamol

(or)

What are CD_4 and CD_8 cells and explain their Importance in Immunity

Learning Outcomes:

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

1) Learn the procedure for the synthesis of drugs. 2) Synthesis of Drugs Assisted by Microwave Oven 3) Acquire skills in Drawing structure and Reaction using Chemdraw 4) Know the reactions and mechanisms involved in synthesis of Drugs.

Practical Syllabus:

1) Synthesis of Sulphanilamide 2) Synthesis of 7- Hydroxy -4- methyl coumarin 3) Synthesis of Chlorobutanol 4) Synthesis of Tolbutamide 07 5) Assay of Chlorpheniramine Maleate 6) Assay of Benzyl Penicillin 2 7) Synthesis of Aspirin Assisted by Microwave Oven 8) Drawing structure and Reaction using Chemdraw

Suggested Co-Curricular Activities

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

1) For Teacher: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of comprehensive product development programs to meet new product criteria and timing. Acquire skills in the preparation of drugs and pharmaceuticals, learn the procedure of synthesis of drugs with good yield.

2) For Students: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the preparation of Cosmeceuticals and Pharmaceutical. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in the given format to the teacher. 3) Max marks for Fieldwork/project work Report: 05. 4) Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements. 5) Unit tests (IE).

Reference books:

1) Wilson and Giswold's Organic medicinal and PharmaceuticalChemistry. 2) Foye's Principles of MedicinalChemistry. 3) Burger's Medicinal Chemistry, Vol I to IV. 4) Introduction to principles of drug design- Smith andWilliams. 5) Remington's Pharmaceutical Sciences. 6) Martindale's extra pharmacopoeia. 7) Organic Chemistry by I.L. Finar, Vol. II. 8) The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5. 9) Text book of practical organic chemistry- A.I.Vogel.

Reference books:

1) The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5. 2) Text book of practical organic chemistry- A.I.Vogel.s

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B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure

	P R Govt College (A), Kakinada	Program & Semester			
Course Code 25-B	B.Sc. HONOURS CHEMISTRY: MAJOR w.e.f AY 2023-24 Course structure TITLE OF THE PAPER VIII – SEMESTER *Skill Enhancement course* **Material & Energy Balances and Utilities in Chemical Industry**	VI B.Sc.- VIII Semester			
Teaching	Hours Allocated: 60 (Theory)	L	T	P	C
Pre-requisites	. Basics of units and dimensions	60	10	30	4+1

Course Objectives:

- Dimensions and units
- Material Balance without Chemical Reactions
- Energy Balance
- Utilities in Chemical Industry
- Fluid flow and Pumps Fluid flow

Course Outcomes:

The course outcomes of coordination chemistry typically include the following:

On Completion of the course, the students will be able to	
CO1	Acquire knowledge on Atomic weight, Molecular weight, Equivalent Weight and Ideal gas law.
CO2	The students will be able to Understanding the concept of Material Balance without Chemical Reactions.
CO3	Understanding the concept of Energy Balance and applying acquiring knowledge on its applications.
CO4	Obtain knowledge on Boilers, Fluid flow and Pumps Fluid flow

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

Skill Development		Employability		Entrepreneurship	

Syllabus

Unit-I: 9Hours

Dimensions and units: Basic Chemical Calculations -Atomic weight, molecular weight, equivalent weight, Mole, composition of (i) Liquid mixtures and (ii) gaseous mixtures. Ideal gas law, vapor pressure, Humidity and Saturation.

Unit-II: 9Hours

Material Balance without Chemical Reactions: Flow diagram for material balance, simple material balance with or without recycle or by-pass for chemical engineering operations such as distillation, absorption, crystallization, evaporation and extraction. Material Balance involving chemical reactions: concept of limiting reactant, conversion, yield, selectivity and liquid phase reaction, gas phase reaction with or without recycle or by pass

Unit-III: 9Hours

Energy Balance: Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes during phase transformation: Enthalpy of fusion, Enthalpy of vaporization, Enthalpy of condensation, Enthalpy of sublimation, Hess's law of constant, Heat Summation and its applications

Unit-IV : 9Hours

Utilities in Chemical Industry a) Boilers: Types of boilers and their functioning b) Water: Specifications of industrial use, various water treatments. c) Steam: Generation and use. d) Air: Specification of industrial use, processing of air

Unit-V: 9Hours

Fluid flow and Pumps Fluid flow: Fans, blowers, compressors, vacuum pump, ejectors. Pumps: Reciprocating pumps, Gear pumps, centrifugal pumps.

