St. FRANCIS COLLEGE FOR WOMEN, BEGUMPETHYDERABAD-500016

(An Autonomous College Affiliated to Osmania University)

DEPARTMENT OF CHEMISTRY

THEORY SYLLABUS CBCS-2026

SEMESTER – I

Paper Title: Analytical Chemistry-I

Programme: M.Sc. Organic Chemistry **Course Code: P26/CHE/DSC/104/L** **Type of course: DSC – 4**	**Max. Hours: 60** **Hours per week: 4** **Max. Marks: 100** **No. of credits: 4**
Module 1: **Techniques of chromatography**	
Module 2: **NMR Spectroscopy –I**	
Module 3: **Vibrational spectroscopy**	
Module 4: **Electronic Spectroscopy**	

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SEMESTER - I

ANALYTICAL CHEMISTRY-I

THEORY

1. Course Description

Programme: M.Sc. Organic Chemistry
Course Code: P26/CHE/DSC/104/L
Course Type: DSC-4
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course objectives:

1. The objective is to learn principles and applications of various Chromatographic techniques
2. Nuclear Magnetic Resonance spectroscopy is a powerful and theoretically complex analytical tool, to develop the understanding of number, positions, intensities and splitting of signals.
3. Infrared spectroscopy, an analytical technique that takes advantage of the vibrational transitions of a molecule for identifying functional groups of organic compounds.
4. UV-Vis spectroscopy is used in analytical chemistry for quantitative determination of different analytes such as transition metal ions and conjugated organic compounds.

3. Course outcomes:

CO1: Understands the significance and applications of various chromatographic techniques in chemical analysis. Explains the principles underlying different chromatographic separation methods.
CO2: Comprehends the magnetic properties of atomic nuclei and their relevance in spectroscopy. Describes the fundamental concepts of nuclear magnetic behavior in analytical studies.
CO3: Interprets IR spectra for functional group identification and structural analysis. Differentiates between IR and Raman spectroscopy in structural elucidation,
CO4: Identifies different types of electronic transitions in organic molecules. Acquires foundational knowledge of electronic spin spectroscopy and its applications.

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4.Course Content:

Module 1: Techniques of Chromatography (15 hrs)

i. Introduction, Classification of chromatographic techniques, differential migration rates, partition ratio, retention time, relation between partition ratio and retention time, capacity factor, selectivity factor. Efficiency of separation- resolution, diffusion, plate theory and rate theory.
ii. **GC:** Principle, instrumentation, detectors- TCD, FID, ECD. Derivatisation techniques, PTGC. GC Analysis of hydrocarbons in a mixture.

iii.HPLC: Principle, instrumentation, detectors- UV detectors, Photodiode array detector, fluorescence detector.HPLC assay of paracetamol in tablets.

Module 2: NMR Spectroscopy-I (^{1}H nmr) (15 hrs)

^{1}H NMR spectroscopy: Magnetic properties of nuclei, Principles of NMR Instrumentation, CW and pulsed FT instrumentation, equivalent and non equivalent protons, enantiotopic and diastereotopic protons, Chemical shifts, factors affecting the chemical shifts, electronegativity and anisotropy, shielding and deshielding effects, Signal integration, Spin-spin coupling: vicinal, germinal and long range, Coupling constants and factors affecting coupling constants. Chemically and magnetically equivalent protons.
Applications of 1H NMR spectroscopy: Reaction mechanisms (cyclic bromonium ion, electrophilic and nucleophilic substitutions, carbocations and carbanions), E, Z isomers, conformation of cyclohexane and decalins, keto-enol tautomerism, hydrogen bonding, proton exchange processes (alcohols, amines and carboxylic acids), C-N rotation. Magnetic resonance imaging (MRI). 1H NMR of organic molecules Ethylbenzoate, 2-butanone and 2-chloropropionic acid) and metal complexes, [HNi(OPEt3)4]+, [HRh(CN)5] (Rh I=1/2).

Module 3: Vibrational Spectroscopy (15 hrs)

Interaction of electromagnetic radiation with matter Factors affecting width and intensity of spectral lines
Rotational (Microwave) Spectroscopy: Classification of molecules based on moment of inertia. Diatomic molecule as rigid rotator and its rotational energy levels. Selection rules (derivation not required), Isotope effect on rotational spectra. Brief description of microwave spectrometer.
Vibrational Spectroscopy: Vibrational energy levels of diatomic molecules, selection rules (derivation not required). Calculation of force constant from vibrational frequency, Anharmonic nature of vibrations. Fundamental bands, overtones and hot bands, Fermi resonance, Vibration-rotation spectra diatomic molecules. Vibrations of poly atomic molecules. Normal modes of

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vibration, concept of group frequencies, Characteristics of vibrational frequencies of functional groups; Stereochemical effects on the absorption pattern in carbonyl group, cis-trans isomerism and hydrogen bonding.

Raman Spectroscopy: Quantum theory of Raman Effect, Vibrational Raman spectra, Stokes and anti- Stokes lines. Complementary nature of IR and Raman spectra

IKS: Introduction to traditional medicine; role of spices used in Indian foods for prevention and treatment of Viral Infections

Module 4: Electronic Spectroscopy (15 hrs)

Overview on terminology and types of transitions, Electronic spectra: Elementary energy levels of molecules, Selection rules for electronic spectra, Woodward-Fieser rules for chromophores: Conjugated dienes, trienes, unsaturated carbonyl compounds, benzene, and its derivatives, poly nuclear aromatic hydrocarbons, calculation of λmax Solvent and structural influences on absorption maxima, stereo chemical factors. Cis-trans isomers, and cross conjugation Quantitative applications of electronic spectroscopy, dissociation constant of a weak acid, Charge transfer spectra.

5.Reference Books:

1. Fundamentals of Molecular Spectroscopy, Banwell and McCash.
2. Introduction to Molecular Spectroscopy, G.M. Barrow.
3. Absorption Spectroscopy of Organic Compounds, J.R. Dyer.
4. Biochemistry: Hames and Hooper.
5. Introduction to Spectroscopy, Pavia Lampman Kriz.
6. Pharmaceutical analysis, Watson
7. NMR in Chemistry- A multinuclear introduction, William Kemp.
8. Organic Spectroscopy, William Kemp.
9. Spectroscopy of organic compounds, P.S. Kalsi.
10. Structural methods n Inorganic chemistry, E.A.V Ebsworth.
11. Organic Spectroscopy, LDS Yadav
12. Organic Spectroscopy, Y.R. Sharma
13. Molecular Spectroscopy – Arhuldas
14. Vibrational spectroscopy – D.N. Satyanarayana

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6.Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
LOCAL	The variety of analytical techniques such as chromatographic, spectroscopic, electrophoretic, and electrochemical and their corresponding methods that have been applied in the analysis of pharmaceuticals.
NATIONAL	These chapters summarize various spectroscopic techniques that have been used in industry to determine the quality of foodstuffs, drugs and pesticides
GLOBAL	Spectroscopic techniques are now being used as part of machine vision systems in many areas, including agriculture for crop health diagnosis and the food industry to identify product freshness and help with product sorting.

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module 1	HPLC and GC, has many applications throughout the chemical industry
EMP (NSQF Level 4,5,6 & 7)	Module 2	This technique can simultaneously characterize the chemical as well as structural composition and is thus well suited for industrial R&D and process monitoring applications.
ED	Module 3	Spectroscopies such as infra-red spectroscopy can provide crucial information on the quality of starting materials and products.
SD	Module 4	Develop hands-on skills in recording and analyzing UV–Visible spectra. Enhance analytical abilities by applying the Beer–Lambert law for quantitative determination and interpretation of spectroscopic data.

c. IKS components

IKS	Syllabus Content	Module
IKS	Introduction to traditional medicine; role of spices used in Indian foods for prevention and treatment of Viral Infections	3

d. Aligned with SDG 3 (Good Health and well-being) and SDG 4 (Quality Education).

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7.Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Problem Solving	Case studies
2.	Participative Learning	Presentation
3.	Experiential Learning	Field Trips
4.	Peer teaching	Students prepare mini-lessons for classmates on assigned topics.

8.Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Maximum Marks: 20M		**Maximum Marks: 20M**	
CIA 1 **Subjective**	**CIA 1** **Subjective**	**CIA 2** **Skill Based Test: 10M**	**CIA 2** **Assignment: 10M**
Section A: 1x10=10M Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	**Section A: 1x10=10M** Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	Discretion of the faculty	Discretion of the faculty

External QP Pattern		
4 Credits 4 Modules (CORE)	SECTION A - Internal Choice	**4 Q X 10 M = 40M**
	SECTION B – Answer any 5 out of 8 (To compulsorily have ONE question from each module)	**5 Q X 4 M = 20M**

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c) Aligning COs with Continuous Internal Assessments

Cos	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Presentation, Quiz	
CO4	CIA-2 Assignment	

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b. Question Paper Pattern

St. Francis College for Women, Begumpet

Faculty of Science – Department of Chemistry

ABSTRACT MODEL PAPER

END SEMESTER EXAM

Paper Title -Analytical Chemistry -I

TIME: $2^{1/2}$ hrs **Course Code:**P26/CHE/DSC/104/L

MAX. MARKS: 60

SECTION –A (Essay Questions)

I. Answer the following **4x 10= 40 Marks**

1.

OR

2

3.

OR

4

5.

OR

6

7.

OR

8

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SECTION –B (Short Answer Questions)

II. Answer any four. **4x5=20 Marks**

9.
10.
11.
12.
13.
14.
15.
16.

