St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
THEORY SYLLABUS CBCS-2024
SEMESTER -VI
ADVANCED CHEMISTRY

1. Course Description

Program: B.Sc.
Course Code: U24/CHE/DSE/601
Course: DSE 3
No. of Credits: 3

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

2. Course Objectives

- To enable the students to understand the concepts of Coordination chemistry and its applications and Inorganic reaction mechanisms of metal complexes.
- The course aims at giving an overview on principles and types of pericyclic reactions, colloids and surface chemistry
- To understand the basic principles and to develop skills in interpretation of various spectra in elucidation of structure of simple molecules.

3. Course Outcomes

CO1: Understand the concepts of Coordination Chemistry in elucidating the structures of complexes and apply in isomerism.

CO2: Understand the reaction mechanisms in metal complexes with applications. Interpret the concepts and applications of HSAB.

CO3: Understand and apply the principles of spectroscopy in solving the problems related to structural analysis of simple organic molecules.

CO4: Elaborate on the concepts of synthetic organic chemistry. To help the students acquire knowledge on the basic principles of colloids and surface chemistry.

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

4. Course Content

MODULE I: COORDINATION CHEMISTRY 15 Hrs

Werner's theory – postulates, experimental evidence. Sidgwick's theory – Calculation of EAN, limitations. Nomenclature of inorganic complex compounds.
Valence bond theory – postulates, geometries of coordination number 4 & 6- tetrahedral $[Ni(NH_3)_4]^{2+}$, $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$, square planar $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)_4]^{2+}$, $[PtCl_4]^{2-}$ Octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$, $[FeF_6]^{4-}$, $[Co(NH3)_6]^{3+}$, $[CoF_6]^{3-}$. Limitations of VBT Crystal field theory – features, splitting of d-orbitals, in octahedral, tetrahedral and square planar complexes, Crystal field stabilization energy (calculation of CFSE for d^n configurations in octahedral complexes),
Magnetic properties of transition- metal complexes: Types of magnetic behaviour, spin only formula, calculation of magnetic moments using spin only formula.
Electronic spectra of metal complexes – d-d transitions, spectrochemical series, Electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$.Determination of composition of complexes - Job's method and mole ratio method.
Thermodynamic and kinetic stability of transition metal complexes. Stability of metal complexes –step wise and overall stability constant and their relationship and chelate effect.

Isomerism in coordination compounds: structural: ionization, hydrate, linkage, co- ordination, coordination- position and polymerisation isomerism. Stereo isomerism – (a) geometrical isomerism in (i) square planar metal complexes of the type $[MA_2B_2]$, $[MA_2BC]$, $[M(AB)_2]$, [MABCD]. (ii) Octahedral metal complexes of the type $[MA_4B_2]$, $[M(AA)_2B_2]$, $[MA_3B_3]$ using suitable examples, (b) Optical isomerism in (i) Tetrahedral complexes [MABCD], (ii) Octahedral complexes $[M(AA)_2B_2]$, $[M(AA)_3]$ using suitable examples.
Applications of coordination compound
Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization – Ziegler Natta catalyst d) water softening.

MODULE II: INORGANIC REACTION MECHANISM AND HSAB 15 Hrs

Inorganic Reaction Mechanism
Lability and inertness of complexes
Substitution Reactions – dissociation and association reactions, mechanism for SN^1 and SN^2 in octahedral and square planar complexes with one example each. Trans effect –theories and applications. Acid Hydrolysis (mechanism) and Base Hydrolysis (mechanism). Electron transfer reactions – outer sphere and inner sphere mechanism (brief account only) – two electron transfer reactions.
Hard and soft acids and bases
Classification, Pearson's concept of hardness and softness, application of HSAB principles, stability of complexes, predicting the feasibility of a reaction.

MODULE III: MOLECULAR SPECTROSCOPY -II 15 Hrs

NMR Spectroscopy 5 Hrs
Principles of nuclear magnetic resonance, number of signals, equivalent & non equivalent protons, position of signals-chemical shift. NMR splitting of signals, Spin-Spin coupling,

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

83

coupling constants. Application of NMR with suitable examples-Ethyl bromide, Ethanol, Acetaldehyde, 1,1,2-Tribromoethane, Ethylacetate, Toluene & Acetophenone.

Mass Spectrometry **5 Hrs**

Basic principles – Nitrogen rule, Types of ions: Molecular ion / parent ion, fragment ions / daughter ions. Theory – formation of parent ions. Representation of mass spectrum. Identification of parent ion, (M+1), (M+2), base peaks (relative abundance 100%) Determination of molecular formula – Mass spectra of ethyl benzene, ethyl bromide, acetophenone, n-butylamine and 1- propanol.

Spectral interpretation **2 Hrs**

Interpretation of IR, UV-Visible, H^1 -NMR and mass spectral data of the following compounds 1. Phenylacetylene 2. Acetophenone 3. Cinnamic Acid 4. para-nitro aniline.

Electron Spin Resonance **3 Hrs**

Electron Spin Resonance (ESR) spectroscopy: Basic principle, hyperfine structure, ESR of simple radicals like $H^{\cdot}$, $CH_3^{\cdot}$ and CH_3CH_2.

MODULE IV: COLLOIDS, SURFACE CHEMISTRY & PERICYCLIC REACTIONS

15 Hrs

Colloids & Surface Chemistry **9 Hrs**

Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations and properties – Kinetic, Optical and Electrical stability of colloids. Protective action. Hardy–Schultz law, Gold number. Liquids in liquids (emulsions): Types of emulsions, preparation and emulsifier. Liquids in solids(gels): Classification, preparations and properties, General applications of colloids. Adsorption: Types of adsorption. Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications.

Photochemistry **6 Hrs**

Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry- Grothus Draper law, Stark Einstein law. Quantum yield,Problems based on quantum efficiency. photochemical combinations of Hydrogen- Chlorine & Hydrogen –Bromine. Jablonski diagram depicting various processes occurring in an excited state. Qualitative description of Fluorescence, phosphorescence, non-radiative process (internal conversion, intersystem crossing.

5. References

1. 30.Wahid.U.Malik, Tuli G.D and Madan R.D (1976) *Selected topics in Inorganic Chemistry*: S.Chand Publishers
2. Puri B.R, Sharma L.Rand Khalia K.C (2014) *Principles of Inorganic Chemistry*: Milestone publishers and Distributers.
3. Tuli G.D, Madan R.D, Basu S.K, Sathyaprakash. *Advanced Inorganic Chemistry Volume II* : S.Chand and company ltd (New Delhi ,India)
4. Sharma, Y.R. *Text Book of Complete Organic Chemistry*, 2nd Edn. Kalyani, 2007.
5. Jain, M.K. & Sharma, S.C. *Modern Organic Chemistry,* 4th Edn. Vishal, 2009.
6. Sharma Y.R (2005) *Elementary Organic Spectroscopy; Principles and Chemical applications* : S.Chand & Company Ltd
7. Puri, B.R., Sharma L.R., and Pathania, M.S. (2003). *Elements of Physical Chemistry.* Jalandhar, Delhi: Vishal Publishing Co.
8. Bahl, A., & Tuli. (2009). *Essentials of physical chemistry: A textbook for B. Sc. classes as per UGC model syllabus* (Rev. multicoloured.). New Delhi: S. Chand.

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

84

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated To Osmania University)
FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -VI
EXPERIMENTS IN PHYSICAL CHEMISTRY II AND INSTRUMENTATION

Program: B.Sc.
Course Code: U20/CHE/DSE/601/P
Course: DSE-3&4
No. of Credits : 1

Max. Hours: 30 Hrs
Max. Marks: 50
Hours per week: 3 Hrs

Course Objectives

- To equip the students with skills to determine various physical parameters using instrumentation methods and to synthesize complexes.

Course Outcomes

CO1: Achieve the expertise in determining pH, conductivity, unknown concentration of solutions and rate constants of reactions.
CO2: Acquire the ability to synthesize metal complexes.

Chemical Kinetics:

1. Catalytic Decomposition of Hydrogen Peroxide.
2. Acid catalyzed hydrolysis of methyl acetate.
3. Kinetic study of oxidation of I^- by $K_2S_2O_8$.

Colorimetry:

4. Determination of Dichromate and Permanganate in a mixture using Beer Lambert's Law.
5. Job's Method for the determination of ferric thiocyanate complex.

pH metry:

6. Titration of strong acid Vs strong base.
7. Determination of ionization constant of acetic acid by pH metric method.

Preparation of Complexes:

8. To prepare a complex of tetraammine copper II sulphate complex.
9. To prepare a complex of chloropentaamminecobalt III chloride.
10. To prepare a complex of hexammine nickel II chloride.

References

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
2. Svehla, G, *Vogel's Qualitative Inorganic Analysis:* Pearson Education, 2012.
3. Mendham, J, *Vogel's Quantitative Chemical Analysis:* Pearson, 2009.

Chairperson
Board of Studies in Che
Dept of Chemistry
Osmania University, Hyd

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

6. **Syllabus Focus**

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

Local /Regional/National /Global Development Needs	Relevance
Local	Knowledge of chemistry of complexes helps in everyday life
Regional	Learning the concepts of surface chemistry and pericyclic reactions changes their perspective towards various processes
National	Through Knowledge of spectral interpretation opens new horizons in skill development and employability
Global	A complete idea of complexes and spectral interpretation increases students inclination towards research

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD EMP	Module 1 synthesis of complexes	Some complexes are synthesized in the Lab.Many metal complexes are widely used in the pharmaceutical companies.This enhances their skill development and employability.
SD	Module 3 Spectral interpretation	Students are taught the instrumentation of all the spectroscopic methods, they are taken to various research labs to show live instrumentation techniques. They are thoroughly trained in spectral interpretation by giving assignments.

7. **Pedagogy**

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1.	Field trips	Students are taken to various institutes like IICT, HCU, IIT , ARCI etc
2.	Role play	Students are made to enact various concepts of chemistry
3.	Seminars/ workshops/ research projects	Students are allowed to participate in seminars and workshops organized in and

Chairperson Board of Studies in Chemistry Dept of Chemistry Osmania University, Hyd-07.

Head Department of Chemistry UCS, Osmania University Hyderabad-500 007.

Chairperson of Studies in Chemistry Dept of Chemistry Osmania University, Hyd-07.

		outside the college. They are encouraged to take up research projects.

