SEMESTER - I

ANIMAL DIVERSITY – INVERTEBRATES & VERTEBRATES

1. COURSE DESCRIPTION

Programme: B. Sc
Course Code: U26/ ZOO/ DSC/101
Type of Course: DSC-1
No. of Credits: 4

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

2. COURSE OBJECTIVES

1. To provide students with a comprehensive understanding of the diversity, classification, and evolutionary significance of invertebrates and vertebrates, from protozoa to mammals.
2. To develop analytical skills in recognizing structural, functional, and adaptive features of animal groups, emphasizing ecological roles, evolutionary trends, and conservation strategies.

3. COURSE OUTCOMES

After the successful completion of the course, the student will be able to:

CO1: **Explain** the fundamental concepts of multicellularity, body organization, symmetries, and body cavities, and **differentiate** major animal phyla based on their structural and functional characteristics. (L II)

CO2: **Analyze** adaptations in various animal groups such as locomotion in protozoa, canal systems in sponges, polymorphism in cnidarians, and parasitic strategies in helminths. (L IV)

CO3: **Understand** evolutionary trends in invertebrates and vertebrates, including the transition from water to land, flight adaptations in birds, and mammalian diversification. (L I)

CO4: **Apply** knowledge of animal diversity to ecological and conservation contexts, demonstrating awareness of threats to vertebrate diversity and strategies for protecting endangered species. (L III)

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4. COURSE CONTENT

MODULE I: INVERTEBRATES - PROTOZOA TO PLATYHELMINTHES 15 HRS

1.1 Concepts of: Multicellularity; Diploblastic and triploblastic organization; Symmetries; Body cavities.

1.2 Protozoa: General characteristics and classification up to classes; Locomotory organelles and locomotion in Protozoa.

1.3 Porifera: General characteristics and classification up to classes; Canal system in sponges and spicules; Evolutionary significance of sponges as early metazoans.

1.4 Cnidaria: General characteristics and classification up to classes; Polymorphism in Hydrozoa and Siphonophora; Coral reef formation and ecological significance.

1.5 Helminthes: General characteristics and classification up to classes of Platyhelminthes and Nemathelminths; Parasitic adaptations in helminths; Regeneration in Turbellarians.

MODULE II: INVERTEBRATES – ANNELIDA TO HEMICHORDATA 15 HRS

2.1 Annelida: General characteristics and classification up to classes; Metamerism and its evolutionary significance; Coelom and coelomocytes.

2.2 Arthropoda: General characteristics and classification up to classes; Vision in Arthropods, Metamorphosis in insects; Economic importance of insects.

2.3 Mollusca: General characteristics and classification up to classes; Torsion & detorsion in gastropods; Pearl formation and economic importance of molluscs.

2.4 Echinodermata: General characteristics and classification up to classes; Water vascular system in starfish; Larval forms of echinoderms.

2.5 Hemichordata: General characteristics and affinities of Hemichordata.

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MODULE III: VERTEBRATES - PROTOCHORDATES TO AMPHIBIANS 15 HRS

3.1 General characteristics of Urochordata and Cephalochordata; Retrogressive metamorphosis in Urochordata.

3.2 Cyclostomata: General characteristics and classification; Evolutionary status and affinities of cyclostomes.

3.3 Pisces: General characteristics and classification up to classes and major orders; Migration and osmoregulation in migratory fishes; Parental care in fishes.

3.4 Amphibia: General characteristics and classification up to orders; Parental care, neoteny, and paedogenesis in amphibians.

3.5 Evolutionary Trends in Early Vertebrates: Transition from water to land; Adaptive features in early tetrapod.

UNIT IV: VERTEBRATES - REPTILIA TO MAMMALIA 15 HRS

4.1 Reptilia: General characteristics and classification up to orders; Biting mechanism in snakes and temporal fossae in reptiles; Adaptive radiations in Mesozoic reptiles.

4.2 Aves: General characteristics and classification up to orders; Flight adaptations and migration in birds; Evolutionary significance of birds as theropod ancestors.

4.3 Mammalia: General characteristics and classification up to orders; Origin of mammals: Monotremes, marsupials, and placentals

4.4 Dentition and aquatic adaptations in mammals.

4.5 Conservation of Vertebrate Diversity: Threats to vertebrate diversity; Conservation strategies for endangered species. Citizen Science and Science Communication

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5. SUGGESTED READINGS:

1. Ruppert, E.E., Fox, R.S., Barnes, R.D. (2004). Invertebrate Zoology: A Functional Evolutionary

Approach. VII Edition, Cengage Learning, India

2. Barrington, E.J.W. (2012). Invertebrate Structure and Functions, II Edition, ELBS and Nelson.

3. Pechenik, J. A. (2015). Biology of the Invertebrates. VII Edition, McGraw-Hill Education

4. Hickman, C., Keen, S., Larson, A., Eisenhour, D. (2018). Animal Diversity, 9th Edition, McGraw-Hill.

5. Young, J.Z. (2004). The Life of Vertebrates, III Edition, Oxford University Press.

6. Kardong, K.V. (2009). Vertebrates: Comparative Anatomy, Function, Evolution, 4th Edition, McGraw-Hill.

7. Pough F.H., Janis, C.M., Heiser, J.B., Heiser, C.B. (2009). Vertebrate Life, VIII Edition, Benjamin Cummings.

8. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.

9. Kotpal, R.L. Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca,

Echinodermata. Rastogi Publications, Meerut.

10. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.

11. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.

12. P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.

13. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.

14. Mohan P.Arora. 'Chordata – I, Himalaya Publishing House Pvt.Ltd.

15. Marshal, Parker and Haswell 'Text book of Vertebrates'. ELBS and McMillan, England.

16. J.W. Young, The Life of Vertebrates, 3rd ed, Oxford University press.

17. Harvey Pough F, Christine M. Janis, B. Heiser, Vertebrate Life, Pearson, 6th ed, Pearson

Education Inc.2002.

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6. SYLLABUS FOCUS

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

Local /Regional/National /Global Development Needs	Relevance
Global Development Needs	It is important to develop an understanding of invertebrate and vertebrate biology and appreciate their biodiversity. They form a key element in the food chains and are the most successful and prolific animals on the planet. Identifying priority areas for biodiversity is essential for directing conservation resources. Fundamentally, we must know where individual species live, which ones are vulnerable, where human actions threaten them and and their levels of protection.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	**Syllabus Content**	**Description of Activity**
SD EMP	II, IV	Guest lecture and Seminar Field trip

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7. PEDAGOGY

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	**Experiential Learning**	Field Trips, Science Experiments
2.	**Participative Learning**	Presentation, Seminar & Workshops

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 Test	Written Exam
CO2	CIA-1 Written Test	
CO3	CIA-2 Assignment	
CO4	CIA-2 Objective Test	

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b) Model Question Paper – End Semester Exam Theory

ANIMAL DIVERSITY – INVERTEBRATES & VERTEBRATES

Course Code: U26/ ZOO/ DSC/101 **MAX MARKS: 60**
Credits: 4 **TIME: 2 hours**

Note: This question paper consists of Section A and B.

The answer to Section A & B must be written in the answer book given.