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Model Question Paper - End Semester Exam

ANALYTICAL SEMESTER –I

PAPER-4 MODEL THEORY

QUESTION PAPER

Course Code: P26/CHE/DSC/104/L
Credits: 4

Max Marks:60
Max Hours:2½hrs

I. Answer the following (Essay Questions) 4x10 = 40M

1.(a) Write the basic functioning of HPLC system? (CO1) **(Level 2)**
(b) Explain the principle of gas chromatographic technique? (CO1) **(Level 2)**

OR

2. (a) What is resolution? Explain the Plate and Rate theory in Chromatography. **(CO1) (Level I)**
(b) Write a brief note on GC Analysis of hydrocarbons in a mixture? **(CO1) (Level 2)**

3. (a)What is a chemical shift? Explain factors that influence chemical shift with suitable examples. **(CO2) (Level 2)**
(b)With the help of an example explain how NMR spectroscopy can be used to study C-N rotation. **(CO2) (Level 2)**

OR

4.(a)Write about the anisotropic effect of alkenes and alkynes. **(CO2) (Level 2)**
(b) What is spin-spin coupling? Explain germinal, vicinal and long range couplings with suitable examples. **(CO2) (Level II)**

5. (a) Explain complementary nature of IR and Raman spectra. **(CO3) (Level 2)**
(b) Describe the isotopic effects on rotational spectra? **(CO3) (Level 2)**

OR

6. (a) Explain the following i) Fundamental bands ii) Overtones iii) Hot bands (CO3) **(Level 2)**
(b) How do you distinguish the inter and intra molecular hydrogen bonding by IR spectra **(CO3) (Level 2)**

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7. (a) Explain the Woodward Fieser rules? **(CO4) (Level I)**
   (b) Write the selection rules in electronic absorption spectroscopy? **(CO4) (Level I)**

OR

8. What a note on the following
   (a) Beers law of absorption to mixture analysis? **(CO4) (Level 2)**
   (b) Write the polar and non-polar solvent effect in electronic absorption spectra? **(CO4) (Level 2)**

SECTION –B (Short Answer Questions)

II Answer any Five **5 x 4 = 20M**

9. Describe a photodiode detector used in HPLC. **(CO1) (Level II)**

10. Write the different methods of gas chromatographic technique. **(CO1) (Level I)**

11. How is PMR useful in the study of reaction mechanism involving carbocation? **(CO2) (Level 2)**

12. Explain enantiotopic and diastereotopic protons using suitable examples. **(CO2) (Level 2)**

13. What are stokes and antistokes in Raman spectroscopy **(CO3) (Level 2)**

14. How do you distinguish Cis-trans isomers by IR spectroscopy? **(CO3) (Level 2)**

15. Write a short note on cross conjugation **(CO4) (Level I)**

16. Explain different types of electronic transitions in molecules. **(CO4) (Level 2)**

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Faculty of Science – Department of Chemistry
MODEL PAPER
M.Sc. I YEAR SEMESTER -I
ANALYTICAL CHEMISTRY - I

Time: $2^{1/2}$ hrs **Course Code: P26/CHE/DSC/104/L**

Max. Marks: 60

SECTION A - INTERNAL CHOICE			**4 Q X 10M = 40 M**	
Question Number	**Module**	**Question**	**CO**	**BTL**
1	**Module 1**	(a) Write the basic functioning of HPLC system? (b) Explain the principle of gas chromatographic technique? **OR**	**CO1**	**Level-2**
2	**Module 1**	(a) What is resolution? Explain the Plate and Rate theory in Chromatography. (b) Write a brief note on GC Analysis of hydrocarbons in a mixture?	**CO1**	**Level-1& 2**
3	**Module 2**	(a)What is a chemical shift? Explain factors that Influence chemical shift with suitable examples. (b)With the help of an example explain how NMR spectroscopy can be used to study C-N rotation. **OR**	**CO2**	**Level 2**
4	**Module 2**	(a)Write about the anisotropic effect of alkenes and alkynes. (b) What is spin-spin coupling? Explain germinal, vicinal and long-range couplings with suitable examples.	**CO2**	**Level 2**
5	**Module 3**	a) Explain complementary nature of IR and Raman spectra. (b) Describe the isotopic effects on rotational spectra? **OR**	**CO3**	**Level 2**

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6	**Module 3**	(a) Explain complementary nature of IR and Raman spectra. (b) Describe the isotopic effects on rotational spectra?	**CO3**	**Level 2**
7	**Module 4**	(a) Explain the Woodward Fieser rules? (b) Write the selection rules in electronic absorption spectroscopy? **OR**	**CO4**	**Level 1**
8	**Module 4**	What a note on the following (a) Beers law of absorption to mixture analysis? (b) Write the polar and non-polar solvent effect in electronic absorption spectra?	**CO4**	**Level 2**
SECTION B - ANSWER ANY 5 OUT OF 8 **5Q X 4 M = 20 M** (To compulsorily have Two questions from **each** module)				
9	**Module 1**	Describe a photodiode detector used in HPLC	**. CO1**	**Level 2**
10	**Module 1**	Write the different methods of gas chromatographic technique. **(CO1) (Level I)**	**. CO1**	**Level 1**
11	**Module 2**	How is PMR useful in the study of reaction mechanism involving carbocation?	**. CO2**	**Level 2**
12	**Module 2**	Explain enantiotopic and diastereotopic protons using suitable examples.	**. CO2**	**Level 2**
13	**Module 3**	What are stokes and antistokes in Raman spectroscopy	**. CO3**	**Level 2**
14	**Module 3**	How do you distinguish Cis-trans isomers by IR spectroscopy?	**. CO3**	**Level 2**

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15	**Module 4**	Write a short note on cross conjugation	**. CO4**	**Level I**
16	**Module 4**	Explain different types of electronic transitions in molecules.	**. CO4**	**Level 2**

4. **Question Paper Blueprint**

Modules	**Hours Allotted in the Syllabus**	**COs Addressed**	**Section A (No. of Questions)**	**Total Marks**	**Section B (No. of Questions)**	**Total Marks**
1	15	1	2	10	2	**5X4=20**
2	15	2	2	10	2	
3	15	3	2	10	2	
4	15	4	2	10	2	

4. CO-PO Mapping

CO	**PO**	**Cognitive Level**	**Class room sessions(hrs)**
1	1	Understanding	15Hrs
2	2	Application	15Hrs
3	3	Understanding	15Hrs
4	2	Application	15Hrs

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Lab course 4 **Analytical Chemistry** **4 hrs/week**

CHEMISTRY LAB: DSC- 4 **LAB: ANALYTICAL CHEMISTRY**

Program: M.Sc.
Course: DSC-4
Semester: I

Subject Code P26/CHE/DSC/104/P
No. of Hrs. allotted: 4 Hrs / week
No. of Credits 2

COURSE OBJECTIVES:

CO1: To develop skills in estimating different ions using titration techniques like complexometry, iodometry, and dichrometry.

CO2 :To gain practical knowledge of Thin Layer Chromatography (TLC) for the separation and identification of compounds.

CO3: To study and determine the physical properties of solutions through experimental method

COURSE OUTCOMES:

CO1: Estimation of ions by complexometry, iodometry, Dichrometry

CO2 : Acquire the practical knowledge on TLC.

CO3: Determination of Physical Properties of Solutions

Lab Course 4

1. Applied analysis:

1. Estimation of acetic acid in commercial vinegar by acid base titration method
2. Estimation of iron in cement by dichrometry
3. Estimation of available chlorine in bleaching powder by Iodometry
4. Estimation of magnesium in talcum powder by complexometry
5. Estimation of calcium in calcium tablets by complexometry
6. Estimation of alkali content in antacid by acid base titration method
7. Estimation of available oxygen in hydrogen peroxide by permanganometry
8. Determination of hardness of water by complexometry
9. Estimation of ascorbic acid in vitamin C by iodometry.
10. Estimation of calcium in milk by complexometry

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II. Thin layer chromatography

11. Determination of purity of the compounds
12. Monitoring the progress of chemical reactions for any of the two preparations

III. Determination of Physical Properties of Solutions:

13. Determination of molecular weight of a polymer by viscometry
14. Determination of critical solution temperature of phenol-water system
15. Effect of added electrolyte on the CST of phenol-water system

Reference Books

1. Advanced practical chemistry, R.Mukhopadhyay& P. Chatterjee, NCBA books (2016)
2. Advanced practical inorganic chemistry, Gurdeep Raj, GOEL publishing house (2015)
3. Advanced experimental Inorganic chemistry, Ayodhya Singh, Campus books Int. (2006)
4. Senior Practical Physical Chemistry: B.D. Khosla, V.C. Garg and A. Khosla
5. Advanced Practical Physical Chemistry, J.B. Yadav

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ANALYTICAL CHEMISTRY
PRACTICAL MODEL PAPER

Course Code: P26/CHE/DSC/104/P
Credits: 2

Max Time:3 Hrs
Max marks :50 marks

1. Write the principle involved in Thin layer chromatography **(CO2) (10 M)**

2 . a) Estimation of available chlorine in bleaching powder by lodometry. **(CO3) (25 M)**

OR

b) Estimation of calcium in calcium tablets by complexometry **(CO1)**

3. Record and Attendance (5 M)

4. Viva (CO1, CO2, CO3 & CO4) (10 M)

Prepared by	Checked &Verified by	Approved by
Name and Signature of the teaching faculty	**Name and Signature of HoD**	**Name and Signature of Principal**
Dr.K.Susmitha,	Head Department of Chemistry St. Francis College for Women Begumpet, Hyderbad-16. **Dr.Sarita Aduri**	**Prof. Uma Joseph**
Dr.Sabiha Fatima		

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Faculty of Science – Department of Chemistry
THEORY SYLLABUS CBCS-2026
SEMESTER –I
Paper Title: Computer Aided Drug Design

Programme: M.Sc.	**Max. Hours: 30**
Course Code: P26/CHE/GE/101	**Hours per week: 2**
Type of course: Generic Elective	**Max. Marks: 50**
No. of credits: 2	
Module 1: Drug–Receptor Interactions and Computational Approaches in Drug Discovery	
Module 2: Study of Molecular docking tools	

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SEMESTER –I

Computer Aided Drug Design
THEORY

1. Course Description

Programme: M.Sc. **Max. Hours: 30**

Course Code: P26/CHE/GE/101 **Hours per week:2**

Type of course: Generic Elective **Max. Marks: 50**

No. of credits: 2

2. Course objectives

1. The basic concepts of molecular docking and drug–receptor interactions.
2. The structure and function of active sites and allosteric binding sites.
3. Understand the principles of structure-based, ligand-based, and de novo drug design.
4. Understand the procedure for protein and ligand preparation for docking studies.
5. To develop the ability to prepare proteins and ligands, identify active sites, set grid parameters, perform docking using PyRx and ClusPro, and analyze molecular interactions using Discovery Studio Visualizer.

3. Course outcomes

CO1: Explain the basic principles of molecular docking and drug–receptor interactions and describe active sites, allosteric binding sites, and the role of grids in docking studies.

CO2: Demonstrate the ability to prepare protein and ligand structures, define the active site and grid parameters, perform docking using PyRx and ClusPro, and analyze protein–ligand interactions using Discovery Studio Visualizer.