8. Course Assessment Plan

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

CO	Continuous Internal Assessments CIA - 50%	End Semester Examination-50%
CO1	CIA 1 written exam (10 M)	Written Exam
CO2	Skill Test 1 (10 M)	
CO3	CIA 1 written exam (10 M)	
CO4	Skill Test 2 (10 M)	

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
MODEL PAPER
B.SC. II YEAR SEMESTER -VI
ADVANCED CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/601**
Max. Marks: 50

SECTION –A (Essay Questions)

I. Answer the following **4X10 =40 Marks**

1. a) Describe the structure of $[Cu(NH_3)_4]$ using Valence bond theory. (CO1) **L1** 5M
   b) Define optical isomerism? Draw and explain the optical isomerism in octahedral complexes. (CO1) **L1** 5M

OR

2. a) Summarise Werner's theory with examples. (CO1) **L2** 5M
   b) Explain the Crystal field splitting in octahedral complexes. (CO1) **L5** 5M
3. Outline the mechanism of SN^1 in the octahedral and SN^2 in square planar complexes with one example each. (CO2) **L2** 10 M

OR

4. a) Define trans effect? Discuss the theories and applications of trans effect. (CO2) **L2** 5M
   b) Distinguish labile and inert complexes? Explain with examples. (CO2) **L4** 5M
5. a) What is the chemical shift? Explain the change in position of signals with examples. (CO3) **L1** 5M
   b) Elaborate about (M+1), (M+2) and base peaks with two examples in Mass spectrometry. (CO3) **L6** 5M

OR

6. a) Indicate the number of signals possible for CH_3-CH_2-CH_2-OH and explain spin- spin splitting. (CO3) **L6** 5M
   b) Explain the basic principles of ESR spectroscopy. (CO3) **L5** 5M
7. a) Classify the various types of colloids? (CO4) **L5** 5M
   b) Deduce the expression for Langmuir adsorption isotherms. (CO4) **L5** 5M

OR

8. What are Flourescence and Phosphorescence ? Explain the phenomenon of florescence and phosphorescence using Jablonski diagram. 10M

SECTION – B (Short answer questions)

II. Answer any four questions. **4 X 5 = 20 Marks**

9. Explain the Job's method of determination of composition of a complex. **(L2)**
10. What is EAN? Calculate the EAN for [Co(NH3)6] and [FeF6]3- **(L1)**
11. Describe the acid hydrolysis of octahedral complexes. **(L2)**
12. Define Hardy Schulze rule and Gold number. **(L1)**
13. Show how the molecular formula of a compound is determined based on its Mass spectrum? **(L1)**
14. Discuss the quantum yield for the photochemical combination of H_2& Cl_2 to form HCl **(L5)**

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyderabad.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

11. Describe the acid hydrolysis of octahedral complexes. **(L2)**
12. Define Hardy Schulze rule and Gold number. **(L1)**
13. Show how the molecular formula of a compound is determined based on its Mass spectrum? **(L1)**
14. List out the various types of NMR signals expected for 1,1,2-tribromoethane? What is the intensity ratio of the peaks? **(L1)**

c. **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	20
2	15	2	2	10	1	15
3	15	3	2	10	2	20
4	15	4	2	10	1	15

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	2,5	Understanding	15
2	1,7	Applying & Analysing	15
3	2,7	Remembering	15
4	4	Creating & Evaluating	15

Prepared by	Checked & Verified by	Approved by
Madhu	D. Sumalatha	
Name and Signature of the teaching faculty Y. Lakshmi madhuri	Name and Signature of the HoD Dr. D.Sumalatha	Name and Signature of Principal Dr. Uma Joseph

Chairperson
Board of Studies in Chem.
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
B.SC. III YEAR SEMESTER -VI
ADVANCED CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/601**
Max. Marks: 50 **Credits: 4**

SECTION A - INTERNAL CHOICE		**4 X 10 M = 40M**		
Question Number	**Question**		**CO**	**BTL**
1	**Module 1**	(a) Describe the structure of [Cu(NH3)4] using Valence bond theory. 5M (b) Define optical isomerism? Draw and explain the optical isomerism in octahedral complexes. **OR**	**CO1**	**Level 1**
2	**Module 1**	(a) Summarise Werner's theory with examples. (b) Explain the Crystal field splitting in octahedral complexes.	**CO1**	**Level I**
3	**Module 2**	Outline the mechanism of SN^1 in the octahedral and SN^2 in square planar complexes with one example each. 10 M **OR**	**CO2**	**Level 2**
4	**Module 2**	(a) Define the trans effect? Discuss the theories and applications of trans effect. (L1) 5M (b) Distinguish labile and inert complexes? Explain with examples. (L4) 5M	**CO2**	**Level 2**
5	**Module 3**	(a) What is the chemical shift? Explain the change in position of signals with examples. 5M (b) Elaborate about (M+1), (M+2) and base peaks with two examples in Mass spectrometry 5M **OR**	**CO3**	**Level 1**
6	**Module 3**	(a) Develop the number of signals possible for CH_3-CH_2-CH_2-OH and explain spin- spin splitting. 5M (b) Explain the basic principles of ESR spectroscopy.	**CO3**	**Level 5 & 6**
7	**Module 4**	(a) Classify the various types of colloids? 5M (b) Deduce the expression for Langmuir adsorption isotherms. 5M **OR**	**CO4**	**Level 5**
8	**Module 4**	What are Flourescence and Phosphorescence ? Explain the phenomenon of florescence and phosphorescence using Jablonski diagram.	**CO4**	**Level 2**

Department of Chemistry, St. Francis College for Women

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

SECTION B – (Short answer questions) ANSWER ANY 4 OUT OF 6			4 X 5M = 20 M	
9	Module 1	9. Explain the Job's method of determination of composition of a complex.	CO1	Level 2
10	Module 2	10.What is EAN ? Calculate the EAN for [Co(NH3)6] and [Fe6]3-	CO1	Level 1
11	Module 3	11. Describe the acid hydrolysis of octahedral complexes.	CO2	Level 2
12	Module 4	12. Define Hardy Schulze rule and Gold number	CO4	Level 1
13	Module 2	13. Show how the molecular formula of a compound is determined based on its Mass spectrum? (L1)	CO3	Level 1
14	Module 3	14. Discuss the quantum yield for the photochemical combination of H_2& Cl_2 to form HCl	CO4	Level 5

SEMESTER-VI

ENVIRONMENTAL BIOTECHNOLOGY

1. Course Description

Programme: BSc
Course Code: U24/BIT/DSE/602
Course Type: DSE-IIB
No. of credits: 4

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

2. Course Objectives

- To facilitate the students to learn, understand, and acquire knowledge on bioremediation, treatment of industrial and municipal wastewater, protection, preservation, and restoration of clean and sustainable ecosystems.
- To emphasize on the importance of production of biofuels and environmental monitoring to tackle and address the contemporary environmental challenges.

3. Couse Outcome

On completion of the course the student will be able to:

CO 1: Recall, interpret and gain knowledge in basics of environmental pollution and pollutants. **(REMEMBER, UNDERSTAND)**

CO 2: Outline the different types of fuels naturally available for human use and apply knowledge and skills gained to produce biofuels. **(UNDERSTAND, APPLY)**

CO 3: Determine the definition, classification, and uses of the types of pesticides and fertilizers and apply the information to produce biopesticides and biofertilizers. **(REMEMBER, UNDERSTAND, APPLY)**.

CO 4: Evaluate the significance of different bioremediation methods and apply knowledge in the development of ecofriendly plants/organisms that can degrade pollutants in the environment. **(APPLY, EVALUATE)**

4. Course content

MODULE - I: ENVIRONMENTAL POLLUTION 15Hrs

- Introduction to Environment and pollution
- Types of pollution-air, water, and soil pollution
- Types of pollutants-inorganics, organic and biotic.
- Sources of pollution-domestic waste, agricultural waste, industrial effluents, and municipal waste
- Greenhouse gases, global warming, and climate change
- Measurement methods of environmental pollution-BOD and COD

MODULE II: BIOMASS AND BIOFUEL 15Hrs

- Renewable and Non-renewable resources.
- Fossil fuels as energy source and their impact on environment.
- Biomass as source of energy (bioenergy)
- Types of biomass-plant, animal, and microbial biomass
- Production of biofuels: bioethanol and biodiesel
- Production of biohydrogen and biomethane

MODULE III: BIOFERTILIZERS AND BIOPESTICIDES 15Hrs

- Chemical fertilizers and their impact on environment(eutrophication)
- Concepts of biofertilizers
- Types of biofertilizers-bacterial, fungal, and algal biofertilizers
- Pesticides and their impact on environment
- Concept of biopesticides, types of biopesticides
- Uses of biofertilizers and biopesticides

MODULE IV: BIOREMEDIATION OF ENVIRONMENTAL POLLUTANTS 15Hrs

- Waste water treatment-sewage and industrial effluents, aerobic and anaerobic methods.
- Bioremediation- concepts and types: in-situ, ex-situ, advantages, and disadvantages.
- Bioremediation of toxic metal ions: biosorption and bioaccumulation

- Composting of organic wastes
- Microbial remediation of pesticides and xenobiotic compounds
- Phytoremediation-concepts and applications

5. Reference books

1. Text Book of Biotechnology - By H.K. Das (Wiley Publications)
2. Biotechnology -By H.J. Rehm and G. Reed. VIH Publications, Germany
3. Biogas Technology - By b.T.Nijaguna
4. Biotechnology - By K.Trehan
5. Industrial Microbiology - By L.E. Casida
6. Food Microbiology - By M.R. Adams and M.O.Moss
7. Introduction to Biotechnology - By P.K.Gupta
8. Essentials of Biotechnology for Students - By Satya N.Das
9. Bioethics – Readings and Cases - By B.A. Brody and H. T. Engelhardt. Jr. (Pearson Education)
10. Biotechnology, IPRs and Biodiversity - By M.B. Rao and Manjula Guru (Pearson Education)
11. Bioprocess Engineering - By Shuler (Pearson Education)
12. Essentials of Biotechnology - By Irfan Ali Khan and Atiya Khanum (Ukaaz Publications)
13. Gene, Genomics and Genetic Engineering - By Irfan Ali Khan and Atiya Khanum(Ukaaz Publications)

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
National (Module 1,4)	This course is pivotal in aligning with governmental initiatives to combat pollution, conserve resources and promote sustainable development thus contributing to the country's environmental resilience.
Global (Module 2,3)	The course bears global significance, addressing pressing ecological concerns through innovative scientific methodologies, fostering international collaboration and knowledge exchange to tackle global challenges effectively.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	**Syllabus Content**	**Description of Activity**
Skill development	Module 1	Seminar presentations, role plays, case studies, and scientific conversations to examine and pinpoint methods for developing competence in responding to environmental changes
Employability	Module 2,3,4	Acquiring practical experience in producing biofuels, biopesticides, and fertilizers through field visits to esteemed research laboratories and the acquisition of environmental management approaches.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Seminar
2.	Experiential Learning `	Quiz
3.	Participative Learning	Group Discussion
4.	Experiential Learning	Field trip
5.	Experiential Learning	Art Projects
6.	Participative Learning	Presentation
7.	Experiential Learning	Internship opportunities
8.	Problem solving	Research projects
9.	Experiential Learning	Science Experiments

8. Course Assessment Plan

a. 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 Quiz/ Presentations/ Assignment	
CO4	CIA-2 Case studies	

b. Question Paper Pattern

ENVIRONMENTAL BIOTECHNOLOGY.