SECTION – A (Long Essay Type)

Answer ALL questions: **Marks: 4 x 10 = 40**

1 Explain Canal system in sponges.

OR

2. Explain Polymorphism in Hydrozoa and Siphonophora

3. What is Metamerism and explain its evolutionary significance

OR

4. Describe Water vascular system in starfish

5. Describe the Adaptive features in early tetrapod, its transition from water to land

OR

6. Explain neoteny and paedogenesis in amphibians.

7. Explain Adaptive radiations in Mesozoic reptiles.

OR

8. Discuss aquatic adaptations in mammals.

SECTION –B (Short Essay Type)

II. Write short notes on any **FOUR** of the following: **Marks: 4 x 5 = 20**

9. Locomotion in Protozoa.
10. Coral reef formation
11. Pearl formation.
12. General characteristics of Hemichordata.
13. Migration in fishes.
14. Flight adaptations in birds

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Explain Canal system in sponges.	CO 1	Level II & IV
2	Module 1	Explain Polymorphism in Hydrozoa and Siphonophora	CO 1	Level IV
3	Module 2	What is Metamerism and explain its evolutionary significance.	CO 2	Level II & IV
4	Module 2	Describe Water vascular system in starfish	CO 2	Level II
5	Module 3	Describe the Adaptive features in early tetrapod, its transition from water to land	CO 3	Level IV
6	Module 3	Explain neoteny and paedogenesis in amphibians.	CO 3	Level II
7	Module 4	Explain Adaptive radiations in Mesozoic reptiles	CO 4	Level IV
8	Module 4	Discuss aquatic adaptations in mammals.	CO 4	Level II
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 1	Locomotion in Protozoa	CO 1	Level I
10	Module 1	Coral reef formation	CO 1	Level II
11	Module 2	Pearl formation.	CO 2	Level II
12	Module 2	General characteristics of Hemichordata	CO 2	Level I
13	Module 3	Migration in fishes	CO 3	Level II
14	Module 4	Flight adaptations in birds	CO 4	Level I

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b) Question Paper Blueprint

Modules	Hours Allotted in the Syllabus	CO Addressed	Section A (No. of Questions)	Total Marks	Section B (No. of Questions)	Total Marks
1	15	CO-1	2	4x10=40	6 (By taking at least one question from each Module)	4x5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. CO-PO MAPPING

CO	PO	Cognitive Level	Classroom sessions (hrs)
1	1, 2	Explain	15
2	2, 7	Analyse	15
3	1, 2	Understand	15
4	1, 2	Apply	15

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ANIMAL DIVERSITY – INVERTEBRATES & VERTEBRATES
PRACTICAL SYLLABUS

1. COURSE DESCRIPTION

Programme:	**B. Sc**	**Max. Hours:**	**30**
Course Code:	**U26/ ZOO/ DSC/101/P**	**Hours per week:**	**2**
Type of Course:	**DSC-1**	**Max. Marks:**	**50**
No. of Credits:	**1**		

2. COURSE OBJECTIVES

1. To develop practical skills in identifying, classifying, and analyzing animal diversity through museum specimens, dissections, virtual tools, and field visits, thereby reinforcing theoretical knowledge with experiential learning.

3. COURSE OUTCOMES

1. **Identify and classify** representative invertebrate and vertebrate specimens using museum collections, slides, and models, and **demonstrate** understanding of their anatomical and adaptive features.
2. **Apply practical knowledge** in comparative anatomy and zoological techniques, including dissections, virtual simulations, and field observations, while also recognizing ecological and conservation aspects such as snake identification and first aid for snake bites.

4. COURSE CONTENT

1. Study of Museum Specimens/Slides/Models (with Classification of animals)

1. Protozoa: Amoeba, Paramecium, Plasmodium vivax
2. Porifera: Sycon, Spongilla
3. Cnidaria: Obelia, Aurelia
4. Platyhelminthes: Fasciola, Taeniasolium
5. Nemathelminths: Ascaris, Wuchereria
6. Annelida: Nereis, Hirudinaria
7. Arthropoda: Prawn, Periplaneta
8. Mollusca: Pila, Sepia

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9. Echinodermata: Asterias, Echinus

10. Protochordates: Balanoglossus, Amphioxus

11. Cyclostomata: Petromyzon, Myxine

12. Pisces: Scoliodon, Labeo

13. Amphibia: Hoplobatrachus, Bufo

14. Reptilia: Calotes, Naja

15. Aves: Columba, Passer

16. Mammalia: Pteropus, Oryctolagus, Funambulus

2. Dissections

Prawn: Appendages, digestive system, nervous system, mounting of statocyst.

Insect: Mouthparts of Anopheles, Culex, housefly, and butterfly.

Virtual dissection of Labeo/Tilapia: Digestive system, brain, and cranial nerves (demonstration only).

3. Key for identification of venomous and non-venomous snakes

4. First aid for snake bite mitigation

5. Animal Album: Mandatory submission of Animal album containing photographs, cut-outs, and write-ups about the studied taxa.

6. Visit to Zoological Park or Natural History Museum

7. Computer-Aided Techniques: Use of virtual dissections and animations for better understanding of anatomical structures.

5. SUGGESTED MANUALS:

1. Lal, S.S. Practical Zoology – Invertebrates, Rastogi Publications.

2. Verma, P.S. Practical Zoology – Invertebrates, S. Chand Publications.

3. Verma, P.S. A Manual of Practical Zoology – Chordata, S. Chand Publications.

4. S.S.Lal, Practical Zoology – Vertebrata

5. Freeman & Bracegirdle, An atlas of embryology

6. MODEL QUESTION PAPER – END SEMESTER EXAM PRACTICAL

ANIMAL DIVERSITY – INVERTEBRATES & VERTEBRATES

Programme: B.Sc. **Course Code: U26/ZOO/DSC/101/P**
Type of Course: DSC-1 **Max. Marks: 50**
No. of credits: 1

I. DRAW, DISSECT AND DISPLAY (Major Dissection) **12 M**
Prawn: Digestive system / Nervous system

II. DRAW, DISSECT AND DISPLAY (Minor Dissection) **8M**

Prawn: Appendages / mounting of statocyst.

III. IDENTIFY, CLASSIFY, DRAW, LABEL & WRITE POINTS OF IDENTIFICATION FOR THE FOLLOWING SPOTS (A-J). **10 x 2 = 20 M**

1. Protozoa: Amoeba, Paramecium, Plasmodium vivax
2. Porifera: Sycon, Spongilla
3. Cnidaria: Obelia, Aurelia
4. Platyhelminthes: Fasciola, Taeniasolium
5. Nemathelminths: Ascaris, Wuchereria
6. Annelida: Nereis, Hirudinaria
7. Arthropoda: Prawn, Periplaneta
8. Mollusca: Pila, Sepia
9. Echinodermata: Asterias, Echinus
10. Protochordates: Balanoglossus, Amphioxus
11. Cyclostomata: Petromyzon, Myxine
12. Pisces: Scoliodon, Labeo
13. Amphibia: Hoplobatrachus, Bufo
14. Reptilia: Calotes, Naja
15. Aves: Columba, Passer
16. Mammalia: Pteropus, Oryctolagus, Funambulus

IV. ANIMAL ALBUM **5 M**

V. RECORD **5 M**

Prepared by	Checked & Verified by	Approved by
Name and Signature of the teaching faculty Dr Vidya Jayaram	Name and Signature of HoD Dr. JYOTHI RANI	Name and Signature of Principal Principal St. Francis College for Women Begumpet, Hyderabad-16.