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4. Course Content

Module 1: Drug–Receptor Interactions and Computational Approaches in Drug Discovery

15 hrs

Introduction, active site, allosteric binding site, use of grids in docking , rigid docking, flexible docking and induced fit docking of ligands. Basic principles and difference between structure and ligand based drug design, denovo drug design and utility to optimize the lead structure.

Module 2: Study of Molecular docking tools **15 hrs**

Protein Preparation, Ligand Preparation, Identification of active site, Setting grid center and dimensions, PyRx and ClusPro docking and Discovery Studio Visualizer

5. Reference books

1. Burger's Medicinal Chemistry and Drug Discovery: Principles and Practices. Vol.1.
2. Medicinal Chemistry by G. Patricks.
3.Text book of Drug Design and Discovery, Edited by Povl Krogsgaard – Larsen Tomm Liljefors.
4. Structure Based Drug Design of Crizotinib (PF-02341066), a Potent and Selective Dual Inhibitor of Mesenchymal–Epithelial Transition Factor (c-MET) Kinase and Anaplastic Lymphoma Kinase (ALK) Martin P. Edwards, J. Med. Chem., 2011, 54 (18), pp 6342- 6363.

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
GLOBAL	• Used in discovery of drugs for: Cancer, HIV/AIDS, Tuberculosis, COVID-19, neurodegenerative diseases • Accelerates vaccine and antiviral development. • Enables precision medicine (target-specific therapy).

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module No. 1	Computational modeling and molecular docking skills, ability to handle protein structural data (PDB files) and Data analysis and interpretation of binding affinity and molecular interactions
EMP	Module No. 2	Pharmaceutical and biotechnology industries, CADD Analyst, Computational Chemist, Drug Discovery Scientist, Research Associate (Molecular Modeling), and Bioinformatics Executive

c) IKS components

IKS	Syllabus Content	Module
IKS	The concepts of protein–ligand interactions and molecular docking	I

d. Aligned with SDG 3 (Good Health and Well-Being) and SDG 4 (Quality Education)

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Problem Solving	Case studies
2.	Peer teaching	Students work in small groups to discuss topics

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8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Maximum Marks: 20M	
CIA 1 **Subjective**	**CIA 2** **Assignment: 10M**
Section A: 2x5=10M Essay question: Answer any 2 out of 3	Discretion of the faculty

External QP Pattern		
2 Credits 2 Modules (CORE)	Open choice answers any 6 out of 8	**6 Q X 5 M = 30M**

b. Aligning COs with Continuous Internal Assessments

CO	**Continuous Internal Assessments CIA – 40%**	**End Semester Examination-60%**
CO1	CIA-1 - Written Exam	Written Exam
CO2	CIA -2 - Practical	

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c. Question Paper Pattern:

St. Francis College for Women, Begumpet
Faculty of Science – Department of Chemistry
ABSTRACT MODEL PAPER
END SEMESTER EXAM

Paper Title: Computer Aided Drug Design **TIME: 1 Hr**
Course Code:P26/CHE/DSC/101 **MAX. MARKS: 30**

SECTION –A (Essay Questions)

I. Answer any six of the following **6x 5=30 Marks**

1.
2.
3.
4.
5.
6.
7.
8.

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Model Question Paper - End Semester Exam

Computer Aided Drug Design
MODEL QUESTION PAPER

Course Code: P26/CHE/GE/101 **Max Marks:30**
Credits: - 2 **Max Hours:1Hr**

SECTION-A

I Answer any six from the following Questions 6x5= 30M

1. Write a note on active site, allosteric binding site (CO1) (Level-1)
2. Explain various types of docking processes. (CO1) (Level-2)
3. Differentiate between structure and ligand-based drug design (CO1) (Level-2)
4. What is denovo drug design. (CO1) (Level-1)
5. Write a note on Structure based drug design (CO1) (Level-1)
6. Explain the role of grid in docking process. (CO1) (Level-2)
7. Write steps involved in protein preparation. (CO2) (Level-2)
8. Name the tools used in active site of protein. (CO2) (Level-2)

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SECTION A - Answer any six questions			6 x 5 = 30M	
Question Number	**Module**	**Question**	**CO**	**BTL**
1	**Module 1**	Write a note on active site, allosteric binding site.	**CO 1**	**Level 1**
2	**Module 1**	Explain various types of docking processes.	**CO 1**	**Level 2**
3	**Module 1**	Differentiate between structure and ligand-based drug design	**CO 1**	**Level 1**
4	**Module 1**	What is denovo drug design.	**CO 1**	**Level I**
5	**Module 1**	Write a note on Structure based drug design	**CO 1**	**Level I**
6	**Module 1**	Explain the role of grid in docking process.	**CO 1**	**Level 2**
7	**Module 2**	Write steps involved in protein preparation.	**CO 2**	**Level 2**
8	**Module 2**	Name the tools used in active site of protein.	**CO 2**	**Level 2**

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d. Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	No. of Questions	Total Marks	Total Marks
1	15	1	6	20	6x5=30
2	15	2	2	10	

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions (Hrs)
1	2	Understand	15
2	1	Apply	15

Prepared by Course Teacher [Name & Signature]	Checked &Verified by HoD/ Programme Coordinator [Name &Signature]	Approved by the Principal
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(Autonomous & affiliated to Osmania University)

Faculty of Science – Department of Chemistry

THEORY SYLLABUS CBCS-2026

SEMESTER –I

Paper Title: Inorganic Chemistry-I

Programme: M.Sc. **Course Code: P26/CHE/DSC/101/L** **Type of course: DSC – 1**	**Max. Hours: 60** **Hours per week: 4** **Max. Marks: 100** **No. of credits: 4**
Module 1: Symmetry of Molecules	
Module 2: Bonding in Metal Complexes-I	
Module 3: Coordination equilibria	
Module 4: Ligational aspects of diatomic molecules	

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SEMESTER –I
INORGANIC CHEMISTRY-I
THEORY

1. Course Description

Programme: M.Sc.
Course Code: P26/CHE/DSC/101
Type of course: DSC – 1
No. of credits: 4

Max. hours: 60
Hours per week:4
Max. marks: 100

2. Course objectives:

1. Determine the Symmetry operations of any small and medium-sized molecule and apply point group theory to the study of optical and magnetic properties and selection rules for absorption.
2. Identify the principles, structure and reactivity of selected coordination complexes, Interpret their electronic spectra and magnetic properties.
3. To understand the stability of coordination complexes by the instrumental techniques.
4. To understand the nature of bonding between the metal and ligand. To study the structure and stereochemistry of metal carbonyl clusters.

3. Course Outcome:

CO1: Discuss the concept of Symmetry elements, Symmetry operation and point groups

CO2: Discuss the postulates of Crystal Field Theory, and Application of Crystal Field theory to calculate magnetic moment & crystal field stabilization energy of Metal complexes.

CO3: Experimental methods to determine the Stability Constants of Metal Complexes

CO4: Discuss bonding modes of CO, NO, 18-electron rule, different bond lengths & frequencies of CO, NO. Explain different nitrogen complexes & how chemical fixation of dinitrogen takes place.

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4. Course Content

Module 1 - Symmetry of Molecules **(15 hrs)**

Concept of Symmetry in Chemistry – Symmetry Operations – Symmetry Elements: Rotational Axis of Symmetry and Types of Rotational Axes, Plane of Symmetry and types of Planes, Improper Rotational Axis of Symmetry, Inversion Center and Identity Element – More about Symmetry Elements – Molecular Point Groups: Definition and Notation of Point Groups, Classification Molecules in to C1, Cs, Ci, Cn,Cnv, Cnh, C∞v, Dn, Dnh, Dnd, D∞h, Sn (n=even), Td, Oh, Ih, Kh,C_{60}(Fullerenes) Groups. Descent in Symmetry with Substitution – Exercises in Molecular Point Groups – Symmetry and Dipole moment – Symmetry criteria for Optical activity.

Module 2 – Bonding in Metal Complexes **(15hrs)**

Crystal Field Theory: Salient features of CFT. d-orbital splitting patterns in regular Octahedral, tetragonally distorted octahedral, Jahn-Tellar theorem, trigonal bipyramidal, trigonal planar, Pentagonal bipyramidal, and linear geometries. Concept of weak field and strong fields. - Calculation of crystal field stabilization energies (CFSE's) in six and four coordinate complexes. Types of magnetic behaviour – magnetic susceptibility – calculation of magnetic moment from magnetic susceptibility spin only formula, - Quenching of orbital angular momentum – Determination of magnetic moment from Guoy's method. Applications of magnetic moment data for the determination of oxidation states, bond type and stereochemistry. Spin crossover: High spin, low spin cross over phenomenon in [Fe $(Ophen)_2(NCS)_2$] and [$Fe(R_2NCS_2)_3$]. Spinel's. Limitations of Crystal field Theory, Adjusted CFT (Ligand field theory). Experimental Evidence for Metal covalency. Thermodynamic aspects of CFT

Module 3 -Coordination Equilibria **(15 hrs)**

Solvation of metal ions- Metal complex formation in Solution-Binary metal complexes. Stability constants (types and relationships between them). – Factors influencing the stability constants:

Metal ion effects (charge/size, IP, crystal field effect, John-Teller effect, Pearson theory of hard and soft acids and bases (HSAB), electronegativity and hardness and softness, symbiosis. (ii) Ligand effects (Basicity, Substituent effect, Steric, chelate (size and number of chelate rings), Macrocyclic and Cryptate effects- crown ethers, crypton, size match selectivity or concept of hole size, limitations, Macrocycles with pendent groups– Methods used for the determination of Stability constants (Basic Principles only): pH metric, Spectrophotometric and Polarographic methods. Ternary Metal Complexes – definition –

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Formation of ternary metal complexes – Step- wise and simultaneous equilibria with simple examples.

Module 4 -Ligational Aspects of Diatomic Molecules **(15 hrs)**

Metal Carbonyls: - Carbon monoxide as a ligand – Molecular orbitals of CO - Donor and Acceptor molecular orbitals of CO; Bonding modes of CO- Terminal and Bridging; Evidence for multiple bonding from Bond lengths and Stretching frequencies; 18 Valence electron rule and its application.