MODEL QUESTION PAPER- THEORY

Course Code: U24/BIT/DSE/602
Credits: 4

Max. Marks: 60
Time: 2 Hrs

SECTION – A

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

1. How do you summarize the various types of pollutants?

OR

2. Describe the various methods to measure pollutants.

3. Compare in detail about renewable and non-renewable resources.

OR

4. What approach would you use to produce bioethanol.

5. How would you describe the process of Biofertilizer production.

OR

6. Outline the production of biopesticides.

7. How would you evaluate the process of bioremediation for cleaner environment.

OR

8. What approach would you use in wastewater treatment.

SECTION –B

II. Answer any <u>FOUR</u> out of the following: **4 x 5 = 20M**

9. Explain about global warming.
10 Outline the production of biohydrogen.
11 How do you explain eutrophication?
12 How would you assess the importance of phytoremediation.
13 Outline the process of composting of organic wastes.
14 How do you make use of biomass as a source of energy?

SEMESTER-END MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE 4 Q X 10 M = 40 M				
Question Number	**Question**	**Question**	**CO**	**BTL(Blooms Taxonomy Level)**
1	Module 1	How do you summarise the various types of pollutants?	CO 1	II
2	Module 1	Describe the various methods to measure pollutants.	CO 1	I
3	Module 2	Compare in detail about renewable and non-renewable resources	CO 2	II
4	Module 2	What approach would you use to produce bioethanol	CO 2	III
5	Module 3	How would you describe the process of Biofertilizer production	CO 3	I
6	Module 3	Outline the production of Biopesticides	CO 3	II
7	Module 4	How would you evaluate the process of bioremediation for cleaner environment	CO 4	V
8	Module 4	What approach would you use in wastewater treatment?	CO 4	III

SECTION B - ANSWER ANY 4 OUT OF 6 4 Q X 5 M = 20 M (To compulsorily have **ONE** question from **each** module)				
9	Module 1	Explain about global warming	CO 1	II
10	Module 2	Outline the production of biohydrogen	CO 2	I
11	Module 3	How do you explain eutrophication?	CO 3	II
12	Module 4	How would you assess the importance of phytoremediation	CO 4	V
13	Any Module	Outline the process of composting of organic wastes	CO 1	II
14	Any Module	How do you make use of biomass as a source of energy	CO 4	III

SEMESTER – VI

ENVIRONMENTAL BIOTECHNOLOGY – PRACTICAL

1. Course Description

Programme: BSc
Course Code: U24/BIT/DSE/602/P
Course Type: DSE-IIB
No. of credits: 1

Max. Hours:30
Hours per week: 2
Max. Marks: 50

2. Course Objective:

- To cultivate practical competencies in bioremediation techniques, biofuel and biofertilizer production, microbial analysis, waste management, estimation of pollutants in samples and environmental monitoring.
- To facilitate the students, gain hands-on experience in applying biotechnological approaches to address environmental issues preparing them for careers in environmental science and related fields.

3. **Course outcomes:**

On completion of the course the student will be able to:

CO-1 Recall and apply basic knowledge and skills in estimation of BOD, COD, and TDS in water samples. (**REMEMBER, APPLY**)

CO-2 Identify and apply basic skills in production of biofuels and biofertilizers. (**APPLY**)

CO-3 Examine, identify, and isolate the microorganisms from polluted soil/Industrial effluents and analyse bioremediation by microorganisms. (**APPLY, ANALYSE**)

PRACTICAL SESSIONS

1. Estimation of BOD in polluted water samples.
2. Estimation of COD in polluted water samples.
3. Estimation of Total Dissolved Solids (TDS) in waste water samples.
4. Determination of quality of water sample (Coliform test)
5. Isolation of microorganisms from pollutes soil/Industrial effluents.
6. Production of hydrogen or biogas.
7. Identification and characterization of Bioremediation microorganisms.
8. Production of microbial biofertilizers.

Spotters:

1. Air/Water pollution.
2. Municipal wastes.
3. Industrial effluents.
4. Algal bloom.
5. Greenhouse effect.
6. Plant biomass.
7. Water waste treatment plan.
8. Organic composting.
9. Biogas plant.
10. Xenobiotic degrading bacteria.
11. Phytoremediation.
12. Microbial biofertilizers.

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

SEMESTER-VI

ENVIRONMENTAL BIOTECHNOLOGY-PRACTICAL

Course Code: U24/BIT/DSE/602/P **Max. Marks: 50**
Credits: 1 **Time: 2 Hrs**

I. MAJOR: (20M)

Perform an experiment to determine the quality of a given water sample. Discuss the principle and procedure of the experiment. Calculate and report the results.

II. MINOR: (10M)

Estimate total dissolved solids from the water sample provided. Write the principle and procedure. Perform the calculations and report the result.

III. IDENTIFY THE GIVEN SPOTTERS: (10M)

IV. VIVA (5M)

V. RECORD (5M)

Prepared by	Checked & verified by	Approved by
4/3/24 (Ms. Shouni Niveditha) Name and Signature of the teaching faculty	4/3/24 (Ms. Shouni Niveditha) Name and Signature of HoD	Name and Signature of Principal

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated To Osmania University)
FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -VI
EXPERIMENTS IN PHYSICAL CHEMISTRY II AND INSTRUMENTATION

Program: B.Sc.
Course Code: U20/CHE/DSE/601/P
Course: DSE-3&4
No. of Credits : 1

Max. Hours: 30 Hrs
Max. Marks: 50
Hours per week: 3 Hrs

Course Objectives

- To equip the students with skills to determine various physical parameters using instrumentation methods and to synthesize complexes.

Course Outcomes

CO1: Achieve the expertise in determining pH, conductivity, unknown concentration of solutions and rate constants of reactions.
CO2: Acquire the ability to synthesize metal complexes.

Chemical Kinetics:

1. Catalytic Decomposition of Hydrogen Peroxide.
2. Acid catalyzed hydrolysis of methyl acetate.
3. Kinetic study of oxidation of I^- by $K_2S_2O_8$.

Colorimetry:

4. Determination of Dichromate and Permanganate in a mixture using Beer Lambert's Law.
5. Job's Method for the determination of ferric thiocyanate complex.

pH metry:

6. Titration of strong acid Vs strong base.
7. Determination of ionization constant of acetic acid by pH metric method.

Preparation of Complexes:

8. To prepare a complex of tetraammine copper II sulphate complex.
9. To prepare a complex of chloropentaamminecobalt III chloride.
10. To prepare a complex of hexammine nickel II chloride.

References

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
2. Svehla, G, *Vogel's Qualitative Inorganic Analysis:* Pearson Education, 2012.
3. Mendham, J, *Vogel's Quantitative Chemical Analysis:* Pearson, 2009.

Chairperson
Board of Studies in Che
Dept of Chemistry
Osmania University, Hyd

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

6. **Syllabus Focus**

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

Local /Regional/National /Global Development Needs	Relevance
Local	Knowledge of chemistry of complexes helps in everyday life
Regional	Learning the concepts of surface chemistry and pericyclic reactions changes their perspective towards various processes
National	Through Knowledge of spectral interpretation opens new horizons in skill development and employability
Global	A complete idea of complexes and spectral interpretation increases students inclination towards research

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD EMP	Module 1 synthesis of complexes	Some complexes are synthesized in the Lab.Many metal complexes are widely used in the pharmaceutical companies.This enhances their skill development and employability.
SD	Module 3 Spectral interpretation	Students are taught the instrumentation of all the spectroscopic methods, they are taken to various research labs to show live instrumentation techniques. They are thoroughly trained in spectral interpretation by giving assignments.

7. **Pedagogy**

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1.	Field trips	Students are taken to various institutes like IICT, HCU, IIT , ARCI etc
2.	Role play	Students are made to enact various concepts of chemistry
3.	Seminars/ workshops/ research projects	Students are allowed to participate in seminars and workshops organized in and

Chairperson Board of Studies in Chemistry Dept of Chemistry Osmania University, Hyd-07.

Head Department of Chemistry UCS, Osmania University Hyderabad-500 007.

		outside the college. They are encouraged to take up research projects.

8. Course Assessment Plan

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

CO	Continuous Internal Assessments CIA - 50%	End Semester Examination-50%
CO1	CIA 1 written exam (10 M)	Written Exam
CO2	Skill Test 1 (10 M)	
CO3	CIA 1 written exam (10 M)	
CO4	Skill Test 2 (10 M)	

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016

(An Autonomous College Affiliated to Osmania University)

Faculty of Science – Department of Chemistry

MODEL PAPER

B.SC. II YEAR SEMESTER -VI

ADVANCED CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/601**

Max. Marks: 50

SECTION –A (Essay Questions)

I. Answer the following **4X10 =40 Marks**

1. a) Describe the structure of $[Cu(NH_3)_4]$ using Valence bond theory. (CO1) **L1** 5M
   b) Define optical isomerism? Draw and explain the optical isomerism in octahedral complexes. (CO1) **L1** 5M

OR

2. a) Summarise Werner's theory with examples. (CO1) **L2** 5M
   b) Explain the Crystal field splitting in octahedral complexes. (CO1) **L5** 5M
3. Outline the mechanism of SN^1 in the octahedral and SN^2 in square planar complexes with one example each. (CO2) **L2** 10 M

OR

4. a) Define trans effect? Discuss the theories and applications of trans effect. (CO2) **L2** 5M
   b) Distinguish labile and inert complexes? Explain with examples. (CO2) **L4** 5M
5. a) What is the chemical shift? Explain the change in position of signals with examples. (CO3) **L1** 5M
   b) Elaborate about (M+1), (M+2) and base peaks with two examples in Mass spectrometry. (CO3) **L6** 5M

OR

6. a) Indicate the number of signals possible for CH_3-CH_2-CH_2-OH and explain spin- spin splitting. (CO3) **L6** 5M
   b) Explain the basic principles of ESR spectroscopy. (CO3) **L5** 5M
7. a) Classify the various types of colloids? (CO4) **L5** 5M
   b) Deduce the expression for Langmuir adsorption isotherms. (CO4) **L5** 5M

OR

8. What are Flourescence and Phosphorescence ? Explain the phenomenon of florescence and phosphorescence using Jablonski diagram. 10M

SECTION – B (Short answer questions)