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St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
DEPARTMENT OF CHEMISTRY

DISCIPLINE SPECIFIC CORE I
CHEMISTRY I
B.Sc. I - SEMESTER- I 60 h

Module 1: Inorganic Chemistry
Chemistry of p-Block elements

Module 2: Organic Chemistry
Structural Theory in Organic Chemistry
Acyclic Hydrocarbons
Aromatic Hydrocarbons

Module 3: Physical Chemistry
Elementary Quantum Mechanics
Chemical Kinetics
Photochemistry

Module 4: General Chemistry
General Principles of Inorganic Quantitative Analysis
Isomerism
Colloids & Surface Chemistry

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SEMESTER - I
CHEMISTRY - I

1. Course Description

Programme: B.Sc.
Course Code: U26/CHE/DSC/101
Course type: DSC - 1
No. of credits: 4

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

2. Course Objectives

- To develop an understanding of the periodic trends, electronic configuration, bonding, structure, and reactivity of p-block elements and their compounds.
- To enable students to comprehend structural theory, bonding, stereochemistry, and the preparation, properties, and reactions of acyclic and aromatic hydrocarbons.
- To introduce the fundamental principles of quantum mechanics, chemical kinetics, and photochemistry, and apply them to explain molecular behavior and reaction mechanisms.
- To equip students with foundational knowledge of inorganic quantitative analysis, structural and stereoisomerism, and the principles governing colloids and surface phenomena.

3. Course Outcomes

On completion of the course the student will be able to

- Analyze the electronic configuration, periodic trends, bonding, and reactivity of p-block elements to predict the properties of their compounds.
- Apply principles of structural theory and mechanistic reasoning to interpret and predict the reactions of acyclic and aromatic hydrocarbons.
- Explain and apply the fundamental concepts of quantum mechanics, chemical kinetics, and photochemistry to analyze molecular systems and reaction rates.
- Demonstrate analytical and conceptual understanding of inorganic quantitative analysis, isomerism, and colloidal and surface phenomena in chemical systems.

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Alkynes– Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of X_2, HX, H2O (tautomerism), Oxidation (formation of enediol) and reduction (catalytic hydrogenation).

Aromatic Hydrocarbons **5h**

Introduction to aromaticity: Huckel's rule – Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Crafts alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

IKS: Traditional distillation methods in the extraction of perfumes.

MODULE III: PHYSICAL CHEMISTRY **15 h (1 h/week)**

Elementary quantum mechanics **3h**

Limitations of classical mechanics and Origin of quantum mechanics-Black body radiation, Rayleigh Jeans law; Planck's radiation law, photoelectric effect, Compton effect, de Broglie's hypothesis. Heisenberg's uncertainty principle. Schrödinger wave equation (derivation not required) – significance of ψ and ψ^2.

Chemical Kinetics **8h**

Introduction to chemical kinetics, rate of reaction, rate laws and rate constant. Molecularity and Order of a reaction. Factors influencing the reaction rates. First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Example - Decomposition of H_2O_2. Problems. Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for second order rate constant, example-Saponification of ester. Characteristics of second order reaction, units for rate constants, half- life period and second order plots. Problems. Methods for determining the order of a reaction. Arrhenius equation – activation energy -problems.

Photochemistry **4h**

Introduction to photochemistry – differences between dark and photo reactions. Laws of photochemistry; Quantum Yield – problems; Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of H_2–Cl_2 and H_2–Br_2 reactions. Abnormal quantum yield – high and low-examples with reasons. Singlet and triplet states. Jablonski diagram – non radiative processes – Internal conversion and Intersystem crossing; radiative processes- Fluorescence and phosphorescence.

4. Course Content

MODULE I: INORGANIC CHEMISTRY **15 h (1 h/week)**

Chemistry of p-Block Elements **15 h**

Structure and bonding in diborane (B_2H_6), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3.

Carbides- Classification -ionic, covalent, interstitial-Structures and reactivity. Industrial applications. Silicones-Classification-straight chain, cyclic and cross-linked and applications.

Nitrides-Classification -ionic, covalent and interstitial- Reactivity – hydrolysis.

Oxides and Oxyacids- Definition and Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed oxide (c) sub oxide (d) peroxide (e) superoxide. Structure of oxides and oxyacids of B, C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Interhalogens- Classification- general preparation- structures of AB, AB_3, AB_5 and AB_7 type and reactivity.

Poly halide- Definition and structure of ICl_2^-, ICl_4^- and I_3^-.

Pseudohalogens- Comparison with halogens.

Structure, bonding and reactivity of Xenon Compounds-Oxides, Halides and Oxy-halides.

MODULE II: ORGANIC CHEMISTRY **15 h (1 h/week)**

Structural Theory in Organic Chemistry **5h**

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

Acyclic Hydrocarbons **5h**

Alkanes– Methods of preparation: Preparation of Alkanes from Grignard reagent. Chemical reactivity- inert nature, free radical substitution, Halogenation example. **Alkenes** - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markovnikov's rule, addition of H_2O, HOX with mechanism and addition of HBr in the presence of peroxide (anti Markovnikov's addition). Oxidation (cis–additions) hydroxylation by $KMnO_4$, OsO_4, anti-addition- peracids (via epoxidation), ozonolysis – location of double bond.

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MODULE IV: GENERAL CHEMISTRY 15 h (1 h/week)

General Principles of Inorganic Quantitative Analysis 5h

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid –weak base, weak acid- strong base and weak acid –weak base. Theory of redox titrations – internal ($KMnO_4$) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations – use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations – theory of adsorption indicators.

Isomerism 5h

Isomerism: Definition of isomers. Classification of isomers: Constitutional and Stereoisomers - definition and examples. Constitutional isomers: chain, functional and positional isomers. Stereoisomers: enantiomers and diastereomers – definitions and examples. Representation of stereoisomers – Wedge, Fischer, Sawhorse, Newmann projection formulae.

Conformational analysis: Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, n- butane, 1,2- dichloroethane, 2-chloroethanol. Cis-trans isomerism: E-Z Nomenclature.

Colloids & Surface Chemistry 5h

Colloids: Definition of colloids-classification of colloids-examples. Solid in liquid (sol)-Preparation, kinetic and electrical properties, stability and protection of colloids - Hardy-Schulze rule and Gold number. Liquid in liquid (emulsion)-types of emulsions and emulsifiers. Liquid in solid (gel)-types and properties. Applications of colloids.

Adsorption: Types of adsorptions; Factors influencing adsorption; Freundlich adsorption isotherm and Langmuir adsorption isotherm. Applications.

5. Reference Books

General reference: B.Sc I Year Chemistry : Semester I, Telugu Academy publication, Hyd.

Module- I

1. Puri, B. R., Sharma, L. R., & Kalia, M. S. (1996). Principles of inorganic chemistry. Vishal Publications.
2. Lee, J. D. (1981). Concise inorganic chemistry (3rd ed.). Oxford University Press.
3. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (2001). Basic inorganic chemistry (3rd ed.). Wiley.

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Module- II

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Module- III

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Module- IV

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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	Helps individuals understand and safely use everyday chemical products such as fuels, medicines, fertilizers, and cleaning agents.
Regional	Supports regional industries like agriculture, petrochemicals, pharmaceuticals, and environmental monitoring.
National	Contributes to national economic growth through industrial development, technological innovation, and scientific research.
Global	Plays a vital role in addressing global challenges such as climate change, sustainable energy, food security, and healthcare advancements.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED /EMP	Syllabus Content	Description of Activity

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SD	Module I	Encourage them to compare and discuss trends in reactivity and chemical behaviour.
EMP	Module II	Students will create a brief dossier on a hydrocarbon compound, highlighting its structure–property link, synthesis, safety, and industrial uses to build employability skills.
ED	Module III	Students will develop a startup proposal for a light-driven or catalytic process applying concepts of quantum mechanics, chemical kinetics, and photochemistry to assess feasibility and market potential.
EMP **NSQF level 3 & 4**	Module IV	Hands on practical training and field visits.

c. IKS component:

IKS	Syllabus Content	Module
	Introduced Traditional distillation methods in the extraction of perfumes.	**II**

7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1	Experiential Learning	Micro-scale experiments in Volumetric analysis and field visits.
2	Participative Learning	Collage/ Quiz/ JAM/Game based