Unit No	Additions	Deletions	Remarks as per Blooms Taxonomy
1	NIL	NIL	NA
2	NIL	NIL	NA
3	NIL	NIL	NA
4	NIL	NIL	NA
5	NIL	NIL	NA

Suggested Co- Curricular Activities

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

List of Textbooks:

1. E.Stocchi:IndustrialChemistry,Vol-I,EllisHorwoodLtd.UK
2. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, NewDelhi.
3. P.C.Jain,M.Jain:Engineering Chemistry, Dhanpat Rai &Sons, Delhi.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut

Reference books:

1. B.I. Bhatt and S.M. Vora: Stoichiometry, Tata McGraw-Hill publishing Company Ltd, New Delhi.
2. E.Stocchi:IndustrialChemistry,Vol-I,EllisHorwoodLtd.UK
3. R. M. Felder, R. W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
4. J.A.Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, NewDelhi.
5. P.C.Jain, M.Jain: Engineering Chemistry, DhanpatRai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi.
7. B.K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut
8. S.C. Bhatia: Chemical Process Industries, Vol.I & II, CBS Publishers, New Delhi.
9. W. L. McCabe and J. C.Smith: Unit Operations in Chemical Engineering, Mc-Graw HillBook Company, NewYork.
10. O. P. Vermani, A. K. Narula: Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.

CO-PO Mapping:

On Completion of the course, the students will be able to	
CO1	Acquire knowledge on Atomic weight, Molecular weight, Equivalent Weight and Ideal gas law.
CO2	The students will be able to Understanding the concept of Material Balance without Chemical Reactions.
CO3	Understanding the concept of Energy Balance and applying acquiring knowledge on its applications.
CO4	Obtain knowledge on Boilers, Fluid flow and Pumps Fluid flow

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

Low =1 Moderate = 2 High = 3 No Correlation = 0

PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSO's)

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

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

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

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

WEIGHTAGE TO THE COURSE CONTENT

Semester - VIII

Material & Energy Balances and Utilities in Chemical Industry

Sl. No.	COURSE CONTENT	Long answer questions	Short answer questions	Total Marks
1	UNIT – I	1	2	20
2	UNIT-II	2	1	25
3	UNIT – III	2	2	30
4	UNIT – IV	2	1	25
5	UNIT – V	1	2	20
Total		8	8	120

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Model Paper for Semester – VIII

Material & Energy Balances and Utilities in Chemical Industry

Duration: 21/2 hrs. Max. Marks: 60

Section -I

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

1. Write about ideal gas law
2. Explain the concept of limiting reactant
3. Define enthalpy of fusion and enthalpy of vapourisation
4. Write the specifications of water in industrial use
5. Write about the classification of pumps
6. Explain the mole concept
7. Write about the classification of fans
8. Define enthalpy of sublimation with example

Section- II

Answer all questions. Each question carries TEN marks 4 X 10 = 40 Marks

9. Explain the distinction between Atomic weight, Molecular weight and Equivalent Weight

(or)

Write about liquid and gas phase reactions with example

10. Write about distillation and crystallization processess

(or)

Explain the heat capacities of gases and gaseous mixtures.

11. Explain Hess law of summation of heat constant and its applications

(or)

Explain the types of boilers and their functions

12. Explain about the compressors and blowers.

(or)

Write about steam generation, its applications

Course 25B: Material & Energy Balances and Utilities in Chemical Industry

Practical Syllabus Skill Enhancement course

Learning Outcomes:

On successful completion of this practical course, student shall be able to:
1.Carry out the Quantitative analysis of calcium in lime stone.
2.Determine the hardness of given water sample usingEDTA.
3.DetermineCODand BOD of a given water sample.
4.Find out the Percentage of available chlorine present in the bleaching powder.

Practical Syllabus:

1. Quantitative analysis of calcium in limestone by complexometric titration.
2. Hardness of water by EDTA titration.
3. Determination of Chemical Oxygen Demand(COD)
4. Determination of Biological Oxygen Demand(BOD)
5. Percentage of available chlorine in bleaching powder

Suggested Co-Curricular Activities

a). Mandatory:
1. For Teacher: Training of students by the teacher in laboratory and field for not lessthan15 hours on the field techniques/skills of detection of N, S and halogens using thegreen procedure, preparation of TLC plates, detection of organic compounds using Rf values in TLC/paper chromatography, loading of column, selection of solvent system for column chromatography, separation of amino acids and dye mixture using chromatographic techniques.

2. For Students: Student shall visit a related industry/ chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reactions. Write their observations and submit a hand written fieldwork/project workreportnotexceeding10 pages in the given format to the teacher.
a. Max marks for Field work/projectworkReport:05.
b. Suggested Format for Fieldwork/project work: Title page, student details, index page,details of place visited, observations, findings and acknowledgements.
c. Unit tests(IE)

Reference books:

1. 4.J.A.Kent:Riegel'sHandbookofIndustrialChemistry,CBSPublishers,NewDelhi.
2. 5.P.C.Jain,M.Jain:EngineeringChemistry,DhanpatRai&Sons,Delhi.
3. 6.R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, NewDelhi.
4. 7.B.K.Sharma:EngineeringChemistry,GoelPublishingHouse,Meerut 5. 8.S.C.Bhatia: Chemical Process Industries, Vol.I &II, CBS Publishers, New Delhi.

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