II. Answer any four questions. **4 X 5 = 20 Marks**

9. Explain the Job's method of determination of composition of a complex. **(L2)**
10. What is EAN? Calculate the EAN for [Co(NH3)6] and [FeF6]3- **(L1)**
11. Describe the acid hydrolysis of octahedral complexes. **(L2)**
12. Define Hardy Schulze rule and Gold number. **(L1)**
13. Show how the molecular formula of a compound is determined based on its Mass spectrum? **(L1)**
14. Discuss the quantum yield for the photochemical combination of H_2& Cl_2 to form HCl **(L5)**

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyderabad.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

11. Describe the acid hydrolysis of octahedral complexes. **(L2)**
12. Define Hardy Schulze rule and Gold number. **(L1)**
13. Show how the molecular formula of a compound is determined based on its Mass spectrum? **(L1)**
14. List out the various types of NMR signals expected for 1,1,2-tribromoethane? What is the intensity ratio of the peaks? **(L1)**

c. **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	20
2	15	2	2	10	1	15
3	15	3	2	10	2	20
4	15	4	2	10	1	15

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (Hrs)
1	2,5	Understanding	15
2	1,7	Applying & Analysing	15
3	2,7	Remembering	15
4	4	Creating & Evaluating	15

Prepared by	Checked & Verified by	Approved by
Madhuri	D. Sumalatha	
Name and Signature of the teaching faculty Y. Lakshmi madhuri	Name and Signature of the HoD Dr. D.Sumalatha	Name and Signature of Principal Dr. Uma Joseph

Chairperson
Board of Studies in Chem.
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016

(An Autonomous College Affiliated to Osmania University)

Faculty of Science – Department of Chemistry

B.SC. III YEAR SEMESTER -VI

ADVANCED CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/601**

Max. Marks: 50 **Credits: 4**

SECTION A - INTERNAL CHOICE		4 X 10 M = 40M		
Question Number	**Question**		**CO**	**BTL**
1	**Module 1**	(a) Describe the structure of [Cu(NH3)4] using Valence bond theory. 5M (b) Define optical isomerism? Draw and explain the optical isomerism in octahedral complexes. **OR**	**CO1**	**Level 1**
2	**Module 1**	(a) Summarise Werner's theory with examples. (b) Explain the Crystal field splitting in octahedral complexes.	**CO1**	**Level I**
3	**Module 2**	Outline the mechanism of SN^1 in the octahedral and SN^2 in square planar complexes with one example each. 10 M **OR**	**CO2**	**Level 2**
4	**Module 2**	(a) Define the trans effect? Discuss the theories and applications of trans effect. (L1) 5M (b) Distinguish labile and inert complexes? Explain with examples. (L4) 5M	**CO2**	**Level 2**
5	**Module 3**	(a) What is the chemical shift? Explain the change in position of signals with examples. 5M (b) Elaborate about (M+1), (M+2) and base peaks with two examples in Mass spectrometry 5M **OR**	**CO3**	**Level 1**
6	**Module 3**	(a) Develop the number of signals possible for CH_3-CH_2-CH_2-OH and explain spin- spin splitting. 5M (b) Explain the basic principles of ESR spectroscopy.	**CO3**	**Level 5 & 6**
7	**Module 4**	(a) Classify the various types of colloids? 5M (b) Deduce the expression for Langmuir adsorption isotherms. 5M **OR**	**CO4**	**Level 5**
8	**Module 4**	What are Flourescence and Phosphorescence ? Explain the phenomenon of florescence and phosphorescence using Jablonski diagram.	**CO4**	**Level 2**

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

Head
Department of Chemistry
UCS, Osmania University
Hyderabad-500 007.

SECTION B – (Short answer questions) ANSWER ANY 4 OUT OF 6			4 X 5M = 20 M	
9	Module 1	9. Explain the Job's method of determination of composition of a complex.	CO1	Level 2
10	Module 2	10.What is EAN ? Calculate the EAN for [Co(NH3)6] and [Fe6]3-	CO1	Level 1
11	Module 3	11. Describe the acid hydrolysis of octahedral complexes.	CO2	Level 2
12	Module 4	12. Define Hardy Schulze rule and Gold number	CO4	Level 1
13	Module 2	13. Show how the molecular formula of a compound is determined based on its Mass spectrum? (L1)	CO3	Level 1
14	Module 3	14. Discuss the quantum yield for the photochemical combination of H_2& Cl_2 to form HCl	CO4	Level 5

SEMESTER – VI

IMMUNOLOGICAL TECHNIQUES

1. Course Description

Programme: B.Sc. **Max. Hours: 30**
Course Code: U24/BIT/SEC/601 **Hours per week: 2**
Course Type: SEC 4 **Max. Marks: 50**
No. of credits: 2

2. Course Objectives:

- To learn about the immune system and its role in recognizing and responding to antigens through antibody production.
- To develop expertise in studying the principles and methodologies of various immunoassay techniques

3. Course Outcomes

On completion of the course the student will be able to:

CO1: Remember, interpret, and use the basic concepts to have a comprehensive understanding of antigen-antibody interactions and their relevance in immunology **(REMEMBER, UNDERSTAND, APPLY)**

CO2: Define, summarize, use, and analyze the knowledge, skills, and competencies to understand immunoassays effectively in various scientific and biomedical sciences **(REMEMBER, UNDERSTAND, APPLY, ANALYSE)**

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

4. Course Content:

MODULE I: ANTIGEN-ANTIBODY REACTIONS **(15 HRS)**

- Hemagglutination
- Antigen-Antibody precipitation (Ouchterlony Double Diffusion)
- Radial immunodiffusion
- Rocket immunoelectrophoretic
- DOT ELISA

MODULE II: IMMUNOASSAY TESTS **(15 HRS)**

- Western blotting
- Widal test
- C Reactive protein test
- Pregnancy test

5. Reference Books:

1. Practical Immunology by Nicholas J. Stevens and Christine L. Tinckam
2. Experimental Immunology" by Ivan M. Roitt, Peter J. Delves, and Abdul K. Abbas
3. Basic Immunology: Functions and Disorders of the Immune System" by Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai
4. Immunological Methods" by Ivan Lefkovits and Benjamin Pernis
5. Manual of Molecular and Clinical Laboratory Immunology" by Barbara Detrick, Robert G. Hamilton, and John L. Schmitz
6. Handbook of Practical Immunohistochemistry: Frequently Asked Questions" by Peter J. T. Verstappen
7. Methods in Molecular Biology: Immunocytochemical Methods and Protocols" edited by Lorette C. Javois
8. Manual of Clinical Immunology" by N. R. Rose, H. G. Herskowitz, and C. S. R. R. Detrick
9. Flow Cytometry Protocols" edited by Teresa S. Hawley and Robert G. Hawley
10. Essentials of Clinical Immunology" by Helen Chapel, Mansel Haeney, Siraj Misbah, and Neil Snowden

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global (Module 1,2)	The curriculum for Immuno-techniques has applications in medical diagnostics and vaccine development. It also has broad applicability and global relevance across diverse fields, including healthcare, research, and environmental science, contributing significantly to advancements in science, medicine, and public health worldwide

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Exploring mechanisms of antigen-antibody interactions	Students gain theoretical and practical knowledge of antigen antibody interactions through hands on training.
Employability	Performing tests related to immunoassays	Students acquire knowledge on immunoassay techniques which make them employable in healthcare sectors.

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

7. Course Assessment Plan

a) Weightage of Marks in Formative and Summative Assessments

Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CIA-20 marks Mini project/ Problem solving/Case studies/ Written test	End Semester exam-30 Marks

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

b) Question Paper Pattern

EXTERNAL- MODEL QUESTION PAPER

Course Code: U24/BIT/SEC/601 **Max Time: 1 Hr**
Credits: 2 **Max. Marks: 30**

I. Major **(15M)**

Discuss in detail about Rocket immuno-electrophoresis technique. Perform the experiment and report the results.

II. Minor/ Spotters **(10M)**

Perform pregnancy test and report the result/ Identify the given spotters

III. Record **(5M)**

Prepared by	Checked & verified by	Approved by
4/3/24 (Dr. A.S. Pooja)	4/3/24 (Ms. Shouni Nivedita)	
Name and Signature of the teaching faculty	Name and Signature of HoD	Name and Signature of Principal

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

SEMESTER –VI
SEC-IV MATERIAL SCIENCE AND CATALYSIS

1. Course Description

Programme: B.Sc.
Course Code: U24/CHE/SEC/601
2 Type of course: SEC
No. of credits: 2

Max. Hours: 30
Hours per week:
Max. Marks: 50

2. Course Objectives:

- To provide students with a comprehensive understanding of catalysis at nanoscale with a focus on the unique properties.
- To equip students with application of catalysts including both homogeneous and heterogeneous types and their role in chemical processes and industries.

3. Course Outcome:

CO 1: Gain foundation in the principles of catalysis and apply at nanoscale.
CO 2: Identify and explain the mechanisms of catalytic reactions including the role of active sites and reaction pathways.

This SEC paper will help students to enhance their overall skills.

Chairperson
Board of Studies in Che...
Dept of Chemistry
Osmania University, Hyd-07.

4. Course Content:

Module I: NANOMATERIALS AS CATALYSTS **15 Hrs**

Introduction: Nanocatalyst-A New Fangled material in the Catalytic World, Challenges to Nanocatalysts, Types of Nanocatalysis.Types of Nanocatalysts, Metal Nanoparticles as Catalysts, Metal Oxide Nanoparticles as Catalysts.

Carbon Family Nanomaterials as Nanocatalyst, other Nanomaterials as Nanocatalysts, Size and Shape, Effect of Nanoparticles on Catalytic Activity, Mechanism of Nanocatalysis

Green Nanocatalysis, Nanocatalysis and the Prospects of Green Chemistry, Some Examples of Nano Catalytic Green Reactions, Recoverability and Recycling of Nanocatalysts.

Applications of Nanocatalysts, nanocatalysts and multicomponent reactions.The concept of nanoreactor photocatalysis.

Module II: CATALYSIS **15 Hrs**

Introduction: Definition of a catalyst and catalysis. Homogeneous and heterogeneous catalysis- Comparison of homogeneous and heterogeneous catalysis with specific examples. General characteristics of catalytic reactions.

Acid-base catalysis- Examples of acid and base catalysed reactions- Hydrolysis of esters and Aldol condensation. Kinetics of acid catalysed reactions. Specific acid and general acid catalysis, Specific base and general base catalysis. Effect of pH on reaction rate of acid and base catalysed reactions.

Phase transfer catalysis: Principle of phase transfer catalysis, classification of phase transfer catalysts. Factors influencing the rate of PTC reactions.

Enzyme catalysis, Characteristics of enzyme catalysis, Examples: (i) Invertase in inversion of cane sugar (ii) Maltase in conversion of maltose to glucose (iii) Urease in decomposition of urea and (iv) Zymase in conversion of glucose to ethanol. Factors affecting enzyme catalysis. Effect of temperature, pH, concentration and inhibitor on enzyme catalysed reactions. Michaelis Menten equation.