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-2:** Collage/Quiz/JAM/	
CO3	**CIA-1:** Written Exam	
CO4	**CIA-2:** Assignment/ Game based/ Poster making	

b. Model Question Paper - End Semester Exam Theory

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. I YEAR SEMESTER -I
CHEMISTRY - I

Time: 2 hrs **Course Code: U26/DSC/CHE/101**

Max. Marks: 60

SECTION –A (Essay Questions)

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

1. a. Classify the oxides based on the oxygen content. 4M

   b. What are interhalogen compounds? Explain the structure of AX_5 type of molecules. 6M

   OR

2. a. Discuss the structure of Diborane. 5M

   b. What are silicones? Give their classification. 5M

3. a. What is the Mesomeric effect? How does it explain the acidity of phenols? 5M

   b. Explain the acidic strength of carboxylic acids by applying the concept of Inductive effect. 5M

   OR

4. a. Write the mechanism for Friedel Crafts alkylation of benzene. 5M

   b. What are ortho, meta and para directing groups? Explain with one example each. 5M

5. a. Write the Schrodinger wave equation and explain the significance of ψ and ψ^2 and draw shapes of p and d atomic orbitals. 10M

   OR

6. a. Derive an expression for the rate constant of first order reaction. 5M

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b. A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion? 5M

7. Explain the principle involved in Redox titrations? Add a note on the detection of end points. 10M

OR

8. a. Classify various types of colloids. 5M

b. Deduce the expression for Langmuir adsorption isotherms. 5M

SECTION –B (Short Answer Questions)

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

9. Discuss the structure of XeO_3.
10. State and explain Markovnikov's rule with mechanism.
11. What is Huckel's rule? State whether naphthalene, cyclopentadienyl anion and tropylium cation are aromatic or not based on Huckel's rule.
12. Determine the order of reaction using Van't Hoff differential method.
13. State and explain Grothus and Draper's law.
14. Discuss the conformations of n-Hexane. Which is more stable and why?

Question Paper Format - Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				4 X 10 = 40 M
Question Number	**Module**	**Question**	**CO**	**BTL**
1	I	a. Classify the oxides based on the oxygen content. 4M b. What are interhalogen compounds? Explain the structure of AX_5 type of molecules. 6M OR	CO1	Level 1 & 2
2	I	a. Discuss the structure of Diborane. (CO1) 5M b. What are silicones? Give their classification. 5M	CO1	Level 1 & 2

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3	II	a. What is the Mesomeric effect? How does it explain the acidity of phenols? 5M b. Explain the acidic strength of carboxylic acids by applying the concept of Inductive effect. 5M OR	CO2	Level 3
4	II	a. Write the mechanism for Friedel Crafts alkylation of benzene. 5M b. What are ortho, meta and para directing groups? Explain with one example each. 5M	CO2	Level 2 & 3
5	III	a. Write the Schrodinger wave equation and explain the significance of ψ and ψ^2 and draw shapes of p and d atomic orbitals. 10M OR	CO3	Level 2
6	III	a. Derive an expression for the rate constant of first order reaction. 5M b. A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion? 5M	CO3	Level 4 & 5
7	IV	Explain the principle involved in Redox titrations? Add a note on the detection of end points. 10M OR	CO4	Level 2
8	IV	a. Classify various types of colloids. 5M b. Deduce the expression for Langmuir adsorption isotherms. 5M	CO4	Level 2 & 4
SECTION B - Short answer questions **ANSWER ANY 4 OUT OF 6**				**4 x 5 = 20M**
9	I	Discuss the structure of XeO_3.	CO1	Level 2
10	II	State and explain Markovnikov's rule with mechanism.	CO2	Level 1 & 4
11	II	What is Huckel's rule? State whether naphthalene, cyclopentadienyl anion	CO2	Level 3

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		and tropylium cation are aromatic or not based on Huckel's rule.		
12	**III**	Determine the order of reaction using Van't Hoff differential method.	**CO3**	**Level 3**
13	**III**	State and explain Grothus and Draper's law.	**CO3**	**Level 2**
14	**IV**	Discuss the conformations of n-Hexane. Which is more stable and why?	**CO4**	**Level 2 & 4**

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	CO1	2	10	6 (By taking at least one question from each module)	4x5=20
2	15	CO2	2	10		
3	15	CO3	2	10		
4	15	CO4	2	10		

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (h)
1	1,3	Understand	15
2	1,2	Analyse	15
3	1,2	Apply	15
4	1,7	Remember	15

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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
SEMESTER -I
LABORATORY COURSE-I - QUANTITATIVE ANALYSIS

1. Course description

Program: B.Sc.
Course Code: U26/CHE/DSC/101/ P
Course type: DSC-1
No. of Credits: 1

Max. Hours: 20
Max. Marks: 50
Hours per week: 2

2. Course Objective

- To enable students to understand the principles of volumetric analysis and apply titrimetric methods for precise quantitative estimation of chemical substances.

3. Course outcomes

CO 1: Students will be able to accurately prepare and standardize solutions, select suitable indicators, and perform various titrimetric methods with proper laboratory technique.

CO 2: Students will be able to apply volumetric analysis techniques to determine the composition or strength of constituents in market samples and interpret the results with appropriate calculations.

4. Course content

QUANTITATIVE ANALYSIS

Acid-Base Titrations

1. Estimation of Carbonate in Washing Soda.
2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.
4. Estimation of Alkali content in Antacid using HCl.

Redox Titrations

1. Determination of Fe(II) using $K_2Cr_2O_7$
2. Determination of Fe(II) using $KMnO_4$ with sodium oxalate as primary standard.
3. Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard

Complexometric Titrations

1. Estimation of Mg^{2+} by EDTA
2. Estimation of Cu^{2+} by EDTA

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5. Reference Books

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2. Vogel, A. I. Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2000. ISBN: 9780582226289
3. Giri, A. N. (2010). A textbook of practical chemistry. Himalaya Publishing House.
4. O.P. Pandey, D.N. Bajpai, & S. Giri. (2020). Practical chemistry. 10th Revised Edition, S. Chand Publishing. ISBN: 9789352535859
5. Gopalan, R., Subramanian, P. S., & Raghavan, K. (2004). Elements of analytical chemistry. Sultan Chand & Sons.
6. Gopalan, R., Venkappayya, D., and Nagarajan, S. (2012). Textbook of Inorganic Chemistry (Lab Manual), 3rd Edition, Universities Press, Hyderabad, ISBN: 9788173718204 7. Ahluwalia, V. K., and Sunita Dhingra, (2005). A Laboratory Manual of Organic and Inorganic Chemistry, 1st Edition, University Press, Hyderabad, ISBN: 9788173715623

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6. Model Question Paper - End Semester Exam Practical

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Faculty of Science – Department of Chemistry
MODEL PAPER
B.Sc. I YEAR SEMESTER -I
LABORATORY COURSE-I - QUANTITATIVE ANALYSIS

Program: B.Sc. **Course Code: U26/DSC/CHE/101/P**
Type of course: DSC-1 **Time: 2 hrs**
No. of credits: 1 **Max. Marks: 50**

1. Estimate the amount of Oxalic acid present in 100 mL of the given unknown solution. You are provided with a pure sample of sodium oxalate and $KMnO_4$ solution of 0.02 M approximately. 30M

2. Viva 10 M
3. Record & attendance 10 M

Prepared by	Checked & Verified by	Approved by
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SEMESTER - I

CELL BIOLOGY, GENETICS & BIOSTATISTICS-THEORY

1. Course Description

Programme: B.Sc | **Max. Hours: 60**

Course Code: U26/BIT/DSC/101 | **Hours per week: 4**

Course Type: DSC-1 | **Max. Marks: 100**

No. of credits: 4

2. Course Objectives

- To outline the basics in cell biology, cell components, their structure and functions
- To apply the underlying principles of Mendelian, non-mendelian inheritance, Linkage, and recombination events in genetic analysis.
- To develop competency and expertise in the applications of statistical methods in biological data