Metal Nitrosyls: - NO as a ligand – Molecular orbitals of NO – Donor and Acceptor components; Bonding modes of NO – Terminal (Linear, Bent) and Bridging; Structural aspects of $[IrCl(PPh_3)_2(CO)(NO)]^+$ and $[RuCl(PPh_3)_2(NO)_2]$. Stereo chemical control of valence in $[Co\ (diars)_2(NO)]^{2+}$ and $[Co(diars)_2(NO)(SCN)]^+$.

Metal Dinitrogen complexes: - N_2 as aligand – Molecular orbitals of N_2; Bonding modes – Terminal and Bridging; Stretching frequencies; Structures of Ru (II) and Os (II) dinitrogen complexes; Chemical fixation of dinitrogen.

5. References Books:

1. Mark, Ladd. (2000). Symmetry and Group theory in Chemistry. London:Marwood Publishers.
2. Carter, R. L. (1998). Molecular Symmetry and Group Theory. John Wiley & Son.
3. Veera Reddy, K. (1999). Symmetry and Spectroscopy of Molecules. New Age International (P) Limited.
4. Cotton, F.A., Wilkinson., Murillo, C.A.,and Bochmann,M.(1999). Advanced Inorganic Chemistry (6th ed).N.Y.Wiley Interscience.
5. Huheey,J.E., KeiterK.A., and Keiter, R.L.(1993).Inorganic Chemistry(4th ed.). Harper Cottens College Publications.
6. Brian, N. F., and Michael, A.H.Ligand Field Theory and Its Applications (Special Topics in Inorganic Chemistry).Wiley-VCH.
7. Taqui Khan,M. M., and Martell,A.E. (1974). Homogeneous Catalysis by Metal complexes. (VolI). NY: Academic Press.
8. Purcell, K.F., and Kotz, J.C. (1977). Inorganic Chemistry. London: Holt-Saunders International Editions.
9. Greenwood., and Earn Shaw, A.E. (1997). Chemistry of the elementals (2nd ed.). Butterworth Heinemann.
10. Tobe, M.L., and John Burgess. (1999). Inorganic Mechanisms. Addison Wesley Longman.

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11. Veera Reddy, Metal ions in Reaction Mechanisms. Golgotia Publications (P) Ltd.
12. Henderson. A.(1993).Mechanisms of Reactions in Transition Metal Sites. London: Oxford Science Publications.

Text Books:

1. Veera Reddy, K. (1999). Symmetry and Spectroscopy of Molecules. New Age International (P) Limited.
2. Cotton, F.A., and Wilkinson. (2009). Advanced Inorganic chemistry (6thed.). John Wiley & sons.
3. Puri, Sharma and Khalia. Selected topics in Inorganic Chemistry.
4. Huheey, J.E., Keiter, E.A. (2000). Inorganic Chemistry-Principles of Structureand Reactivity(4thed.). Pearson Education Asia Pvt. Ltd.
5. Shriver, D.F., Atkins, P.W.,and Langford, C.H. (1999). Inorganic Chemistry (3rd ed.). Oxford, UK: ELBS Oxford University Press.
6. Lee, J.D. (2009). Concise Inorganic Chemistry(5thed.). Chapman & hall. Hong.
7. Hussain Reddy, K. (2007). Bioinorganic Chemistry. New Age International Publishers.

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1. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global	People use concepts of Symmetry like rotations, Reflections Translations and Tessellations (Tiling of geometric shapes without any gaps) as part of their career
Global	Coordination compounds have specific colours. Therefore, they find an important place in industries to impart intense colorations to Fabrics
Regional	Understand the basics of stability constants of Metal complexes to design synthesis of metal complexes
Global	Underpins advancements in catalysis, fertilizer production, environmental monitoring, green energy technologies, and biomedical research, thereby contributing to sustainable industrial growth and environmental protection.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module -1	Models of different geometries prepared by students
ED	Module -II	Synthesis of Metal complexes which are used in Medicine as Therapeutic Agents
EMP (NSQF Level 4,5,6 & 7)	Module III	Transition Metals like Copper, Iron used in biological processes from electron transfer to catalysis
SD/EMP	Module - IV	builds strong theoretical foundations essential for research, higher studies, and professional roles in chemistry.

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7.Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Preparation of Models -Art Project
2.	Participative Learning	Seminar
3.	Problem Solving	Research projects
4.	Peer teaching	Students prepare mini-lessons for classmates on assigned topics.

Continuous Internal Assessment

Max. marks: 20 M		Max. marks: 20 M	
CIA - 1	**CIA - 2**	**Skill Based Test - 1(10M)**	**Skill Based Test -2 (10M)**
Section A: 1X10=10M Essay question (Module 1) 2 questions given. Answer ONE **Section B: 2X5=10M** Short questions (Module 2) 3 questions given. Answer TWO	**Section A: 1X10=10M** Essay question (Module 3) 2 questions given. Answer ONE **Section B: 2X5=10M** Short questions (Module 4) 3 questions given. Answer TWO	Discretion of the faculty	Discretion of the faculty
Average of two IA's will be considered			

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Course Assessment Plan

Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA – 40%	End Semester Examination-60%
CO1	CIA-1 - Written exam	Written Exam
CO2	CIA -1- Written exam	
CO3	CIA-2- Seminar /Google form	
CO4	CIA-2- - Quiz	

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Faculty of Science – Department of Chemistry

ABSTRACT MODEL PAPER

END SEMESTER EXAM

Paper Title -Inorganic Chemistry -I

Time: 2½hrs **Course Code:** P26/CHE/DSC/101/L

Max. marks: 60

SECTION –A (Essay Questions)

I. Answer the following **4x 10=40 Marks**

1.

OR

2

3.

OR

4

5.

OR

6

7.

OR

8

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SECTION –B (Short Answer Questions)

II. Answer any five **5 X 4 =20 Marks**

9.

10.

11.

12.

13.

14.

15.

16.

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SEMESTER –I
INORGANIC CHEMISTRY
PAPER-1 MODEL THEORY
QUESTION PAPER

Course Code: P26/CHE/DSC/101/L **Max Marks:**60

Credits: - 4 **Max Hours:**2½hrs

SECTION-A

I Answer the following Questions **4x10= 40M**

1. (a) Define Plane of Symmetry. Explain the types of Symmetry planes with suitable examples (CO1) Level 2

   (b) Explain the Improper Axis of Symmetry on BF3 (CO1) Level 2

OR

2. (a) Explain the classification of Molecules into Point groups (CO1) Level 2

   (b) Explain the Descent in symmetry in ML6 octahedral molecule with Substitution. (CO1) Level 2

3. (a) Discuss the consequences of Jahn-Teller distortion with any two examples. (CO2) Level 2

   (b) Calculate the crystal field splitting energy in i) $[Fe(CN)6]^{4-}$ and ii) $[Ni(H2O)6]^{2+}$ (CO2) Level 5

OR

4. (a) Explain Guoy's methods for the determination of magnetic moment values. (CO2) Level 2

   (b) Quenching of orbital angular momentum and magnetic moment values. (CO2) Level 2

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5. (a) Explain the Polarographic method for the determination of stability constants. (CO3) Level 2

(b) Write a short note on Macrocyclic and Cryptate effects (CO3) Level1

OR

6. (a) Discuss the following i) HSAB principle ii) Irving-William's order. (CO3) Level 2

(b) Explain the Spectrophotometric method of determination of Stability Constant of Metal complexes.(CO3) Level 2

7. (a) Explain bonding in metal carbonyl Complexes. (CO4) Level 1

(b) Discuss the linear and bent configurations in metal Nitrosyls with examples. (CO4) Level 2

OR

8. (a) Discuss the chemical fixation of Dinitrogen. (CO4) Level 2

(b) Explain how stretching frequency data is useful in bonding in metal carbonyls and metal Dinitrogen complexes. (CO4) Level 3

SECTION-B

II. Answer any FIVE **5 X 4 =20 M**

9. Explain the difference between Principal axis and Secondary axes with an example. (CO1) Level 2
10. Determine the Point group of Ferrocene (staggered) listing all symmetry elements. (CO1) Level 3
11. Draw the crystal field splitting diagram in Square Planar Complexes. (CO2) Level 4
12. Write a short note on Spin Cross Over. (CO2) Level 1
13. Explain Thermodynamic and concentration stability constants (CO3) Level 2
14. Discuss the Applications of HSAB principle (CO3) Level 2
15. What is the 18-electron rule? Explain the concept in Trinuclear and Tetranuclear metal Carbonyls (CO4) Level 2
16. Discuss the structural features of bridging metal Nitrosyls with Examples. (CO4) Level 3

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Faculty of Science – Department of Chemistry
MODEL PAPER
M.Sc. I YEAR SEMESTER -I
INORGANIC CHEMISTRY - I

Time: 2½hrs **Course Code: P26/CHE/DSC/101/L**

Max. Marks: 60

SECTION A - INTERNAL CHOICE				**4 X 10 = 40 M**
Question Number	**Module**	**Question**	**CO**	**BTL**
1	**I**	(a) Define Plane of Symmetry. Explain the types of Symmetry planes with suitable examples. (b) Explain the Improper Axis of Symmetry on BF3. **OR**	**CO1**	**Level 2**
2	**I**	(a) Explain the classification of Molecules into Point groups. (b) Explain the Descent in symmetry in ML6 octahedral molecule with Substitution.	**CO1**	**Level 2**
3	**II**	(a) Discuss the consequences of Jahn-Teller distortion with any two examples. (b) Calculate the crystal field splitting energy in i) $[Fe(CN)6]^{4-}$ and ii) $[Ni(H2O)6]^{2+}$ **OR**	**CO2**	**Level 2 & 5**
4	**II**	(a) Explain Guoy's methods for the determination of magnetic moment values (b) Quenching of orbital angular momentum and magnetic moment	**CO2**	**Level 2**

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		values.		
5	III	(a) Explain the Polarographic method for the determination of stability constants. (b) Write a short note on Macrocyclic and Cryptate effects **OR**	CO3	Level 1&2
6	III	(a) Discuss the following i) HSAB principle ii) Irving-William's order (b) Explain the Spectrophotometric method of determination of Stability Constant of Metal complexes.	CO3	Level 2
7	IV	(a) Explain bonding in metal carbonyl Complexes. (b) Discuss the linear and bent configurations in metal Nitrosyls with examples. **OR**	CO4	Level 1& 2
8	IV	(a) Discuss the chemical fixation of Dinitrogen. (b) Explain how stretching frequency data is useful in bonding in metal carbonyls and metal Dinitrogen complexes.	CO4	Level 2 & 3
SECTION B - Short answer questions **ANSWER ANY 5 OUT OF 8**				**5 x 4 = 20M**
9	I	Explain the difference between Principal axis and Secondary axes with an example.	CO1	Level 2
10	II	Determine the Point group of Ferrocene (staggered) listing all symmetry elements.	CO1	Level 3