5. References:

- T. Pradeep *Nano: The Essentials*, McGraw-Hill Education.
- CNR Rao et.al. *Chemistry of nanomaterials: Synthesis, Properties and applications,* Wiley-VCH Verlag GmbH & Co. KGaA.
- William D. Callister, Jr. John Wiley & Sons Materials Science and Engineering An Introduction.
- Nanotechnology: Principles and Practices by Sulabha K. Kulkarni
- Principles of Physical Chemistry by Puri, Sharma and Pathania, 2017.
- Text Book of Physical Chemistry P.L Soni, O.P Dharmaha, U.N Dash.
- Physical Chemistry by Atkins and De Paula, 8 th Edn.

8. Course Assessment Plan

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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1- Assignment	Written Exam
CO2	CIA2- Skill test	

9.

a) Weightage of Marks in Formative and Summative Assessments

Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CIA-20 marks	End Semester exam-30 Marks

Chairperson
Board of Studies in Che...
Dept of Chemist...
Osmania University, Hyd-07.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Local and regional	Products made from nanomaterials and their roles in human life.
National and global	Catalysts commonly used in industry/research for the synthesis of numerous compounds.

7. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	All	Current progress on the application of nanomaterials synthesized using Nano catalysts.
ED	All	Gives us an insight of fundamentals of catalysts and its development in the production process.
EMP	All	Research and knowledge helps in designing nanomaterials, which are all important skills for working in biotechnology, pharmaceuticals, and advanced materials.

Chairperson
Board of Studies in Chem
Dept of Chemistry
Osmania University, Hyd-07.

b) Question Paper Pattern

St. FRANCIS COLLEGE FOR WOMEN BEGUMPET HYDERABAD – 500 016 (AN AUTONOMOUS COLLEGE AFFILIATED TO OSMANIA UNIVERSITY) CHEMISTRY

Model Paper

B.Sc. III - Semester VI

SKILL ENHANCEMENT COURSE

MATERIAL SCIENCES AND CATALYSIS

Course Code: U24/CHE/SEC/601

Time: 1 Hr
Max. Marks: 30

SECTION A - Answer any six questions 6 x 5 = 30 Marks

Question Number	MODULE	Question	CO	BTL
1	Module 1	What are the different Types of Nanocatalysis?	CO 1	(Level IV)
2	Module 1	Explain the Mechanism of Nanocatalysis.	CO 1	(Level II)
3	Module 1	Write a note on Prospects of Nanocatalysis in Green Chemistry with examples.	CO 1	(Level I)
4	Module 1	Explain any 4 applications of Nanocatalysis.	CO 1	(Level I)
5	Module 2	Define catalysis. Give the characteristics of catalysis.	CO 2	(Level I)
6	Module 2	Derive Michaelis - Menten Equation.	CO 2	(Level IV)
7	Module 2	Discuss the principle of Phase transfer Catalysis.	CO 2	(Level II)
8	Module 2	Explain the kinetics of Acid-catalyzed reactions.	CO 2	(Level IV)

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

SEMESTER - VI

MEDICAL BIOTECHNOLOGY

1. **Course Description**
   Programme: BSc
   Course Code: U24/BIT/DSE/601
   Course Type: DSE-IIA
   No. of credits: 4

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

2. **Course Objectives**
   - To interpret and apply the knowledge in diagnosis of various common inherited human diseases.
   - To assess the role of various modern biotechnological approaches for a therapeutic strategy in regenerative medicine and pharmacogenomics.

3. **Course Outcomes:**

On completion of the course the student will be able to:

CO1: Identify and explain the process of gene therapy as a therapeutic approach towards regenerative medicine and assess the molecular markers in prognosis of the disease. **(REMEMBER, UNDERSTAND, EVALUATE)**

CO2: Summarize and analyze the consequences of structural and numerical chromosomal aberrations in the development of genetic disorders and implement various prenatal tests in diagnosis. **(UNDERSTAND, APPLY, ANALYZE)**

CO3: Summarize, adapt, and assess human genome project and various DNA sequencing techniques. **(UNDERSTAND, APPLY, EVALUATE)**

CO4: Describe, demonstrate high throughput analysis of gene functions by microarray, immune techniques, and device methods to silence genes by antisense therapy. **(UNDERSTAND, APPLY, CREATE)**

4. Course Content

MODULE I: INTRODUCTION TO MEDICAL BIOTECHNOLOGY AND THERAPEUTIC APPROACHES FOR HUMAN DISESASES (16Hrs)

- Introduction and scope of medical biotechnology: Applications of medical biotechnology in the field of pharmacology, stem cell, tissue engineering, gene therapy
- Gene therapy– background, types of gene therapy-somatic and germ cell gene therapy, augmentation therapy, ex vivo & in vivo gene therapy.
- Vectors in gene therapy-retrovirus, adenovirus, adeno-associated virus vector system1hr
- Non-viral systems-human artificial chromosome, lipoplexes, pure DNA construct, DNA molecular conjugates.
- Gene therapy for SCID, AIDS, cancer, familial hypercholesterolemia, lesch-nyhan syndrome,hemophilia.
- Clinical research-trials, phases, patient recruitment and participation, outcome, legal and ethical issues.
- SNP's: DNA based drugs (pharmacogenomics), difference in drug response, single nucleotide polymorphism, CYP2D6 Gene, KRAS gene, TPMT Gene polymorphisms.
- Molecular markers- RFLP, RAPD, STRs and their applications

MODULE II: GENETIC DISORDERS AND GENETIC COUNSELLING (16Hrs)

- Human cytogenetic- chromosome structure, preparing a Karyotype
- Chromosome banding: G,R, C, Q,T banding techniques, FISH
- Genetic disorders:numerical and structural aberrations
- Autosomal and Sex-linked disorders:Cystic Fibrosis,Tay Sachs, Klinefelter's, hemophilia,Turner's syndrome.
- Mitochondrial diseases:LHON,MERRF
- Prenatal testing & significance: Ultrasonography, Amniocentesis, Chorionic villus sampling
- Fetal blood cells in maternal blood, maternal serum alpha-fetoprotein, maternal serum beta-HCG.
- Genetic counseling: Role of genetic counselor, pedigree analysis, modes of inheritance and its importance.

MODULE III: HUMAN GENOME ANALYSIS (14Hrs)

- Human Genome Project (HGP) – an overview of the project, goals of the project, major scientific strategies & approaches used in HGP.
- About the organizations behind this project, major highlights of human genome, genes present in human genome, genome of some other organisms sequenced.
- Expected scientific & medical benefits of this project.
- DNA sequencing - Maxam and Gilberts-sequencing method and limitations.
- Sanger's dideoxy sequencing-sequencing method, benefits and limitations.
- Alternate methods of DNA Sequencing- pyrosequencing.

MODULE IV: DNA TECHNOLOGY AND APPLICATIONS (14Hrs)

- High throughput analysis of gene function-DNA chips/DNA microarrays technique, application, and future of DNA chips.
- Antisense therapy- antisense oligonucleotides as therapeutic agents, RNA interference, application in slow ripening of tomato, antisense therapy for cancer and AIDS.
- Gene knock out technique-Loss of function of gene, applications.
- Immuno-techniques: Immuno florescence, Immunohisto-chemistry, RIA, ELISA (HIV)

5. Reference books

1. Peter D. Turnpenny and Ellard S.(2007). *Elements of Medical Genetics*, Philadelphia: Elsevier
2. Glick, B. R. and Pasternak. (2002). *Molecular Biotechnology: Principle and applications of recombinant DNA*: ASM Press.
3. Ramasamy, P.(2002). *Trends in Biotechnology*, University of Madras: Pearl press.
4. Trevan. (2001). *Biotechnology*: Tata McGraw-Hill.
5. Jogdand, S. N. (2000). *Medical Biotechnology*: Mumbai. Himalaya Publishing house,.
6. Jenkins, N (Ed) (1999). Animal *cell biotechnology: Methods and Protocols,* New Jersey: Humana press.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global (Modules 1,3, & 4)	Medical biotechnology is essential for meeting the needs of global healthcare development because it fosters innovation, expands access to care, and addresses major genetic diseases in humans.
National (Module 2)	Planning for public health, developing the economy, improving healthcare, and advancing ethics are all benefited by genetic counselling and testing leading to long-term advantages to national healthcare systems.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill development	Module 1	Case studies on Clinical trials and gene therapy techniques
Employability	Module 2	Role plays as genetic counsellor and a medical practitioner, assessing various genetic counselling cases
Entrepreneurship development	Modules 3 & 4	Visit to reputed biotech labs/companies to understand various biotechnological tools and equipment used in health care and medicine.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	Participative Learning	Seminar
2.	Participative Learning	Presentation
3.	Experiential Learning	Science experiments
4.	Participative Learning	Group Discussion
5.	Experiential Learning	Research Projects
6.	Experiential Learning	Internship opportunities
7.	Problem Solving	Case Studies

8. Course Assessment Plan

a) 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 Assignment/Case study/Group discussion/Case study	
CO3	CIA-2 Written Exam	
CO4	CIA-2 Assignment/Presentation	

b) Model Question Paper- End Semester Exam

MODEL QUESTION PAPER- THEORY

Course Code: U20/BIT/DSE/601
Credits: 4

Max Marks: 60
Time: 2 Hrs

SECTION – A

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

1. How can you explain the method of Gene therapy with suitable examples.

OR

2. How can you assess the importance of RAPD as molecular marker in plant forensic
3. How would you use various chromosome banding techniques in studying the structure of chromosome.

OR

4. How can you identify chromosomal anomalies by prenatal diagnosis. Add a note on its advantages and limitations
5. How would you summarise the human genome project. Outline its main objectives and outcome.

OR

6. How would you use Sanger's method of DNA sequencing. Write its applications and limitations
7. How would you study gene expression by DNA microarray Technology? Add a note on its applications.

OR

8. How can you elaborate on antisense RNA therapy? Explain its importance in slow ripening of fruits.

SECTION – B

II. Answer any <u>four</u> of the following **4 x 5 = 20 M**

9. Define SNP's and its role in disease diagnosis.
10. How would you describe the stages in Clinical trials?
11. What approach would you use in Genetic Counselling?
12. How would you apply Pyrosequencing to study DNA sequence.
13. How could you modify gene expression by Gene Knock out technique
14. How would you use ELISA as a diagnostic tool.