3. Course Outcomes

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

CO1: Define the basic concepts in cell biology, cell organelles, chromosome structures **(REMEMBER, UNDERSTAND) L I & II**

CO2: Outline the underlying principles and process of cell division and apoptosis **(REMEMBER, UNDERSTAND) L I & II**

CO3: Discuss and identify how genes are transferred from generation to generation with various types of gene interactions **(UNDERSTAND, APPLY) L II & III**

CO4: Understand and apply sampling methods and measures of central tendency, probability and hypothesis testing to analyze biological data **(UNDERSTAND, ANALYZE) L II &IV**

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4. Course Content

MODULE I: CELL STRUCTURE AND FUNCTIONS **(15HRS)**

1.1 Cell as basic unit of living organisms - bacterial, fungal, plant and animal cells
1.2 Ultrastructure of Prokaryotic cell: Cell membrane, Nucleoid, Plasmids
1.3 Ultrastructure of Eukaryotic cell: Cell wall, Cell membrane, Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi apparatus, Ribosomes, Lysosomes, Peroxisomes, Gloxysomes
1.4 Cell membrane - Fluid mosaic model, Sandwich model, Cell membrane permeability, Transport across membrane – active & passive transport, Cytoskeleton – microtubules & microfilaments
1.5 Structure of Chromosome - chromatids, centromere, telomere, Components of chromosomes – histones & non histones
1.6 Specialized chromosomes – Polytene & Lampbrush chromosomes

MODULE II: CELL DIVISION AND CELL CYCLE **(15HRS)**

2.1 Bacterial cell division
2.2 Phases of Eukaryotic Cell cycle
2.3 Mitosis-Stages (Spindle assembly) & significance
2.4 Meiosis-Stages (Synaptonemal complex) & significance
2.5 Regulations of Cell cycle – proteins involved in check points
2.6 Senescence, Necrosis and Apoptosis

MODULE III: PRINCIPLES AND MECHANISM OF INHERITANCE **(15HRS)**

3.1 Mendel's experiments on Pea plants, Mendel's Laws - Law of Dominance, Law of Segregation - Monohybrid Ratio, Law of Independent Assortment - Dihybrid ratio
3.2 Deviation from Mendel's Laws - Partial or Incomplete dominance (Eg. Flower Colour in *Mirabilis jalapa*), Co-dominance (Eg. MN Blood groups), non-Mendelian inheritance, Variegation in leaves of *Mirabilis jalapa*
3.3 Non allelic interactions – types of Epistasis
3.4 Penetrance and Expressivity (Eg. Polydactyly, Waardenburg syndrome), Pleiotropism, Multiple allelism (Eg. ABO Blood groups)
3.5 X-Y chromosomes - Sex determination in Drosophila, Birds, Man, *Bonellia;* Sex-linked inheritance – X- linked Inheritance (Hemophilia, Colour blindness), Y- linked inheritance - Holandric genes
3.6 Linkage and Recombination – Cytological proof of crossing over (Ex: Drosophila) and phases of linkage, recombination frequency

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MODULE IV: BIOSTATISTICS - BASIC CONCEPTS (15HRS)

4.1 Introduction to Biostatistics; Kinds of data & variables, sample size, methods of sampling - random & non-random

4.2 Diagrammatic (line diagram, bar diagram & pie diagram) and graphical representation of data (histogram, frequency polygon & frequency curve)

4.3 Measures of central tendency - mean, median, mode

4.4 Measures of dispersion - range, mean deviation, variance and standard deviation, standard error

4.5 Concepts of probability – probability rules, probability distribution: Binomial & Poison distributions and Normal distribution.

4.6 Hypothesis testing – null and alternative hypothesis; Test of Significance (Student's t-test and Z-test). Chi-square test & its significance

5. Reference book

1. Cooper G.M., Hausman R.E. (2013). *The Cell, A Molecular Approach.* Sunderland (MA): Sinauer Associates.
2. Lodish H et. al. (2012). *Molecular Cell Biology*. New York: W. H. Freeman, Palgrave Macmillan.
3. Gupta P.K. (2011). *Genetics.* Meerut, India: Rastogi Publications.
4. Plopper, G. (2011). *Lewin's cells* (II Edition.). Jones & Bartlett Learning.
5. Peter J. Russell. (2009). *Genetics- A Molecular Approach* (III Edition). San Francisco, United States of America: Benjamin Cummings.
6. Singh B.D. (2009). *Genetics.* New Delhi: Kalyani Publishers
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11. Bailey, N.T.J , Statistical methods in Biology, Cambridge Univ.Press
12. Fundamentals of Biostatistics, P Hanmanth Rao and K.Janardhan

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6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global (Modules 1, 2, 3 and 4)	The global relevance of Cell Biology, Genetics, and Biostatistics is reflected in the curriculum through its focus on fundamental life processes and modern scientific applications. Cell Biology and Genetics enable students to understand cellular mechanisms, heredity, and molecular interactions essential for biotechnology and medical research worldwide. Biostatistics equips them with skills in experimental design, data analysis, and accurate interpretation of biological results. Together, these subjects prepare learners to contribute effectively to global research, healthcare advancements, and evidence-based scientific decision-making.

b. Components on Skill Development/Entrepreneurship/Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill development	Module I, III	Presentation by the students on various cell biology and genetics topics. Students will be solving problems related to the laws of inheritance and linkage.
Employability	Module II, IV	Students will receive hands-on training in the preparation and observation of slides demonstrating cell division, increasing their employability in cytogenetics laboratories, related diagnostic and research facilities. Practical sessions in Biostatistics will equip them with essential skills in data collection, statistical analysis, and interpretation, preparing them for research, clinical studies, and evidence-based scientific work.

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7. Pedagogy

S. No	Student Centric Methods Adopted	Type/Description of Activity
1.	Seminar	Participative Learning
2.	Presentation	Participative Learning
3.	Quiz	Experiential Learning
4.	Group Discussion	Participative Learning
5.	Art Projects	Experiential learning
6.	Case studies	Problem solving
7.	Research Projects	Problem solving

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-2- Quiz/ Article writing/Assignment	
CO3	CIA-1 Written Exam	
CO4	CIA-2 Presentation/ Case studies/Art projects	

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b. Model question paper- End Semester Exam

St. Francis College for Women, Begumpet

Faculty of Science – Department of Biotechnology

MODEL QUESTION PAPER

END SEMESTER EXAM

Cell Biology, Genetics & Biostatistics

TIME: 2hrs **Course Code: U26/BIT/DSC/101**

MAX.MARKS: 60

SECTION –A (Essay Questions)

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

1. How would you describe the Fluid Mosaic model with well labeled diagrams.

OR

2. Describe the ultra-structure of a prokaryotic cell with a neat labelled diagram.

3. Outline the different stages of mitosis with neat labelled diagrams.

OR

4. Summarize senescence and necrosis.

5. Illustrate the Mendel's law of inheritance.

OR

6. Explain in detail about Sex linked Inheritance with examples.

7. Classify the measures of central tendency.

OR

8. Explain in detail about Chi square analysis with a suitable example. Add a note on its significance

SECTION –B (Short Answer Questions)

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

9. Describe about Lampbrush Chromosomes
10. Summarize Apoptosis
11. Explain about Pleiotropy
12. Summarize the properties of normal distribution
13. Illustrate the cytological proof of crossing over in Drosophila
14. Classify the types of data.