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11	II	Draw the crystal field splitting diagram in Square Planar Complexes.	CO2	Level 4
12	III	Write a short note on Spin Cross Over.	CO2	Level 1
13	III	Explain Thermodynamic and concentration stability constants.	CO3	Level 2
14	IV	Discuss the Applications of HSAB principle	CO3	Level 2
15	V	What is the 18 electron rule? Explain the concept in Trinuclear and Tetranuclear metal Carbonyls.	CO4	Level 2
16	VI	Discuss the structural features of bridging metal Nitrosyls with Examples.	CO4	Level 3

a. Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Mark	Section B (No. of Questions)	Total Marks
1	15	1	2	10	2	5 X 4 =20
2	15	2	2	10	2	
3	15	3	2	10	2	
4	15	4	2	10	2	

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5. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions(hrs)
1	2	Applying	15Hrs
2	3	Understanding	15Hrs
3	3	Understanding	15Hrs
4	1	Understanding	15Hrs

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SEMESTER-I PRACTICALS

CHEMISTRY LAB: DSC- I **LAB: INORGANIC CHEMISTRY**

Program: M.Sc.
Course: DSC-1
Semester: I

Subject Code P26/CHE/DSC/101/P
No. of Hrs. allotted: 4 Hrs / week
No. of Credits : 2

COURSE OUTCOMES:

CO1: Understand the importance of Inorganic qualitative analysis especially complexometric and Redox titrations and its use in research and industry.
CO2: Learn the simple procedures to synthesize complexes. Gravimetric analysis is one of the most accurate and precise methods of macro quantitative analysis

Lab course 1 **Inorganic Chemistry** **4 hrs/week**

I. EDTA back-titrations:
(i) Estimation of Ni2+
(ii) Estimation of Al3+

II. EDTA substitution titrations:
Estimation of Ca2+

III. Redox Titrations
(i) Estimation of Ferrocyanide and Ferricyanide in a mixture

IV. Preparation of complexes:
(i). Hexaammine nickel (II) chloride
(ii). Tris (acetylacetanato) manganese
(iii). Tris (ethylenediamine) nickel (II) thiosulphate
(iv). Mercury tetrathiocyanato cobaltate (II)
(v). Chloro pentaammine cobalt (III) chloride
(vi). Tetrammine copper (II) sulphate and estimation of NH3 and calculation of % purity
(vii) One component gravimetric estimation
(i) Estimation of Zn2+
(ii) Estimation of Ba2+ (as BaSO4)

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Suggested Books: (For both semesters).

1. (i). Text book of Quantitative Inorganic Analysis by A.I. Vogel, 3rd edition, ELBS 1969.
(ii). Vogel's text book of Quantitative Inorganic analysis. Jeffery et al, 4th edition, ELBS 1988.
(iii). Vogel's text book of Quantitative Inorganic Analysis. 6th edition, Pearson education ltd 2002.
2. Practical Inorganic chemistry By G.Marr and R.W.Rockett 1972.
3. Experimental Inorganic/Physical Chemistry – An Investigative integrated approach to Practical Project work. By Mounir A. Malati, 1999.
4. Advanced experimental Inorganic chemistry by. Ayodhya Singh.
5. Practical Inorganic Chemistry by G. Pass & H. Sutchiffe, 2nd edn John Wiley & sons.

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INORGANIC CHEMISTRY
PRACTICAL MODEL PAPER

Course Code : P26/CHE/DSC/101/P **Max Time:3hrs**
Credits: 2 **Max marks :50 marks**

Answer all questions

1. Explain the principle and procedure for the Synthesis of the metal complex (CO2) 10 M
OR
2. Explain the Principle in the Estimation of metal ions (Barium / Zinc) by Gravimetric Analysis (CO2)
3. Estimate the amount of metal ions in a given solution by a systematic procedure of Complexometric / Redox Titration) 25 M. (CO1)
4. Record and Attendance 5 M
5. Viva Voce 10 M

Prepared by	Checked &Verified by	Approved by
Name and Signature of the teaching faculty	Name and Signature of HoD	Name and Signature of Principal
Dr Y. Lakshmi Madhuri	Dr Saritha Aduri	Prof. Uma Joseph

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Faculty of Science – Department of Chemistry
THEORY SYLLABUS CBCS-2026
SEMESTER –I
Paper Title: Organic Chemistry -I

Programme: M.Sc.	**Max. Hours: 60**
Course Code: P26/CHE/DSC/102/L	**Hours per week: 4**
Type of course: DSC – 2	**Max. Marks: 100**
No. of credits: 4	
Module 1: Stereochemistry	
Module 2: Reaction Mechanism-I	
Module 3: Reaction Mechanism-II	
Module 4: Conformational analysis (Acyclic systems)	

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SEMESTER –I

ORGANIC CHEMISTRY-I

THEORY

1. Course Description

Programme: M.Sc.

Course Code: P26/CHE/DSC/102/L

Type of course: DSC – 1

No. of credits: 4

Max. Hours: 60

Hours per week:4

Max. Marks: 100

2. Course objectives

1. To learn various concepts of stereochemistry by applying symmetry operations.
2. Appreciation of the relative stabilities and reactivities of the reactive intermediate. Understand the mechanisms involved in Additions and Elimination reactions.
3. The aim of the reaction mechanism is to provide students with the tools to describe and work out reaction mechanisms of different chemical reactions and recognize neighboring group participation.
4. Deals with different types of strains, energy and stability of different conformers.

3. Course outcomes

CO1: Explain the criteria for chirality and discuss axial, planar and helical Chirality

CO2: Discuss the generation, structure and reactivity of reactive intermediates and methods of determination of reaction mechanism.

CO3: Explain Neighboring group participation in aliphatic Electrophilic substitution. Discuss Ambident nucleophiles, non-classical carbocation & SET mechanism.

CO4: Discuss the conformations in saturated and unsaturated acyclic compounds and the factors affecting the stability and reactivity of conformations.

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4. Course Content

Module 1: Stereochemistry **15 hrs**

Molecular representations: Wedge, Fischer, Newman and Saw-horse formulae, their description and interconversions.

Molecular Symmetry & Chirality: Symmetry operations and symmetry elements (Cn & Sn). Criteria for Chirality. Desymmetrization.

Optical Isomerism, optical activity, specific rotation, concept of chirality, Enantiomers and Diatereomers.

Axial, planar and helical chirality: Axially chiral allenes, spiranes, alkylidene cycloalkanes, chiral biaryls, atropisomerism, planar chiral ansa compounds and trans- cyclooctene, helically chiral compounds and their configurational nomenclature

Determination of configuration in E, Z-isomers: Spectral and Chemical methods of configuration determination of E, Z isomers. Determination of configuration in aldoximes and ketoximes.

IKS: Wedge, Fischer, Newman and Saw-horse formulae, their description and interconversions.

Module 2: Reaction mechanism-I **15 hrs**

Reactive Intermediates: Generation, detection, structure, stability and reactions of carbenes, nitrenes and free radicals.
Electrophilic addition to carbon carbon double bond: Stereoselective addition to carbon carbon double bond; anti addition- Bromination and epoxidation followed by ring opening. Syn addition of OsO_4 and $KMnO_4$.

Elimination reactions Elimination reactions E2, E1, E1CB mechanisms. Orientation and stereoselectivity in E2 eliminations. Pyrolytic syn elimination and α-elimination.

Determination of reaction mechanism: Determination of reaction mechanism: Energy profiles of addition and elimination reactions, transition states, product isolation and structure of intermediates, use of isotopes, chemical trapping and crossover experiments.

Module 3: Reaction mechanism-II **15 hrs**
Nucleophilic Aromatic substitution: Aromatic Nucleophilic substitution: SN1(Ar), SN2(Ar), and benzyne mechanisms; evidence for the structure of benzyne. VonRichter rearrangement. Definition and types of ambident nucleophiles.
Neighbouring group participation: Criteria for determining the participation of neighbouring group. Enhanced reaction rates, retention of configuration, isotopic labeling and cyclic intermediates. Neighbouring group participation involving Halogens, Oxygen, Sulphur, Nitrogen, Aryl, Cycloalkyl groups, σ and π-bonds. Introduction to nonclassical carbocations.

Electrophilic substitution at saturated carbon and single electron transfer reactions. Mechanism of aliphatic electrophilic substitution. SE1, SE2, and SEi, & SET mechanism.

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Module 4: Conformational analysis (acyclic systems) **15 hrs**

Conformational isomerism: Introduction to the concept of dynamic stereochemistry. Conformational diastereoisomers and conformational enantiomers. Study of conformations in 1,2-disubstituted ethane derivatives like dihalobutanes, halohydrin, ethylene glycol, butane-2, 3-diol amino alcohols and 1,1,2,2-tetrahalobutanes. Klyne-Prelog terminology for conformers and torsion angles

Conformations of unsaturated acyclic compounds: Propylene, Acetaldehyde and Butanone.

Factors affecting the conformational stability and conformational equilibrium:

Attractive and repulsive interactions. Use of Physical and Spectral methods in conformational analysis.

Conformational effects on the stability and reactivity of acyclic diastereoisomers: Steric

and stereo electronic factors-examples. Conformation and reactivity. The Curtin – Hammett principle

5. Reference books

1. Stereochemistry of carbon compounds by Ernest L.Eliel and Samuel H.Wilen
2. Stereochemistry of organic compounds-Principles and Applications by D. Nasipuri
3. Stereochemistry by V M Potapov
4. Stereochemistry, conformation and mechanism P S Kalsi
5. The third dimension in Organic Chemistry, by Alan Bassindale
6. Advanced Organic Chemistry by Jerry March
7. Mechanism and Structure in Organic Chemistry S. Mukerjee

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6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
LOCAL	Stereochemistry is a unique science concerned with the study of how molecules are affected by the way their atoms are arranged in space. It is also known as 3D chemistry.
REGIONAL	A chemical mechanism is a theoretical conjecture that tries to describe in detail what takes place at each stage of an overall chemical reaction.
NATIONAL	Conformational analysis is the study of the energetics between different rotamers and is useful for understanding the stability of different isomers by taking into account the spatial orientation and through-space interactions of substituents.
GLOBAL	Stereochemistry has become a significant issue for both of the pharmaceutical industry and the regulatory authorities

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module No. 1	Invite entrepreneurs, professionals, or researchers who apply stereochemistry to share their experiences and insights
ED	Module No.2	Developing new reaction mechanisms that offer advantages over traditional methods. This could involve improved selectivity, higher yields, or reduced environmental impact.
ED	Module No.3	A fully detailed mechanism would correlate the original structure of the reactants with the final structure of the products.
EMP (NSQF Level 4,5,6 & 7)	Module No. 4	Supporting drug design and pharmaceutical research Enabling computational chemistry careers Improving polymer and materials development Strengthening R&D and academic opportunities

c) IKS components

IKS	Syllabus Content	Module
IKS	Wedge, Fischer, Newman and Saw-horse formulae, their description and interconversions.	I

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d). Aligned with SDG 4 (Quality Education).