SEMESTER-END MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE 4 Q X 10 M = 40 M				
Question Number	**Question**	**Question**	**CO**	**BTL(Blooms Taxonomy Level)**
1	Module 1	How can you explain the method of Gene therapy with suitable examples.	CO 1	II
2	Module 1	How can you assess the importance of RAPD as molecular marker in plant forensic	CO 1	V
3	Module 2	How would you use various chromosome banding techniques in studying the structure of chromosome	CO 2	III
4	Module 2	How would you use various chromosome banding techniques in studying the structure of chromosome	CO 2	IV
5	Module 3	How would you summarize the human genome project. Outline its main objectives and outcome.	CO 3	II
6	Module 3	How would you use Sanger's method of DNA sequencing. Write its applications and limitations	CO 3	III
7	Module 4	How would you study gene expression by DNA microarray Technology? Add a note on its applications	CO 4	III

8	Module 4	How can you elaborate on antisense RNA therapy? Explain its importance in slow ripening of fruits.	CO 4	VI

SECTION B - ANSWER ANY 4 OUT OF 6
4Q X 5 M = 20 M
(To compulsorily have **ONE** question from **each** module)

9	Module 1	Define SNP's and its role in disease diagnosis	CO 1	I
10	Module 2	How would you describe the stages in Clinical trials?	CO 2	II
11	Module 2	What approach would you use in Genetic Counselling	CO 2	III
12	Module 3	How would you apply Pyrosequencing to study DNA sequence.	CO 3	III
13	Module 4	How could you modify gene expression by Gene Knock out technique	CO 4	VI
14	Module 4	How would you use ELISA as a diagnostic tool	CO 4	III

SEMESTER-VI

MEDICAL BIOTECHNOLOGY- PRACTICAL

1. Course description

Programme: B.Sc

Course Code: U24/BIT/DSE/601/P

Course Type: DSE-IIA

No. of credits: 1

Max. Hours: 30

Hours per week:2

Max. Marks: 50

2. Course Objective:

- To illustrate. analyze and compare various karyograms and interpret pedigree charts of genetic disorders.

3. Course Outcomes:

On completion of the course the student will be able to:

CO1: To interpret and apply basic skills in the construction of karyogram for human chromosome sets. **(UNDERSTAND, APPLY)**

CO2: To describe, analyze and assess inheritance patterns by constructing pedigrees and determining clotting & bleeding time **(UNDERSTAND, ANALYZE, EVALUATE)**

PRACTICAL SESSIONS

1. PTC testing to prove monogenic inheritance.
2. Preparation of karyogram /ideogram for normal male, female, Down's syndrome, Klienfelter's, Turners and Edwards syndrome.
3. Determination of bleeding and clotting time.
4. Pedigree analysis for genetic disorders-preparation of pedigree charts for tongue rolling, ear six lobes, blood groups, colour blindness.
5. Genetic counseling- case studies.
6. RAPD analysis
7. RFLP analysis
8. Comet assay

Spotters:

1. Identify the karyotype (Down's syndrome)
2. Identify the karyotype (Klinefelter syndrome)
3. Chromosomal banding technique
4. Identify the inheritance pattern of pedigree (autosomal disorder)
5. Identify the inheritance pattern of pedigree (allosomal disorder)
6. Prenatal diagnosis- invasive technique
7. Prenatal diagnosis- non-invasive technique
8. Identify the type of gene therapy- ex vivo or in vivo
9. ELISA technique
10. Identify the SNP genotypes of different samples after performing PCR-RFLP
11. Count the viable cells on Neubauer chamber (hemocytometer)

SEMESTER-VI

MEDICAL BIOTECHNOLOGY- PRACTICAL

Course Code: U24/BIT/DSE/601/P **Max. Marks: 50**

Credit: 1 **Time: 2Hrs**

I. MAJOR: (20M)

Determine the Bleeding and Clotting time of the given blood sample. Write the principle and procedure. Report the results

II. MINOR: (10M)

Deduce the given problems on pedigree analysis

III. IDENTIFY THE GIVEN SPOTTERS: (10M)

IV. VIVA (5M)

V. RECORD (5M)

Prepared by	Checked & verified by	Approved by
4/3/24 (V. Deepa Sowjitha) Name and Signature of the teaching faculty	4/3/24 (Ms. Shouni Nivedita) Name and Signature of HoD	Name and Signature of Principal

SEMESTER –VI

PHARMACEUTICAL BIOCHEMISTRY

1. Course Description:

Programme : B.Sc.
Course Code : U24/BIC/DSE/602
Type of course: DSE 2B
No. of credits : 4

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

2. Course Objectives:

1. The students will be able to explore the dimensions of applied Biochemistry.
2. Students will be ready for Industries like pharmaceutical R & D, Clinical Trials.

3. Course Outcome: This course will help students in –

CO1: List and Define the principles of pharmacology and pharmaceutical biochemistry. (L 1 & 2)

CO2: Summarise and Illustrate the biochemical approach to principles of drugs and drug Mechanism (L 2 & 3)

CO3: Infer the benefits of drug components and adverse drug effects. (L4)

CO4: Assess conceptual knowledge dimensions of drugs their benefits and adverse effects. (L5)

4. Course Content

Module I: INTRODUCTION TO PHARMACOLOGY **(15 hrs)**

Introduction to Pharmacology and pharmaceutical biochemistry. Blood-Buffer System. Biological Membranes and transport systems. History of Drugs, Sources and Classification of drugs Drug nomenclature. Essential Medicines (Drugs) Concept.

Module II: PHARMACOKINETICS **(15 hrs)**

Absorption, Bioavailability & Distribution of drugs. Routes of drug administration. Biotransformation – Metabolism of Drugs. Inhibition of Drug Metabolism. Overview of drugs as inhibitors to enzymes ACE , leukotrienes, Lipoxygenase, Cycloxygenase, DNA Polymerase Inhibitors, HIV - Protease /Reverse Transcriptase, Integrase) . Excretion & Kinetics of Elimination.

Module III: PHARMACODYNAMICS **(15 hrs)**

Principles &Mechanism of Drug action though Chemicals, Enzymes (Stimulation and Inhibition), Receptors. (Drug Receptor Interaction) Drug-dose response, combined effect of Drugs, Drug Dosage. Factors modifying Drug action.

Introduction to Chemotherapy, Miscellaneous drugs & essential drugs – their therapeutic uses & biochemical/ metabolic relevance. Role of vaccines and sera in pharmaceutics.

Module IV: ADVERSE DRUG EFFECTS **(15 hrs)**

Adverse responses – Side effects, Secondary effects, Toxic effects, Intolerance, Idiosyncrasy, and Allergy of drugs. (Mechanisms and Types of allergic reactions). Photosensitivity due to drugs. Drug Dependence – Drug abuse and addiction. Drug withdrawal reactions, Teratogenicity, Carcinogenicity, Mutagenicity. Drug induced Diseases.

5. Reference Books:

1. Essentials of Medical Pharmacology by K D Tripathi.
2. The Pharmacology volume I and II –Goodman and Gillman
3. Essentials of Pharmaceutical biochemistry including practical exercises (EDN 2) by HarbansLal, International Edition, 2019
4. Biochemistry for the pharmaceutical sciences by Charles P. Woodbury, 2011
5. Pharmacology and Pharmatherapeutics – R.S.Satoskar,S.D.Bhandhakarand
6. Lippincotts illustrated review Pharmacology
7. Clinical Chemistry by Bishop, Duben- Engelkirk&Fody.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
National	It plays a crucial role in supporting the quality, safety, and efficacy of pharmaceuticals, within India.
Global	The principles of pharmacology are applicable universally.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Employability	Module 2 & 3	Practicals

7.Pedagogy

S.No	Type/Description of activity	Student Centric Methods Adopted
1.	Seminar Presentation	Participative Learning
2.	Science Experiments	Experiential Learning
3.	Industrial training	Experiential Learning

8. Course Assessment Plan

a) Weightage of Marks in Formative and Summative Assessments

COs	Formative Assessment - FA (40%)	Summative Assessment -SA (60%)
CO1	CIA-1	End Semester exam
CO2	CIA-1	
CO3	CIA-2 Presentation/Case Studies/Video M aking.	
CO4	CIA-2 Quiz/Assignment	

b) Model Question Paper

PHARMACEUTICAL BIOCHEMISTRY

Code: U24/BIC/DSE/602 **Max Marks: 60**
Credits: 4 **Time: 2 Hrs**

I. Answer the following questions **(4x10=40M)**

1. (a)Discuss biological membrane transport systems.
   (OR)
   (b) Explain sources and classification of Drugs.

2. (a)Discuss routes of drug administration with examples
   (OR)
   (b)Demonstrate role of drugs as enzyme inhibitors with examples.

3. (a) Categorise factors modifying drug action.
   (OR)
   (b) Analyze essential drugs and their metabolic relevance.

4. (a)Assess adverse drug responses in brief.
   (OR)
   (b) Hypothesise on drug abuse and addiction.

II. Write Short notes on any 4 questions **(4x5=20 M)**

5. Blood buffers
6. Pharmacology
7. Drug excretion
8. Cycloxygenase
9. Drug dosage
10. Chemotherapy

GUIDELINES FOR MODEL PAPER SETTING AS PER BLOOMS TAXONOMY LEVEL (BTL)

DSE 2B: Pharmaceutical Biochemistry

SECTION A - INTERNAL CHOICE (4 X 10 M = 40 M)				
Question Number	**Question**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	**Module 1**	Discuss biological membrane transport systems.	**CO 1**	**2**
2	**Module 1**	Explain sources and classification of Drugs.	**CO 1**	**2**
3	**Module 2**	Discuss routes of drug administration with examples	**CO 2**	**2**
4	**Module 2**	Demonstrate role of drugs as enzyme inhibitors with examples.	**CO 2**	**3**
5	**Module 3**	Categorise factors modifying drug action	**CO 3**	**4**
6	**Module 3**	Analyze essential drugs and their metabolic relevance.	**CO 3**	**4**
7	**Module 4**	Assess adverse drug responses in brief.	**CO 4**	**5**
8	**Module 4**	Hypothesise on drug abuse and addiction.	**CO 4**	**5**
SECTION B - ANSWER ANY 4 OUT OF 6 (4Q X 5M = 20M) (To compulsorily have **ONE** question from **each** module)				
9	**Module 1**	Blood buffers	**CO 1**	**1,2**
10	**Module 1**	Pharmacology	**CO 2**	**1,2**
11	**Module 2**	Drug excretion	**CO 3**	**2,3**
12	**Module 2**	Cyclooxygenase	**CO 4**	**2,3**
13	**Any Module**	Drug dosage	**CO 3**	**4**
14	**Any Module**	Chemotherapy	CO 4	**5**

PHARMACEUTICAL BIOCHEMISTRY
PRACTICAL

1. Course Description:

Programme : B.Sc.
Course Code : U24/BIC/DSE/602/P
Type of course : DSE
No. of credits : 1

Max. Hours: 30
Hours per week:2
Max. Marks: 50

2. Course objective:

Prepare students for Industries like pharmaceutical R & D and Clinical Trials.