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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 would you describe the Fluid Mosaic model with well labelled diagrams?	CO 1	II
2	Module 1	Describe the ultra-structure of a prokaryotic cell with a neat labelled diagram	CO 1	II
3	Module 2	Outline the different stages of mitosis with neat labelled diagrams.	CO 2	I
4	Module 2	Summarize senescence and necrosis.	CO 2	II
5	Module 3	Illustrate the Mendel's law of inheritance.	CO 3	III
6	Module 3	Explain in detail about Sex linked Inheritance with examples.	CO 3	II
7	Module 4	Compare the measures of central tendency.	CO 4	IV
8	Module 4	Explain in detail about Chi square analysis with a suitable example. Add a note on its significance	CO 4	II

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	Describe about Lampbrush Chromosomes	CO 1	I
10	Module 2	Summarize Apoptosis	CO 2	II
11	Module 3	Explain about Pleiotropy	CO 3	II
12	Module 4	Categorize the properties of normal distribution	CO 4	IV
13	Any Module	Illustrate the cytological proof of crossing over in Drosophila	CO 3	III
14	Any Module	Classify the types of data	CO 4	IV

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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	CO-1	2	10	6 (At least One question from each module)	5
2	15	CO-2	2	10		5
3	15	CO-3	2	10		5
4	15	CO-4	2	10		5

9. CO-PO Mapping

CO	PO	Cognitive Level	Class room sessions(hrs)
1	1,3,7	Remember and understand	15
2	1,7	Remember and understand	15
3	1,2,7	Understand and apply	15
4	1,2,4,7	Understand and analyze	15

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SEMESTER – I

CELL BIOLOGY, GENETICS& BIOSTASTITICS - PRACTICAL

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

Course Code: U26/BIT/DSC/101/P **Hours per week: 2**

Course Type: DSC-1 **Max. Marks: 50**

No. of credits: 1

Course objective:

- To learn fundamental laboratory techniques for studying cellular structures and processes.
- To gain proficiency in understanding various mendelian and non mendelian inheritance patterns
- To apply statistical techniques for analysing and interpreting biological data

Course Outcomes:

CO1: Recall and analyze various stages of Mitosis and Meiosis (**REMEMBER, ANALYSE**)
L I & IV

CO2: Interpret and apply skills in solving problems based on Mendelian inheritance, Co- dominance and Epistatic gene interactions (**UNDERSTAND, APPLY**) **LII & III**

CO3: Define, describe, compute, and examine the basic concepts in biostatistics and use of statistical methods for interpreting the results **(REMEMBER, UNDERSTAND, APPLY, ANALYSE) L I,II,III & IV**

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PRACTICAL SESSIONS

1. Microscopic observation of cells: bacteria, fungi, plant and animal
2. Preparation of different stages of Mitosis (onion root tips)
3. Preparation of different stages of Meiosis (pollen mother cells in plants)
4. Problems on Monohybrid and Dihybrid crosses
5. Problems on Co-dominance
6. Problems on Epistasis
7. Problems on Mean, Median and Mode
8. Construction of bar diagram, pie diagram, line diagram, histogram
9. Problems on probability & probability distribution
10. Problems on Hypothesis testing – Student's t-test, Z-test, Chi-square test

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SEMESTER – I

CELL BIOLOGY, GENETICS & BIOSTASTITICS - PRACTICAL

Course Code: U26/BIT/DSC/101/P **Max. Marks: 50**

Credits: 1 **Time: 2Hrs**

I. MAJOR: (20M)

Prepare a temporary slide using onion root tips and identify different stages of mitosis under the microscope. Write the principle and procedure of the experiment. Report the results.

II. MINOR: (10M)

Solve the given problems

III. IDENTIFY THE GIVEN SPOTTERS (10M)

IV. VIVA (5M)

V. RECORD (5M)

Prepared by	Checked & verified by	Approved by
Ms. Mini Fernandez **Teaching faculty**	**Ms. Shouni Niveditha** **HoD**	**Prof. Uma Joseph** **Principal**

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SEMESTER I

Core Course 1

CHEMISTRY OF BIOMOLECULES

Code : **U26/BIC/DSC/101**

Credits : **4**

Total hours : **60**

Hours/week : **4**

Module I : **WATER & BUFFERS**

Module II : **CARBOHYDRATES**

Module III : **AMINO ACIDS & PROTEINS**

Module IV : **LIPIDS**

SEMESTER -1

CHEMISTRY OF BIOMOLECULES

1. Course Description

Programme : B.Sc.
Course Code : U26/BIC/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. To understand the basic molecules of life about the structures, properties, functions and classification.
2. To elucidate the importance of knowledge on the biochemical aspects of the biomolecules in biological systems.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Understand basic biochemical principles related to water, acids and bases, pH and buffer systems, and functional groups in biomolecules. (L1)

CO2: Understand the classification, structure, and biological roles of carbohydrates. (L1)

CO3: Summarize the structures of amino acids, reactions of amino acids, protein classification, different levels of organization of proteins(L2)

CO 4: Illustrate the structure and function of lipids, fatty acids and lipoproteins(L3)

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4. Course Content:

MODULE 1: WATER & BUFFERS **15 Hours**

Scope of Biochemistry, introduction to Biomolecules, water as a biological solvent, weak acids and weak bases, pH and the concept of buffers, biological buffers and their physiological importance, the Henderson–Hasselbalch equation with simple numerical problems, and the common functional groups present in biomolecules.

MODULE 2: CARBOHYDRATES **15 Hours**

Classification of carbohydrates; monosaccharides including their structures and Fischer and Haworth projections; reactions of monosaccharides with special reference to mutarotation; derivatives of monosaccharides such as amino sugars and glycosides; glycosidic bond formation along with disaccharides and oligosaccharides; polysaccharides including storage and structural polysaccharides; and bacterial cell wall polysaccharides.

MODULE 3: AMINO ACIDS & PROTEINS **15 Hours**

Classification, structure, stereochemistry, and chemical reactions of amino acids; the titration curve of glycine and pK values; essential, nonessential, and non-protein amino acids; peptide bond formation and naturally occurring peptides such as glutathione and enkephalin; protein classification and levels of structural organization including primary, secondary, tertiary, and quaternary structures with examples of haemoglobin and myoglobin; general properties of proteins including denaturation and renaturation; and determination of amino acid composition and amino acid sequencing of proteins.

MODULE 4: LIPIDS **15 Hours**

Classification of lipids along with their reactions and properties; saturated, unsaturated, and essential fatty acids; the structure and functions of neutral fats, waxes, phospholipids, and sphingolipids; the structure and functions of cholesterol and glycolipids; prostaglandins and lipoproteins; bio membranes with emphasis on the behaviour of amphipathic lipids in water and the formation of micelles, bilayers, vesicles, and liposomes; and membrane composition with the fluid mosaic model.