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Problem Solving	Case studies
2.	Experiential Learning	Field Trips
3.	Participative Learning	Presentation
4.	Peer teaching	Students work in small groups to discuss topics

8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Maximum Marks: 20M		**Maximum Marks: 20M**	
CIA 1 **Subjective**	**CIA 1** **Subjective**	**CIA 2** **Skill Based Test: 10M**	**CIA 2** **Assignment: 10M**
Section A: 1x10=10M Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	**Section A: 1x10=10M** Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	Discretion of the faculty	Discretion of the faculty

External QP Pattern		
4 Credits 4 Modules (CORE)	SECTION A - Internal Choice	**4 Q X 10 M = 40M**
	SECTION B – Answer any 5 out of 8 (To compulsorily have ONE question from each module)	**5 Q X 4 M = 20M**

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b) Aligning COs with Continuous Internal Assessments

Cos	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 Presentation	
CO4	CIA-2 Assignment	

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c. Question Paper Pattern:

Organic Chemistry-I

Model Question Paper – Theory

Subject Code: P26 /CHE/DSC/202/L

Time: 2½ h **Max marks: 60**

Section – A

Answer all questions **(4X10=40 M)**

1. (a).
   (b).

(or)

2. (a).
   (b)

3. (a).
   (b).

(or)

4. (a).
   (b).

5. (a).
   (b).

(or)

6. (a).
   (b).

7. (a).
   (b).

(or)

8. (a).
   (b).

Section - B

Answer any 5 of the following questions **(5X4 =20 M)**

9.
10.
11.
12.
13.
14.
15.
16.

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SEMESTER –I
ORGANIC CHEMISTRY
PAPER-1 MODEL THEORY
QUESTION PAPER

Course Code: P26/CHE/DSC/102/L **Max Marks:60**
Credits: - 4 **Max Hours:2½hrs**

SECTION-A

I Answer the following Questions **4x10= 40M**

1. a) Explain about the four symmetry elements with one example each. **(CO1) (Level 1)**

b) Describe axial chirality in allenes. **(CO1) (Level 2)**

OR

2, a) How do you determine the configuration of aldoximes and ketoximes? **(CO1) (Level 2)**

b) Write a note on Optical Isomerism. Define Enantiomers and Diastereomers give one example each. **(CO1) (Level 2)**

3. a) Give a short note on Chemical trapping. . **(CO2) (Level 1)**

b) Explain orientation in elimination reactions **(CO2) (Level 1)**

OR

4.a) How Crossover experiments are used in determining the reaction mechanisms **(CO2) (Level 1)**

b) Explain the stereochemistry involved in E2 Eliminations **(CO2)(Level 2)**

5. a) Explain NGP involving Halogens **(CO3) (Level 2)**

b) Write the $SNAr_2$ addition -elimination reaction with mechanism **(CO3) (Level 2)**

OR

6. a. Describe geometry and generation methods of carbene **(CO3) (Level 2)**

b. Explain Benzyne Mechanism **(CO3) (Level 2)**

7. Write a note on how physical and spectral methods are useful in conformational analysis **(CO4) (Level 2)**

OR

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8. a) Write about Klyne Prelog terminology? Illustrate with examples **(CO4) (Level 1)**

b) Outline the preferred conformations of ethylene chlorohydrin, and Acetaldehyde **(CO4) (Level 2)**

SECTION-B

II. Answer any FIVE **5x4=20**

9. Give a short note on ANSA compounds**(CO1) (Level 1)**

10. Explain any three spectral methods used to distinguish cis and Trans isomers. **(CO1) (Level 2)**

11. 1Illustrate about syn addition with one example. **(CO2) (Level 1)**

12. Explain about E1CB elimination reactions **(CO2) (Level 2)**

13. Write the mechanism involved in Von Rotcher reaction **(CO3) (Level 1)**

14. Explain the SET mechanism **(CO3) (Level 1)**

15. Explain Curtin Hammet principle. Explain with a suitable example. **(CO4) (Level 1)**

16. Explain the conformational analysis of ethylene glycol **(CO3) (Level 1)**

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Faculty of Science – Department of Chemistry
THEORY SYLLABUS CBCS-2026
SEMESTER –I
Paper Title: Organic Chemistry -I

SECTION A - INTERNAL CHOICE			**4Q X 10 M = 40M**	
Question Number	**Module**	**Question**	**CO**	**BTL**
1	Module 1	a) Explain about the four symmetry elements with one example each. b) Describe axial chirality in allenes.	CO 1	Level II Level I
2	Module 1	a) How do you determine the configuration of aldoximes and ketoximes? b) Write a note on Optical Isomerism. Define Enantiomers and Diastereomers give one example each.	CO 1	Level I Level II
3	Module 2	a) Give a short note on Chemical trapping. b) Explain orientation in elimination reactions	CO 2	Level I Level II
4	Module 2	a) How Crossover experiments are used in determining the reaction mechanisms b) Explain the stereochemistry involved in E2 Eliminations	CO 2	Level I Level II

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5	Module 3	a) Explain NGP involving Halogens b) Write the $SNAr_2$ addition - elimination reaction with mechanism	CO 3	Level II
6	Module 3	a) Describe geometry and generation methods of carbene b) Explain Benzyne Mechanism	CO 3	Level II Level II
7	Module 4	Write a note on how physical and spectral methods are useful in conformational analysis	CO 4	Level II
8	Module 4	a) Write about Klyne Prelog terminology? Illustrate with examples. b) Outline the preferred conformations of ethylene chlorohydrin, and Acetaldehyde		Level II Level II

SECTION B - ANSWER ANY 5 OUT OF 8 **5 Q X 4 M = 20 M**
(To compulsorily have Two question from each module)

9	Module 1	Give a short note on ANSA compounds	CO 1	Level I
10	Module 1	Explain any three spectral methods used to distinguish cis and Trans isomers.	CO 1	Level II
11	Module 2	Illustrate about syn and anti-addition with one example each.	CO2	Level II
12	Module 2	Explain about E1CB elimination reactions	CO 2	Level II
13	Module 3	Write the mechanism involved in Von Rotcher reaction	CO 3	Level II

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14	Module 3	Explain the SET mechanism	CO3	Level II
15	Module 4	Explain Curtin Hammett principle. Explain with a suitable example.	CO4	Level II
16	Module 4	Explain the conformational analysis of Tetra halo butanes	CO4	Level II

d. Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	10	2	4
2	15	CO-2	2	10	2	4
3	15	CO-3	2	10	2	4
4	15	CO - 4	2	10	2	4

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions(hrs)
1	1	Understanding	15
2	5	Evaluating	15
3	6	Create	15
4	5	Evaluating	15

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ORGANIC CHEMISTRY PRACTICAL

1. Course Description:

Program: M.Sc.
Course: DSC-2
Semester: I

Subject Code P26/CHE/DSC/102/P
No. of Hrs. allotted: 4 Hrs / week
No. of Credits : 2

Course Objectives

Organic synthesis courses focus on designing efficient routes to complex molecules through strategic bond formation and functional group transformations.

Course Outcomes

CO1: Understand the importance of organic compound synthesis and its use in research and industry. Understand the procedures for the different steps for the organic compound synthesis

CO2: Understand the mechanisms for the synthesis of organic compounds in different steps.

Understand the recrystallisation of organic compound in variousssteps for the organic compound synthesis.

Lab Course 2

Organic Chemistry **4 hours/ week**

Synthesis of the following compounds: Tetrahydrocarbazole, 7-hydroxy-4-methyl coumarin, m-dinitrobenzene, m-nitroaniline, hippuric acid, azlactone, anthracene-maleic anhydride adduct, Phthalimide, 2,4-dihydroxyacetophenone. 2,3 Diphenyl quinoxalines, Benzimidazoles.

References

1. Text book of practical organic chemistry, Vogel
2. Text book of practical organic chemistry, Mann and Saunders.
3. Spectral identification of organic compounds Bassler, Silverstein 5th Edition

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MODEL PRACTICAL QUESTION PAPER
ORGANIC CHEMISTRY-I

Course Code: P26/CHE/DSC/102/P

Max. Marks: 50 **Time: 3 hrs**

Q1. Write the principle involved in the synthesis of given organic compound. **(CO1, CO2)10M**

Q2. Synthesise the given organic compound and perform recrystallisation.**25M (CO1, CO2)**

Q3. Record + Attendance **5M**

Q4. Viva **10M**

Prepared by Course Teacher [Name &Signature]	Checked &Verified by HoD/ Programme Coordinator [Name &Signature]	Approved by the Principal
Dr. M. Bhargavi **Dr. K. Susmitha**	B-Saritha **Dr. Saritha Aduri** Head Department of Chemistry St. Francis College for Women Begumpet, Hyderbad-16.	**Prof. Uma Joseph** Principal St. Francis College for Women Begumpet, Hyderabad-16.

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Faculty of Science – Department of Chemistry

THEORY SYLLABUS CBCS-2026

SEMESTER – I

Paper Title: Physical Chemistry-I

Programme: M.Sc. Organic Chemistry **Course Code: P26/CHE/DSC/103/L** **Type of course: DSC – 3**	**Max. Hours: 60** **Hours per week: 4** **Max. Marks: 100** **No. of credits: 4**
Module 1: Thermodynamics - I	
Module 2: Electrochemistry	
Module 3: Quantum Chemistry	
Module 4: Solid-state Chemistry	

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SEMESTER –I

PHYSICAL CHEMISTRY-I

1. Course Description

Programme: M.Sc.
Course Code: P26/CHE/DSC/103/L
Type of course: DSC – 3
No. of credits: 4

Max.Hours : 60
Hours per week:4
Max.Marks: 100

2. Course objectives:

1. To establish the mathematical criteria for chemical equilibrium and spontaneity by deriving fundamental relations between state functions like Entropy, Enthalpy, and Free Energy.