3. Course Outcome:

This course will help the students to-

CO1: Enhance knowledge on drug labels.

CO2: Analyse various components of pharmaceuticals

PRACTICAL SESSIONS

1. Phytochemical screening of a medicinal plant.
2. Qualitative Analysis of Phytochemicals
3. Estimation of Total Phenols by Folin – Ciocalteau method.
4. Estimation of Flavonoids and assessment of its medicinal role
5. Determination of Antioxidant enzyme – catalase.
6. Estimation of Bilirubin by Vanden Bergh reaction
7. Kidney Function Test & calculation of clearance.
8. Preparation of ORS.
9. Preparation of Condy's Lotion.
10. Understating drug label and drug composition
11. Case study

MODEL QUESTION PAPER
PRACTICAL

Course Code: U24/BIC/DSE/602/P
Credits: 1

Max Time: 2 Hrs
Max. Marks: 50

Answer the following:

1. Write the principle involved in the estimation of total phenols by Folin's method. (5 M)
2. Write the procedure in the preparation of ORS. (5M)
3. Estimate the concentration of the Phenols by Folin's method. (20 M)
   Conc. of Phenol Standard = 100µg/ml
4. Identify the secondary metabolite in the given sample. (10 M)
5. Viva (5 M)
6. Record (5 M)

Prepared by Course Teacher [Name & Signature]	Checked &verified by HOD [Name & Signature]	Approved by the Principal
S. Kavitha	21/12/24 (S. Malathi Varma) HOD Biochemistry St. Francis College for Women Begumpet, Hyderabad-16.	

Professor Karuna Rupula
Department of Biochemistry
University College of Science
Osmania University
Hyderabad-500 007 (TS)

SEMESTER –VI

PLANT BIOCHEMISTRY

1. Course Description

Programme : B.Sc.
Course Code : U24/BIC/DSE/601
Type of course: DSE 2A
No. of credits : 4

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

2. Course Objectives:

1. Inculcate knowledge of Plant cell structure, plant hormones, and secondary metabolites in students.
2. Enhance the skills of plant tissue culture techniques.

3. Course Outcomes: It helps the graduates to-

CO 1: Interpret the detail structure of the plant cell and basic cycles that are essential for their survival. (L2)

CO2: Illustrate the knowledge of various metabolic reactions and the uses of secondary metabolites. (L3)

CO3: Infer & assess the knowledge of various plant hormones. (L4,5)

CO4: Plan the techniques to execute plant cell culture experiments. (L6)

4. **Course Content –**

Module I: PLANT CELL STRUCTURE & PHOTOSYNTHESIS **(15 hrs)**

Plasma membrane, vacuole and tonoplast membrane, cell wall, plastids and peroxisomes, Photosynthetic pigments, absorption and action spectra, Red drop and Emerson Enhancement effect, concept of two photosystems, Light reactions. Cyclic and non-cyclic photophosphorylation. Dark reactions, Calvin cycle and regulation; C4 cycle and Crassulacean acid metabolism (CAM), Photorespiration

Module II: NITROGEN METABOLISM AND SECONDARY METABOLITES (15 hrs)

Nitrogen Cycle. Nitrogen Metabolism: Mechanism and Regulation of Utilization of Ammonia, Nitrate and other Nitrogen Sources, Nitrogen Fixation: Mechanism and Regulation of Nitrogen Fixation, Symbiotic and Asymbiotic Nitrogen Fixation and Biochemistry of Nitrogenase.

Representatives of alkaloid group and their amino acid precursors, function of alkaloids,

Examples of major phenolic groups: flavonoids, tannins and lignin, biological role of plant phenolics.

Module III: PLANT HORMONES AND STRESS PHYSIOLOGY **(15 hrs)**

Introduction to plant hormones and their effect on plant growth and development. Structure, Function and commercial applications of Auxins, Gibberellins, Cytokinins, Abscissic acid, Ethylene and Brassino steroids and their derivatives.

Responses of plants to biotic stress (pathogen and insects) HR and SAR mechanisms and abiotic stress (water, temperature and salt) Drought tolerance mechanisms.

Module IV: PLANT TISSUE CULTURE **(15hrs)**

Cell and tissue culture techniques, types of cultures: organ and explant culture, callus culture, cell suspension culture and protoplast culture. Plant regeneration pathways: organogenesis somatic embryogenesis. Applications of cell and tissue culture and soma clonal variation

5. **Reference Books:**

1. Caroline Bowsher, Martin steer, Alyson Tobin Plant Biochemistry (2008), Garland Science ISBN 9780-8153-4121-5
2. Buchanan: Biochemistry and molecular Biology of plant. (2005) 1 edition. I K International, ISBN-10: 8188237116, ISBN-13: 978-8188237111.
3. P.M Dey and J.B. Harborne; (1997): Plant Biochemistry, Academic Press ISBN-10:0122146743
4. Robert H. Smith , Plant Tissue Culture, Techniques and Experiments (2005) Academic Press, 2012 ISBN 0323160476, 9780323160476

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global	Its applications extend to various fields, making it a crucial area of study with significant global relevance.
National	It holds national relevance by contributing to enhanced agricultural productivity, and advancements in research.

b) Components on Skill Development/Entrepreneurship development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module 4	Hands on practicals on Plant tissue culture

7. Pedagogy

S.No	Type/Description of activity	Student Centric Methods Adopted
1.	Field trips	Experiential Learning
2.	Research projects	Problem Solving
3.	Workshops	Participative Learning

8. Course Assessment Plan

a) Weightage of Marks in Formative and Summative Assessments

COs	Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CO1	CIA-1	End Semester exam
CO2		
C03	CIA-2 Presentation/ Model making/Quiz/ Assignment	
C04	CIA-2 Objective test	

b) Model Question Paper

PLANT BIOCHEMISTRY

Code : U24/BIC/DSE/601 **Max. Marks: 60**
Credits : 4 **Time :2 Hrs**

I. Answer the following questions **(4x10=40M)**

1. (a)Describe the fluid Mosaic model of Plasma Membrane.
   OR
   (b) Explain plastids & add a note on significance of peroxisomes.

2. (a)Illustrate in detail Cyclic & Non-Cyclic Photophosphorylation.
   OR
   (b)Illustrate Nitrogen Cycle with appropriate diagram.

3. (a)Analyze the mechanism of growth regulation by plant hormones.
   OR
   (b)Compare different secondary metabolites with biological significance.

4. (a)Compile various Cell & Tissue Culture Techniques.
   OR
   (b)Compose the various Plant Regeneration Pathways?

II. Write Short notes on any 4 questions **(4x5=20M)**

5.Cell Wall

6. CAM

7. Tannins & Lignins

8. Functions of Alkaloids

9. Auxins

10. Gibberlins

GUIDELINES FOR MODEL PAPER SETTING AS PER BLOOMS TAXONOMY LEVEL (BTL)

Semester V: DSE 2A- Plant Biochemistry

SECTION A - INTERNAL CHOICE (4 X 10 M = 40 M)				
Question Number	**Question**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	**Module 1**	Describe the fluid Mosaic model of Plasma Membrane.	**CO 1**	**2**
2	**Module 1**	Explain plastids & add a note on significance of peroxisomes.	**CO 1**	**2**
3	**Module 2**	Illustrate the mitochondrial electron transport chain.	**CO 2**	**3**
4	**Module 2**	Illustrate in detail Cyclic & Non-Cyclic Photophosphorylation.	**CO 2**	**3**
5	**Module 3**	Illustrate Nitrogen Cycle with appropriate diagram.	**CO 3**	**3**
6	**Module 3**	Analyze the mechanism of growth regulation by plant hormones.	**CO 3**	**4**
7	**Module 4**	Compile various Cell & Tissue Culture Techniques.	**CO 4**	**6**
8	**Module 4**	Compose the various Plant Regeneration Pathways.	**CO 4**	**6**
SECTION B - ANSWER ANY 4 OUT OF 6 (4Q X 5M = 20M) (To compulsorily have **ONE** question from **each** module)				
11	**Module 1**	Cell Wall	**CO 1**	**2**
12	**Module 1**	CAM	**CO 2**	**2**
13	**Module 2**	Tannins & Lignins	**CO 3**	**3**
14	**Module 2**	Functions of Alkaloids	**CO 4**	**3**
15	**Any Module**	Auxins	**CO 5**	**4,5**
16	**Any Module**	Gibberlins	CO5	**6**

PLANT BIOCHEMISTRY
PRACTICAL

1. Course Description:

Programme : B.Sc.
Course Code : U24/BIC/DSE/601/P
Type of course : DSE
No. of credits : 1

Max. Hours: 30
Hours per week: 2
Max. Marks: 50

2. Course Objectives:

Introduce the basic practical knowledge of plant biochemistry.

3. Course Outcome: This course will help the students to-

CO1: Assess various plant contents like pigments and secondary metabolites. (L5)

CO2: Prepare the procedure and technique of Plant tissue culture.(L6)

PRACTICAL SESSIONS

1. Estimation of Total Soluble Sugar.
2. Estimation of Total phenolic content using Folin-Ciocalteau method
3. Qualitative Analysis of Phytochemicals
4. Estimation of Carotene.
5. Estimation of Lycopene content of tomato.
6. Estimation of Pectin Substances as Calcium Pectate
7. Determination of Antioxidant activity by DPPH method.
8. Separation of Plant pigments by Thin Layer Chromatography
9. Determination of Catalase Enzyme activity
10. Plant tissue culture (Demo)

MODEL QUESTION PAPER
PRACTICAL

Course Code: U24/BIC/DSE/601/P **Max Time: 2 Hrs**
Credits: 1 **Max. Marks: 50**

Answer the following:

1. Write the principle involved in the estimation of total phenol by Folin-Ciocalteau Method (5M)
2. Estimate the concentration of total phenol by Folin-Ciocalteau Method.
   Conc of Std. Catechol = 10 µg/ml (20M)
3. Identify the given Phytochemicals in the given sample. (15M)
4. Viva (5M)
5. Record (5M)

Prepared by Course Teacher [Name & Signature]	Checked &Verified by HOD [Name & Signature]	Approved by the Principal
	21/2/24 (S. Malathi Varma) HOD Biochemistry St. Francis College for Women Begumpet, Hyderabad-16.	

Professor Karuna Rupula Department of Biochemistry University College of Science Osmania University Hyderabad-500 007 (TS)

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016

(An Autonomous College Affiliated To Osmania University)

FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY

THEORY SYLLABUS CBCS-2024

SEMESTER -VI

POLYMER CHEMISTRY

1. Course Description

Program: B.Sc. Max.
Course Code: U24/CHE/DSE/602
Course: DSE- 4
No. of Credits: 4

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

2. Course Objectives

- To familiarize the students with the mechanism of polymerization and determination of their molecular mass.
- To introduce different levels of polymer structures and significance of Tg and Tm.
- To learn about different types of polymers.
- To understand the factors that influence the degradation of polymers.