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5. Reference Books

1. Dr. U.Satyanarayana and U.Chakrapani **Biochemistry** 5th ed. (2001) Elsevier (New Delhi), Books and Allied Private Limited. ISBN: 81-87134-80-1
2. J.L.Jain : **Fundamentals of Biochemistry**, (2001), S. Chand & Company (New Delhi)
3. Albert L. Lehninger: **Principles of Biochemistry** (2013) 6th ed. Nelson, D.L. and Cox, M.M.W.H. Freeman and Company (New York)
4. Jeremy M Berg, John L Tymoczko, and LubertStryer **Biochemistry**, 5thedW H Freeman; (2002) ISBN-10: 0-7167-3051-0
5. Dr. A.C Deb: **Fundamentals of Biochemistry**, (1999), New Central Book Agency Private Limited. ISBN : 81-7381-144-X

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global Development needs	Understanding biomolecules has far-reaching implications, addressing global challenges and contributing to advancements in science and Diet therapies across the world.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module I, II, IV	Practicals- Qualitative analysis

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7. **Pedagogy**

S. No	Type/Description of Activity	Student Centric Methods Adopted
1.	Science Experiments, Field Trips	Experiential Learning
2.	Presentation/Assignment	Participative Learning
3.	Quiz	Experiential Learning

8. **Course Assessment Plan**

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

COs	Continuous Internal Assessments – CIA (40%)	End Semester Examination (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
C03	CIA-2 – Objective	
C04	CIA-2 – Assignment/ model making/ PPT	

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b) Model Question Paper

CHEMISTRY OF BIOMOLECULES

Code : U26/BIC/DSC/101 **Max Marks : 60 M**
Credits : 4 **Time : 2 Hrs**

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

1. Describe water as a biological solvent, highlighting its properties and biological significance.

OR

2. Define weak acids and weak bases. What is pH? Explain the concept of buffer solutions

3. Define carbohydrates. Give their classification with suitable examples indicating their structures.

OR

4. List the reactions of monosaccharides.

5. Explain the forces that stabilize the tertiary & quaternary structure of proteins.

OR

6. Describe the determination of N & C terminal amino acid of a peptide?

7. Illustrate the structural features & functions of phospholipids.

OR

8. Categorize the reactions of fatty acids & add a note on their biological importance.

II. Write Short notes on any 4 questions (out of 6) **(4x5=20M)**

9. Henderson-Hasselbalch Equation
10. Bacterial cell wall Polysaccharides
11. Mutarotation
12. Denaturation of proteins
13. Essential amino acids
14. Lipoproteins

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Question Paper format – Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				**4Q X 10 M = 40 M**
Question Number	**Module Covered**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Describe water as a biological solvent, highlighting its properties and biological significance.	CO 1	Level I
2	Module 1	Define weak acids and weak bases. What is pH? Explain the concept of buffer solutions	CO 1	Level I
3	Module 2	Define carbohydrates. Give their classification with suitable examples indicating their structures.	CO 2	Level I
4	Module 2	List the reactions of monosaccharides	CO 2	Level I
5	Module 3	Explain the forces that stabilize the tertiary & quaternary structure of proteins.	CO 3	Level II
6	Module 3	Describe the determination of N & C terminal amino acid of a peptide?	CO 3	Level II
7	Module 4	Illustrate the structural features & functions of phospholipids.	CO 4	Level III
8	Module 4	Categorize the reactions of fatty acids & add a note on their biological importance.	CO 4	Level III
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have ONE question from each module)				**4Q X 5 M = 20 M**
9	Module 1	Henderson-Hasselbalch Equation	CO 1	Level I
10	Module 2	Bacterial cell wall Polysaccharides	CO 2	Level I
11	Module 2	Mutarotation	CO 2	Level I
12	Module 3	Denaturation of proteins	CO 3	Level II
13	Module 3	Essential amino acids	CO 3	Level II
14	Module 4	Lipoproteins	CO 4	Level III

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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	CO-1	2	4X10=40	6 (Open Choice) At least 1 Question from each Module	4X5=20
2	15	CO-2	2			
3	15	CO-3	2			
4	15	CO-4	2			

9. **CO-PO Mapping:**

CO	PO	Cognitive Level	Class room sessions(hrs)
1	1	Remember	15
2	2	Understand	15
3	1	Application	15
4	2	Application	15

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QUALITATIVE ANALYSIS OF BIOMOLECULES PRACTICAL

1. Course Description:

Max. Hours: 30
Course Code: U24/BIC/DSC/101/P
Type of course: DSC 1

Hours per week: 2
No. of credits: 1
Max. Marks: 50

2. Course objectives:

Introduce the basic molecules of life with respect to their isolations and qualitative estimations.

3. Course Outcomes:

This course will help the students to-

CO1: Demonstrate the procedures to isolate biomolecules from food sources.

CO2: Apply the skills in qualitative identification of Sugars and lipids by following a series of tests and procedures

4. Course Content

PRACTICAL SESSIONS

1. General Laboratory practices and safety procedures
2. Isolation of starch from potato.
3. Isolation of casein from milk.
4. Qualitative Analysis of Carbohydrates. (4 sessions)
5. Qualitative Analysis of Lipids. (3 sessions)
6. Preparation of buffers & determination of pH.
7. Achromic Point
8. Determination of specific rotation of sugars using Polarimeter (Glucose & Fructose)

5. Reference Books:

1. Experimental Biochemistry-A student companion -Beedu Sashidhar Rao & Vijay Deshpande
2. Laboratory Manual in Biochemistry-Jayaraman, J. Wiley Eastern

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6. Model Question Paper – End Semester Exam Practical

QUALITATIVE ANALYSIS OF BIOMOLECULES

Course Code: U26/BIC/DSC/101/P
Credits: 1

Max Time: 2 Hrs
Max. Marks: 50

Answer the following.

1. Write the schematic representation (flowchart) for the qualitative analysis of
   a. Carbohydrates
   b. Principle involved in the isolation of casein from milk. (10 M)
2. Identify the given sugars present in the given solutions **A** and **B** (10 + 10 M)
3. Extract casein from the given sample of milk (10 M)
4. Viva (5M)
5. Record (5M)

Prepared by Course Teacher	Checked &verified by	Approved by
Dr.G. Sony Teaching faculty	Dr.G. Sony HOD Biochemistry	Prof. Uma Joseph Principal

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DEPARTMENT OF CHEMISTRY

DISCIPLINE SPECIFIC CORE I
CHEMISTRY I
B.Sc. I - SEMESTER- I 60 h

Module 1: Inorganic Chemistry
Chemistry of p-Block elements

Module 2: Organic Chemistry
Structural Theory in Organic Chemistry
Acyclic Hydrocarbons
Aromatic Hydrocarbons

Module 3: Physical Chemistry
Elementary Quantum Mechanics
Chemical Kinetics
Photochemistry

Module 4: General Chemistry
General Principles of Inorganic Quantitative Analysis
Isomerism
Colloids & Surface Chemistry

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SEMESTER - I
CHEMISTRY - I

1. Course Description

Programme: B.Sc.
Course Code: U26/CHE/DSC/101
Course type: DSC - 1
No. of credits: 4

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

2. Course Objectives

- To develop an understanding of the periodic trends, electronic configuration, bonding, structure, and reactivity of p-block elements and their compounds.
- To enable students to comprehend structural theory, bonding, stereochemistry, and the preparation, properties, and reactions of acyclic and aromatic hydrocarbons.
- To introduce the fundamental principles of quantum mechanics, chemical kinetics, and photochemistry, and apply them to explain molecular behavior and reaction mechanisms.
- To equip students with foundational knowledge of inorganic quantitative analysis, structural and stereoisomerism, and the principles governing colloids and surface phenomena.

3. Course Outcomes

On completion of the course the student will be able to

- Analyze the electronic configuration, periodic trends, bonding, and reactivity of p-block elements to predict the properties of their compounds.
- Apply principles of structural theory and mechanistic reasoning to interpret and predict the reactions of acyclic and aromatic hydrocarbons.
- Explain and apply the fundamental concepts of quantum mechanics, chemical kinetics, and photochemistry to analyze molecular systems and reaction rates.
- Demonstrate analytical and conceptual understanding of inorganic quantitative analysis, isomerism, and colloidal and surface phenomena in chemical systems.

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Alkynes– Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of X_2, HX, H2O (tautomerism), Oxidation (formation of enediol) and reduction (catalytic hydrogenation).

Aromatic Hydrocarbons **5h**

Introduction to aromaticity: Huckel's rule – Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Crafts alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

IKS: Traditional distillation methods in the extraction of perfumes.