2. To analyze the electrolytic solutions and electrode interfaces, specifically focusing on ion-solvent interactions and the mechanisms of over potential.

3. To apply the postulates of quantum mechanics to microscopic systems, utilizing operator algebra to solve the Schrödinger wave equation.

4. To correlate the atomic arrangement of solids with their electronic properties, focusing on superconductivity. To provide a theoretical foundation for top-down and bottom-up synthesis of nanoparticles and their characterization.

3. Course Outcomes:

CO1: Students will be able to calculate entropy changes for ideal gas mixing and use the van't Hoff equation to quantify how equilibrium constants shift with temperature.

CO2: Students will be able to derive the Nernst equation for concentration cells and apply Debye-Hückel limiting law to determine mean ionic activity coefficients in dilute solutions.

CO3: Students will be able to determine eigenvalues and Eigen functions for a particle in a 1D and 3D box and interpret the physical significance of wave functions and probability densities.

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CO4: Students will be able to evaluate the mechanisms of high temperature superconductivity and also master the preparation, characterization of Nano materials.

Expected Level of Output: Conceptual level

4. Course Content

Module 1 -Thermodynamics-I **(15 Hrs)**

Concept of Entropy: Entropy as a function of V and T, Entropy as a function of P and T, Entropy change in isolated systems- Clausius inequality, Entropy change as criterion for spontaneity and equilibrium.

Third law of thermodynamics: Evaluation of absolute entropies from heat capacity data for solids, liquids and gases; Standard entropies and entropy changes of chemical reactions. Helmholtz and Gibbs free energies (A and G). Driving force for chemical reactions—relative signs of ΔH and ΔS.

Thermodynamic relations: Gibbs equations, Maxwell relations. Temperature dependence of G. Gibbs-Helmholtz equation. Pressure dependence of G.

Chemical potential: Gibbs equations for non-equilibrium systems: Material equilibrium, Phase equilibrium. Clapeyron equation and Clausius- Clapeyron equation, Conditions for equilibrium in a closed system. Chemical potential of ideal gases, Ideal-gas reaction equilibrium: derivation of equilibrium constant, Temperature dependence of equilibrium constant-the van't Hoff equation.

Module 2- Electrochemistry- I **(15 Hrs)**

Electrochemical Cells: Derivation of Nernst equation – problems. Chemical and concentration cells (with and without transference): Liquid junction potential (LJP) – derivation of the expression for LJP – its determination and elimination.

Types of reversible electrodes: Gas electrode, Metal-Metal ion electrode, Metal-insoluble metal salt electrode, Redox electrodes, ex. Quinhydrone electrode, Ion-selective electrodes, ex: H+ selective-glass electrode, other ion selective electrodes (fluoride, sodium, calcium etc.). Applications of EMF measurements: Solubility product, potentiometric titrations, determination of pH using glass electrode, equilibrium constant measurements. Applications of ion-selective electrodes in medicine (ex: blood electrolyte analysis).

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Decomposition potential and its significance: Electrode polarization – its causes and elimination. Concentration over-potential

Concept of activity and activity coefficients in electrolytic solutions: The mean ionic activity coefficient, Debye-Huckel theory of electrolytic solutions: Debye-Huckel limiting law (derivation not required). Calculation of mean ionic activity coefficient Limitations of Debye-Huckel theory Extended Debye-Huckel law

Theory of electrolytic conductance: Derivation of Debye-Huckel-Onsager equation – its validity and limitations.

Concept of ion association: Bjerrum theory of ion association (elementary treatment)-ion association constant – Debye-Huckel-Bjerrum equation.

IKS: The application of ion-selective electrodes for blood analysis quantified through modern electrochemical measurements

Module 3 - Quantum Chemistry- I **(15 Hrs)**

Wave particle duality and uncertain principle-significance of these for microscopic entities. Emergence of quantum mechanics Wave mechanics and Schrödinger wave equation.

Operators: Operator algebra Commutation of operators, linear operators. Complex functions. Hermitian operators Operators ∇ and ∇^2 Eigen functions and eigen values. Degeneracy. Linear combination of eigen functions. Well behaved functions. Normalized and orthogonal functions

Postulates of quantum mechanics: Physical interpretation of wave function. Observables and Operators Measurability of operators Average values of observables. The time dependent Schrodinger equation.Separation of variables and the time-independent Schrodinger equation

Theorems of quantum mechanics: Real nature of the eigenvalues of a Hermitian operator-significance. Orthogonal nature of the eigen values of a Hermitian operator-significance of orthogonality. Expansion of a function in terms of eigenvalues Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle

Particle in a box: one dimensional and three-dimensional Plots of Ψ and Ψ^2- discussion Degeneracy of energy levels Calculations using wave functions of the particle in a box-orthogonality, measurability of energy, position and momentum, average values and probabilities

Application of Particles in 1D-box Model: To the spectra of conjugated molecules. HOMO-LUMO gaps and relevance to electronic spectroscopy.

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Module 4 - Solid-state Chemistry **(15 Hrs)**

Electronic properties of Solids: Electronic structure of solids, band theory of metals, insulators and semi-conductors. Electrons, holes and Excitons. The temperature dependence of conductivity of extrinsic semi-conductors. Photo conductivity and photovoltaic effect – p-n junctions.
Superconductivity: Occurrence of superconductivity. Destruction of superconductivity by magnetic fields – Meissner effect. Types of superconductors. Theories of super conductivity – BCS theory. High temperature superconductors: Structure of defect perovskites. High Tc superconductivity in cuprates. Phase diagram of Y-Ba-Cu-O system. Crystal structure of YBa2Cu3O7-x.Prepartion of 1-2-3 materials.Origin of high Tc superconductivity.

Nanoparticles and their applications:
Introduction to nanoparticles. Reduced dimensionality in solids: systems with various dimensions - examples. Preparation of nano particles –top down and bottom up methods. Preparation of nanomaterials- – sol gel methods (ex: nanotitania, silicagel), chemical vapour deposition method (ex: carbon nanotubes, metal nanoparticles), and thermolysis (ex: metal nanoparticles from metal complexes/salts) Characterization of nanoparticles – XRD, SEM, TEM, AFM (no instrumentation details, principles only). Optical properties of nanoparticles, Applications of nanoparticles in water purification, catalysis, sensors, cosmetics, drug delivery, and diagnosis, energy materials.

IKS: Synthesis and characterization of nanoparticles

5. Reference Books:

1. Atkin's Physical Chemistry, 11e, Peter Atkins and Julio de Paula, Oxford University press 2018
2. Physical Chemistry, 6e, Ira N. Levine, McGraw Hill, 2011
3. Physical Chemistry-A Molecular approach, D.A. McQuarrie and J.D. Simon, Viva Books Pvt Ltd , 2020
4. Molecular Thermodynamics, D.A. McQuarrie and J.D. Simon, University Science Books, 1999
5. An Introduction to Electrochemistry, S. Glasstone; East-West Press (Pvt.) Ltd. 2006.
6. Modern Electrochemistry, J. O. M. Bockris & A. K. N. Reddy, Plenum, 2012 reprint.
7. Principles of Physical Chemistry, 4e, Samuel H. Maron and Carl F. Prutton, Oxford & IBH, 2017.
8. Quantum Chemistry, Ira N. Levine, Prentice Hall

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9. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill

10. Introduction to Solids, Leonid V. Azaroff, Tata McGraw Hill

11. Solid state Chemistry, D.K. Chakrabarthy, New Age International

12. Solid state Chemistry and its aplications, A.R. West, Plenum.

16. Principles of the Solid State, H. V. Keer, New Age International

17. Elementary Quantum Chemistry, F. L. Pilar, McGraw Hill.

18. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press

19. Self-Assembled Nanostructures, Jin Zhang, Zhong-lin Wang, Jun Liu, Shaowei Chen & Gan-YLiu, Kluwer Academic/Plenum

20. Introduction to Nanotechnology, Charles P. Poole Jr, F. J. Owens, Wiley India Pvt. Ltd.

21. The physics and chemistry of solids by Stephen Elliott, Wiley Publishers.

6. Syllabus Focus

a. Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Local	Improving energy efficiency in domestic systems and advancing local manufacturing of functional materials and semiconductors.
Regional	Engineering electrolytic solutions for regional water management and driving innovation in computational molecular modeling.
National	Shaping national energy policies and fostering medical breakthroughs through advanced pollutant regulation and healthcare technology.
Global	Leading international efforts in sustainable energy development and scaling high-efficiency industrial technologies like superconductivity.

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b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module 4	Creating 3D crystal lattices and unit cells to visualize structural geometry.
ED	Module 2	Developing electrochemical sensors and electrodes for medical and industrial use.
EMP (NSQF Level 4,5,6 & 7)	Module 1	Calculating energy efficiency and reaction spontaneity for chemical process roles.
SD/EMP	Module 3	Mastering operator algebra and wave mechanics for advanced research and R&D.

c. IKS Components

IKS	Syllabus Content	Module
IKS	Synthesis and characterization of nanoparticles	4
IKS	The application of ion-selective electrodes for blood analysis quantified through modern electrochemical measurements	2

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d. Aligned with SDG 3 (Good Health and well- being), SDG 4 (Quality Education), SDG 6(Clean Water &Sanitation), SDG 7 (Affordable & Clean Energy), SDG 9 (Industry, Innovation & Infrastructure), and SDG 12 (Responsible Consumption & Production).

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Measuring the EMF of cells to calculate Solubility Product
2.	Participative Learning	Seminar on medical applications
3.	Problem Solving	Case studies
4.	Peer teaching	Students prepare mini-lessons for classmates on assigned topics.