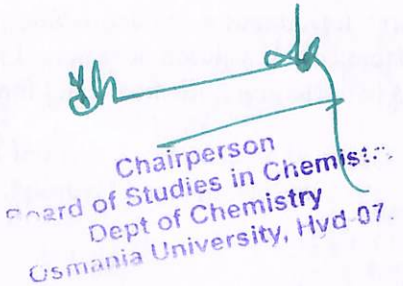
3. Course Outcomes

CO 1: Understand the different mechanisms of polymerization and methods of their molecular weight determination.

CO 2: Apply the knowledge of polymer structure to Tg and Tm.

CO3: Understand synthesis, properties and applications of rubbers and plastics.

CO 4: Develop fundamental knowledge of fibers, biodegradable polymers and polymer degradation.



POLYMER CHEMISTRY

4. Course Syllabus

Module 1: Polymerisation 15 Hrs

Introduction to Polymers, Classification of polymers based on structure, chemistry of polymerisation, addition polymerisation, copolymerisation, condensation polymerisation, coordination polymerisation, Ziegler-Natta catalyst, Kinetics of polymerization - Free radical chain polymerization, Cationic polymerization, Anionic polymerization.

Degree of polymerisation, physical properties, weight average number average molecular weight. Experimental methods of molecular weight determination- End group analysis, Viscometry and Light scattering.

Module 2: Crystallinity and Glass transition temperature 15 Hrs

Determination of crystalline melting point and degree of crystallinity. Factors affecting crystalline melting point. Effect of crystallinity on properties of polymers. Helix structures, Spherulites, Polymer single crystals. Glass Transition temperature (T_g). Factors affecting glass transition temperature. Importance of Glass Transition temperature, T_g and molecular weight, T_g and plasticisers, T_g and copolymers, T_g and melting point. Heat distortion temperature.

Module 3: Rubbers and Plastics 15 Hrs

Natural rubbers, drawbacks of natural rubber, vulcanization, rubber compounding, foamed rubbers, gutta-percha rubber, properties and applications of synthetic rubbers- poly isoprene, poly buta- diene, poly styrene butadiene, neoprene rubbers, nitrile rubbers, polysulfide rubbers.

Thermosetting and thermoplastics. Thermoplastics: poly olefins, poly styrene, PVC, teflon, their preparation, structure and applications. Thermosetting plastics: phenolic resins, amino resins, polyester resins, epoxy resins - preparation, structure and applications. Laminates and fabrication of plastics. Types and properties of Silicones and Adhesives.

Module 4: Fibers, biodegradable polymers and Polymer degradation 15 Hrs

Natural and synthetic fibers, study of synthetic fibers- polyamides, poly esters, poly acrylates.

Biodegradable Polymers: Introduction, biodegradation mechanism and properties of starch based polymers, polyesters, water soluble polymers. Environmental impacts. Applications of biodegradable polymers in agriculture, medicine and food packaging industry.

Polymer degradation: Types of degradation- thermal degradation, mechanical degradation, Photo degradation. Oxidative degradation and Hydrolytic degradation.

Chairperson
Board of Studies in Chem
Dept of Chemist
Osmania University, Hyd-07

5. References

1. Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, *Polymer science*, New Age International, 1986.
2. Vermani.O.P. Narula.A.K. (2004*), Industrial Chemistry*, New Delhi, Galgotia Publications Pvt Ltd.
3. Gopalan.R, Venkappayya & Nagarajan.S, (2005), *Textbook of Engineering Chemistry* (3rd edition) New Delhi,Vikas Publishing House Pvt. Ltd.
4. Jain and Jain , *Engineering chemistry* Dhanpat Raj Publishing company
5. Principles of Physical Chemistry by Puri, Sharma and Pathania, 2017.
6. Text Book of Physical Chemistry P.L Soni, O.P Dharmaha, U.N Dash.
7. Physical Chemistry by Atkins and De Paula, 8 th Edn.
8. Chatwal. R.G., (2006) Chemistry and Industry, New Delhi, Himalaya Publishing House.

6. Syllabus Focus

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

Local /Regional/National/ Global Development Needs	Relevance
Local	Products made from polymers and its unforgettable roles in human life.
Regional	Polymers are commonly being used in catalytic applications as supports for compounds.
National	Polymers are crucial due to their versatility, cost-effectiveness and wide applications in various industries.

Chairperson
Board of Studies in Chemistry
Dept of Chemistry
Osmania University, Hyd-07.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP (Mention any ONE of the above at a time)	Syllabus Content (Mention Module No. or part content applicable)	Description of Activity (Activity that will be conducted in class to support the focus of SD/ED/EMP in the syllabus content)
SD	All	Advancement of polymers processing techniques of exciting possibilities for creating novel polymer based elements and devices.
ED	All	Give us an insight of fundamentals of polymer business and its development in the production process.
EMP	All	Research and knowledge helps in designing machinery procurement.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Field Trip
2.	Participative Learning	Presentations
3.	Problem solving	Case studies

Chairperson
Board of Studies in Chem.
Dept of Chemistry
Osmania University, Hyd-07.

8. Course Assessment Plan

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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1-Written Exam	Written Exam
CO2	CIA1-Written Exam	
CO3	CIA2- Role Play	Written Exam
CO4	CIA2- Group Survey	

b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
B.Sc. III YEAR SEMESTER -VI
POLYMER CHEMISTRY

TIME: 2hrs **Course Code: U24/CHE/DSE/602**
Max. Marks: 60

SECTION A - INTERNAL CHOICE 4 X 10 M = 40M

Question Number	Question		CO	BTL
1	Module 1	Outline the mechanism of free-radical addition polymerization and Coordination polymerization. 10M **OR**	CO 1	(Level I)
2	Module 1	What is the average molecular weight? How is it determined by viscometry? 10M	CO 1	(Level I)
3	Module 2	a) Define crystalline melting point and discuss the factors affecting crystalline melting point. 5 M b) How does the crystalline melting point affect the properties of polymers? 5 M	CO 2	(Level III)

		OR		
4	**Module 2**	a) What is Glass Transition temperature (T_g). Explain the factors affecting glass transition temperature. 5M b) Describe the relationship between Tg and molecular weight. 5M	**CO 2**	**(Level I)**
5	**Module 3**	a) Why does natural rubber require vulcanisation and how is it done? 5 M b) Write the preparation, properties and applications of poly isoprene and poly styrene butadiene rubbers. 5 M **OR**	**CO 3**	**(Level II)**
6	**Module 3**	a) Differentiate between thermoplastics and thermosetting plastics. 5 M b) Discuss the synthesis, properties and applications of PVC and phenolic resins. 5 M	**CO 3**	**(Level I)**
7	**Module 4**	Explain the synthesis, properties and applications of polyamides and polyesters. 10 M **OR**	**CO 4**	**(Level II)**
8	**Module 4**	What are biodegradable polymers? Explain the biodegradation mechanism of starch based and water soluble polymers. 10 M	**CO 4**	**(Level I)**
SECTION B - ANSWER ANY 4 OUT OF 6			**4 X 5 M = 20 M**	
9	**Module 2**	Write short notes on helix structures and polymer single crystals.	**CO 1**	**(Level I)**
10	**Module 1**	How are the polymers classified based on their structure? Give suitable examples.	**CO 1**	**(Level I)**
11	**Module 3**	Discuss briefly about fabrication of plastics.	**CO 2**	**(Level II)**
12	**Module 1**	What is copolymerisation? Give the classification of copolymers.	**CO 2**	**(Level II)**
13	**Module 3**	Explain the applications of biodegradable plastics.	**CO 3**	**(Level II)**
14	**Module 4**	Write about thermal and photodegradation of polymers.	**CO 4**	**(Level II)**

Chairperson
Board of Studies in Chemis
Dept of Chemistry
Osmania University, Hyd-07.

SEMESTER –VI

SEC-4 RESEARCH METHODOLOGY

1. Course Description:

Programme: B.Sc. **Max. Hours: 30**
Course Code: U24/BIC/SEC/601 **Hours per week: 2**
Type of course: SEC 4 **Max. Marks: 50**
No. of credits: 2

2. Course Objectives:

- This course aims to provide students with a knowledge on the construction of good research design.
- Permit students to evaluate the data and acquire proficiency in report writing.

3. **Course Outcome:** This SEC paper will help students to enhance their overall skills to-

CO 1: Create a good research design (L6)

CO2: Generate a report(L6)

4. Course Content

Module I: INTRODUCTION TO RESEARCH METHODS (15 hrs)

Definition of Research, role and objectives of research. Collecting and reviewing literature, conceptualization and formulation of a research problem, identifying variables, constructing hypothesis, synopsis. Selecting and defining research problem, need for research design, features of a good research design, different research designs (exploratory, descriptive experimental and diagnostic research)

Module II: DATAANALYSIS & SCIENTIFIC PAPER WRITING (15 hrs)

Data collection & Analysis: Primary & Secondary data, Validity and Reliability of data collection procedures, data preparation. Preparation of Manuscript- Review, Research article. Scientific paper writing: Structure of a Research Paper, Referencing and various formats for reference writing, Bibliography, Thesis Writing.

5. Reference Books:

1. Kothari C.R., " Research Methodology, Methods and Techniques, Second Edition, (2008), New Age International Publibcation.
2. Dawson, C, (2002). Practical research methods, UBS Publishers, New Delhi.
3. Ranjith Kumar: Research Methodology, A step by step guide for beginners, Pearson Education, Sixth Edition 2009.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global	Essential for addressing global challenges and applicability of research findings across diverse contexts.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill	Module 1 & 2	Trains students in Scientific paper writing

7. Course Assessment Plan

Weightage of Marks in Formative and Summative Assessments

Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CIA-20 marks Review paper writing/ Mini research proposal writing	**End Semester exam-30 Marks**

EXTERNAL- MODEL QUESTION PAPER

Course Code: U24/BIC/SEC/601 **Max Time: 1 Hr**
Credits: 2 **Max. Marks: 30**

Answer the following:

1. Categorize the different types of research designs? (10M)
2. Compare the primary and secondary data collection. (10M)
3. Demonstrate the different types of referencing an article. (5M)
4. Compose hypothesis writing. (5M)

Prepared by Course Teacher [Name & Signature]	Checked &verified by HOD [Name & Signature]	Approved by the Principal
21/2/24	21/2/24 (S. Malathi Varma) HOD Biochemistry St. Francis College for Women Begumpet, Hyderabad-16.	

Professor Karuna Rupula Department of Biochemistry University College of Science Osmania University Hyderabad-500 007 (TS)