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8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Maximum Marks: 20M		**Maximum Marks: 20M**	
CIA 1 **Subjective**	**CIA 1** **Subjective**	**CIA 2** **Skill Based Test: 10M**	**CIA 2** **Assignment: 10M**
Section A: 1x10=10M Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	**SectionA: 1x10=10M** Essay question: Answer any 1 out of 2 **Section B: 2x5=10M** Short questions: Answer any 2 out of 3	Discretion of the faculty	Discretion of the faculty

External QP Pattern		
4 Credits 4 Modules **(CORE)**	SECTION A - Internal Choice	**4 Q X 10 M = 40M**
	SECTION B – Answer any 5 out of 8 (To compulsorily have ONE question from each module)	**5 Q X 4 M = 20M**

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b. Aligning COs with Continuous Internal Assessments

CO	Continuous Internal Assessments CIA – 40%	End Semester Examination-60%
CO1	CIA-1 - Written Exam	Written Exam
CO2	CIA -2 - Presentations	
CO3	CIA-2 - Assignment	
CO4	CIA-1 - Written Exam	

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c. Question Paper Pattern:

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Faculty of Science – Department of Chemistry

ABSTRACT MODEL PAPER

END SEMESTER EXAM

Paper Title -Physical Chemistry -I

TIME: 2½hrs **Course Code:**P26/CHE/DSC/103/L

MAX. MARKS: 60

SECTION –A (Essay Questions)

I. Answer the following **4x 10=40 Marks**

1. (a)

(b)

OR

2 (a)

(b)

3. (a)

(b)

OR

4 (a)

(b)

5.(a)

(b)

OR

6 (a)

(b)

7. (a)

(b)

OR

8. (a)

(b)

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SECTION –B (Short Answer Questions)

II. Answer any 5 out of 8 questions **4x5=20 Marks**

9.

10.

11.

12.

13.

14.

15.

16.

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Model Question Paper - End Semester Exam

PHYSICAL CHEMISTRY-I

MODEL QUESTION PAPER

Course Code: P26/CHE/DSC/103/L
Credits: - 4

Max Marks:60
Max Hours:2½hrs

SECTION-A

I Answer the following Questions **4x10= 40M**

1. (a) Derive Van't Hoff's equation. **(CO1) (Level 2)**

(b) State third law of thermodynamics. Explain the evaluation of absolute entropy of gases from heat capacity data. **(CO1) (Level 2)**

OR

2. (a) What is chemical potential? Write Gibbs equations for non-equilibrium systems. **(CO1) (Level 1)**

(b) Deduce the Caussius-Clapeyron equation **(CO1) (Level 2)**

3. (a) What is electrode polarization? How can it be eliminated? **(CO2) (Level 1)**

(b) What is liquid junction potential? Derive an expression for LJP. How is it determined experimentally? **(CO2) (Level 2)**

OR

4. (a) What is a Quinhydrone electrode? How is the pH of a solution determined using this Electrode? **(CO2) (Level 1)**

(b) Derive Debye-Huckel-Onsagar equation. **(CO2) (Level 2)**

5. (a) State and explain the postulates of quantum mechanics. **(CO3) (Level 2)**

(b) Derive Schrodinger wave equation for particles in 1D box. **(CO3) (Level 2)**

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OR

6. (a) Explain the terms: i) Hermitian Operator ii) Linear operator. **(CO3) (Level 2)**

(b) Show that the function Sin 3x is an Eigenfunction of the d^2/dx^2. Evaluate the Eigenvalue? **(CO3) (Level 5)**

7. **(a)** Discuss BCS theory of superconductivity. **(CO3) (Level 1)**

(b) Explain preparation of Nanoparticles-Top down and bottom-up method. **(CO3) (Level 2)**

OR

8. (a) Describe the Phase diagram of the Y-Ba-Cu-O system. **(CO3) (Level 2)**

(b) Describe the sol-gel method for the preparation of nanomaterials. **(CO3) (Level 2)**

SECTION-B

II. Answer any FIVE **5x4=20M**

9. Derive the Gibbs-Helmholtz equation. **(CO1) (Level 2)**
10. Derive any two Maxwell relations. **(CO1) (Level 2)**
11. Write a short note on decomposition potential and its significance. **(CO2) (Level 1)**
12. Deduce the Nernst equation for Half-cell potential. **(CO2) (Level 5)**
13. Explain the following:

i) Well behaved function ii) Normalized wave function **(CO3) (Level 2)**

14. Explain the concept of wave-particle duality. **(CO3) (Level 2)**
15. Explain Meisner's effect. What is its significance? **(CO3) (Level 2)**
16. Explain the characterization of nanoparticles using AFM. **(CO3) (Level 2)**

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SECTION A - INTERNAL CHOICE		4 Q X 10M = 40 M		
Question Number	**Module**	**Question**	**CO**	**BTL**
1	**Module 1**	(a) Derive Van't Hoff's equation. (b) State third law of thermodynamics. Explain the evaluation of absolute entropy of gases from heat capacity data. OR	**CO 1**	**Level 2**
2	**Module 1**	(a) What is chemical potential? Write Gibbs equations for non-equilibrium systems. (b) Deduce the Caussius-Clapeyron equation	**CO 1**	**Level 1 &2**
3	**Module 2**	(a) What is electrode polarization? How can it be eliminated? (b) What is liquid junction potential? Derive an expression for LJP. How is it determined experimentally? OR	**CO 2**	**Level 1 &2**
4	**Module 2**	(a) What is a Quinhydrone electrode? How is the pH of a solution determined using this Electrode? (b) Derive Debye-Huckel-Onsagar equation.	**CO 2**	**Level 1 &2**
5	**Module 3**	(a) State and explain the postulates of quantum mechanics. (b) Derive Schrodinger wave equation for particles in 1D box. OR	**CO 3**	**Level 2**
6	**Module 3**	(a) Explain the terms: i) Hermitian Operator ii) Linear operator. (b) Show that the function Sin 3x is an Eigenfunction of the d^2/dx^2. Evaluate the Eigenvalue.	**CO 3**	**Level 2 &5**
7	**Module 4**	(a) Discuss BCS theory of superconductivity. (b) Explain preparation of nanoparticles-Top down and bottom-up method. OR	**CO 4**	**Level 1 &2**

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8	**Module 4**	(a) Describe the Phase diagram of the Y-Ba-Cu-O system. (b) Describe the sol-gel method for the preparation of nanomaterials.	**CO 4**	**Level 2**
SECTION B - ANSWER ANY 5 OUT OF 8 (To compulsorily have Two questions from **each** module)		**5Q X 4 M = 20 M**		
9	**Module 1**	Derive the Gibbs-Helmholtz equation.	**CO 1**	**Level 2**
10	**Module 1**	Derive any two Maxwell relations.	**CO 1**	**Level 2**
11	**Module 2**	Write a short note on decomposition potential and its significance.	**CO 2**	**Level 1**
12	**Module 2**	Deduce the Nernst equation for Half-cell potential.	**CO 2**	**Level 5**
13	**Module 3**	Explain the following: i) Well behaved function ii) Normalized wave function	**CO 3**	**Level 2**
14	**Module 3**	Explain the concept of wave-particle duality.	**CO 3**	**Level 2**
15	**Module 4**	Explain Meisner's effect. What is its significance?	**CO4**	**Level 2**
16	**Module 4**	Explain the characterization of nanoparticles using AFM.	**CO4**	**Level 2**

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d. Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	COs Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	1	2	10	2	5x4=20
2	15	2	2	10	2	
3	15	3	2	10	2	
4	15	4	2	10	2	

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions(hrs)
1	2	Understand	15
2	1	Understand	15
3	7	Apply	15
4	6	Understand	15

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SEMESTER-I PRACTICALS

CHEMISTRY LAB: DSC- 3 **LAB: PHYSICAL CHEMISTRY**

Program: M.Sc.
Course: DSC-3
Semester: I

Subject Code P26/CHE/DSC/103/P
No. of Hrs. allotted: 4 Hrs / week
No. of Credits : 2

COURSE OBJECTIVES:

- To determine the rate constants and order of various reactions
- To apply the instrumentation techniques like conductometry and potentiometry in acid-base titrations
- To determine the specific rotation of sugars using a polarimeter

COURSE OUTCOMES:

CO1: Analyze the overall order of various reactions.
CO2: Determine the concentration of acids using a conductometer and potentiometer.
CO3: Obtain the specific rotation of sugars using a polarimeter.

Lab course 3 **Physical Chemistry** **4 hrs/week**

I. Data Analysis I: Significant figures, Precision, and accuracy

II. Chemical kinetics:

1. Acid-catalysed hydrolysis of methyl acetate with 1N HCl
2. Acid-catalysed hydrolysis of methyl acetate with 2N HCl
3. Peroxydisulphate- I- reaction (overall order)
4. Oxidation of iodide ion by hydrogen peroxide- iodine clock reaction

III. Conductometry:

5. Determination of cell constant
6. Titration of strong acid vs strong base
7. Titration of weak acid vs strong base
8. Determination of dissociation constant of a weak acid

IV. Potentiometry:

9. Titration of strong acid vs strong base

10. Titration of weak acid vs strong base and determination of dissociation constant of a weak acid
11. Determination of single electrode potential

V. Polarimetry:

12. Determination of specific rotation of sucrose
13. Determination of specific rotation of glucose
14. Determination of specific rotation of fructose

VI. Adsorption:

15. Adsorption of acetic acid on animal charcoal or silica gel

Reference Books:

1. Senior Practical Physical Chemistry: B.D. Khosla, V.C. Garg and A. Khosla
2. Experimental Physical Chemistry: V. Athawale and P. Mathur.
3. Practical Physical Chemistry: B. Vishwanathan and P.S. Raghavan.
4. Practical in Physical Chemistry: P.S. Sindhu
5. Advanced Practical Physical chemistry: J.B.Yadav

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PHYSICAL CHEMISTRY

PRACTICAL MODEL PAPER

Course Code: P26/CHE/DSC/103/P **Max Time:3hrs**

Credits: 2 **Max marks :50 marks**

Answer all questions.

1. Write the Principle involved in the given experiment. **(CO1, CO2, CO3) 10 M**

2. a) Determine the strength of the given acid using Conductometer/Potentiometer. **(CO2)**

OR

b) Determine the specific rotation of Optically active Compounds **(CO3)**.

OR

c) Kinetic Study of 1st Order / 2nd Order Reactions **(CO1)** **25 M**

3. Record and Attendance **5 M**
4. Viva Voce **(CO1, CO2, & CO3)** **10 M**

Prepared by	Checked &verified by	Approved by
Name and Signature of the teaching faculty	Name and Signature of HoD	Name and Signature of Principal
B. Uma Rani	B. Saritha	
Dr. B. Uma Rani	Dr. Saritha Aduri	Prof. Uma Joseph

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