MODULE III: PHYSICAL CHEMISTRY **15 h (1 h/week)**

Elementary quantum mechanics **3h**

Limitations of classical mechanics and Origin of quantum mechanics-Black body radiation, Rayleigh Jeans law; Planck's radiation law, photoelectric effect, Compton effect, de Broglie's hypothesis. Heisenberg's uncertainty principle. Schrödinger wave equation (derivation not required) – significance of ψ and ψ^2.

Chemical Kinetics **8h**

Introduction to chemical kinetics, rate of reaction, rate laws and rate constant. Molecularity and Order of a reaction. Factors influencing the reaction rates. First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Example - Decomposition of H_2O_2. Problems. Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for second order rate constant, example-Saponification of ester. Characteristics of second order reaction, units for rate constants, half- life period and second order plots. Problems. Methods for determining the order of a reaction. Arrhenius equation – activation energy -problems.

Photochemistry **4h**

Introduction to photochemistry – differences between dark and photo reactions. Laws of photochemistry; Quantum Yield – problems; Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of H_2–Cl_2 and H_2–Br_2 reactions. Abnormal quantum yield – high and low-examples with reasons. Singlet and triplet states. Jablonski diagram – non radiative processes – Internal conversion and Intersystem crossing; radiative processes- Fluorescence and phosphorescence.

4. Course Content

MODULE I: INORGANIC CHEMISTRY **15 h (1 h/week)**

Chemistry of p-Block Elements **15 h**

Structure and bonding in diborane (B_2H_6), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3.

Carbides- Classification -ionic, covalent, interstitial-Structures and reactivity. Industrial applications. Silicones-Classification-straight chain, cyclic and cross-linked and applications.

Nitrides-Classification -ionic, covalent and interstitial- Reactivity – hydrolysis.

Oxides and Oxyacids- Definition and Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed oxide (c) sub oxide (d) peroxide (e) superoxide. Structure of oxides and oxyacids of B, C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Interhalogens- Classification- general preparation- structures of AB, AB_3, AB_5 and AB_7 type and reactivity.

Poly halide- Definition and structure of ICl_2^-, ICl_4^- and I_3^-.

Pseudohalogens- Comparison with halogens.

Structure, bonding and reactivity of Xenon Compounds-Oxides, Halides and Oxy-halides.

MODULE II: ORGANIC CHEMISTRY **15 h (1 h/week)**

Structural Theory in Organic Chemistry **5h**

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

Acyclic Hydrocarbons **5h**

Alkanes– Methods of preparation: Preparation of Alkanes from Grignard reagent. Chemical reactivity- inert nature, free radical substitution, Halogenation example. **Alkenes** - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markovnikov's rule, addition of H_2O, HOX with mechanism and addition of HBr in the presence of peroxide (anti Markovnikov's addition). Oxidation (cis–additions) hydroxylation by $KMnO_4$, OsO_4, anti-addition- peracids (via epoxidation), ozonolysis – location of double bond.

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MODULE IV: GENERAL CHEMISTRY 15 h (1 h/week)

General Principles of Inorganic Quantitative Analysis 5h

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid –weak base, weak acid- strong base and weak acid –weak base. Theory of redox titrations – internal ($KMnO_4$) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations – use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations – theory of adsorption indicators.

Isomerism 5h

Isomerism: Definition of isomers. Classification of isomers: Constitutional and Stereoisomers - definition and examples. Constitutional isomers: chain, functional and positional isomers. Stereoisomers: enantiomers and diastereomers – definitions and examples. Representation of stereoisomers – Wedge, Fischer, Sawhorse, Newmann projection formulae.

Conformational analysis: Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, n- butane, 1,2- dichloroethane, 2-chloroethanol. Cis-trans isomerism: E-Z Nomenclature.

Colloids & Surface Chemistry 5h

Colloids: Definition of colloids-classification of colloids-examples. Solid in liquid (sol)-Preparation, kinetic and electrical properties, stability and protection of colloids - Hardy-Schulze rule and Gold number. Liquid in liquid (emulsion)-types of emulsions and emulsifiers. Liquid in solid (gel)-types and properties. Applications of colloids.

Adsorption: Types of adsorptions; Factors influencing adsorption; Freundlich adsorption isotherm and Langmuir adsorption isotherm. Applications.

5. Reference Books

General reference: B.Sc I Year Chemistry : Semester I, Telugu Academy publication, Hyd.

Module- I

1. Puri, B. R., Sharma, L. R., & Kalia, M. S. (1996). Principles of inorganic chemistry. Vishal Publications.
2. Lee, J. D. (1981). Concise inorganic chemistry (3rd ed.). Oxford University Press.
3. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (2001). Basic inorganic chemistry (3rd ed.). Wiley.

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4. Huheey, J. E., Keiter, E. A., & Keiter, R. L. (1993). Inorganic chemistry: Principles of structure and reactivity (4th ed.). Harper Collins College Publishers.
5. Greenwood, N. N., & Earnshaw, A. (1989). Chemistry of the elements. Pergamon Press.
6. Shriver, D. F., & Atkins, P. W. (1999). Inorganic chemistry (3rd ed.). Oxford University Press.
7. Gopalan, R. (2009). Textbook of inorganic chemistry. University Press.

Module- II

1. Morrison, R. T., & Boyd, R. N. (2011). Organic chemistry. Pearson Education (Prentice Hall).
2. Solomons, T. W. G., & Fryhle, C. B. (2016). Organic chemistry. Wiley (John Wiley & Sons).
3. Bruice, P. Y. (2017). Organic chemistry. Pearson Education.
4. Wade, L. G., Jr. (2013). Organic chemistry. Pearson Education.
5. Jones, M., Jr. (2010). Organic chemistry. W. W. Norton & Company.
6. McMurry, J. (2015). Organic chemistry. Cengage Learning (Brooks/Cole).
7. Soni, P. L., & Soni, H. M. (2012). Organic chemistry. Sultan Chand & Sons.
8. Ghosh, S. K. (2009). General organic chemistry. Bharati Bhawan Publishers.
9. Pillai, C. N. (2008). Organic chemistry. Universities Press (India) Pvt. Ltd.

Module- III

1. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2013). Principles of physical chemistry (46th ed.). Vishal Publishing Company.
2. Raj, G. (2009). Advanced physical chemistry (35th ed.). Goel Publishing House.
3. Lewis, G., & Glasstone, S. (1966). Elements of physical chemistry. Macmillan.
4. Atkins, P. W. (2001). Physical chemistry (7th ed.). Oxford University Press.
5. Kapoor, K. L. (1994). A textbook of physical chemistry (Vols. 4 & 5). Macmillan India Ltd.
6. Laidler, K. J. (1987). Chemical kinetics (3rd ed.). McGraw Hill.
7. Rajaraman, J., & Kuriacose, J. (1993). Kinetics and mechanism of chemical transformations. Macmillan India.
8. Turro, N. J. (1978). Molecular photochemistry. W. A. Benjamin, Inc.
9. Rohatgi-Mukherjee, K. K. (1978). Fundamentals of photochemistry. Wiley Eastern. Dogra, S. K., & Dogra, S. (1996). Physical chemistry through problems (4th ed.). New Age International.
10. Kalidas, C., & Sangaranarayanan, M. V. (2019). Physical chemistry: Problems and solutions. University's Press.

Module- IV

1. Jeffery, G. H., Bassett, J., Mendham, J., & Denney, R. C. (1999). Vogel's textbook of quantitative chemical analysis (5th ed.). Addison Wesley Longman Inc.
2. Day, R. A., & Underwood, A. L. (2004). Quantitative analysis (6th ed.). Prentice Hall of India.

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3. Svehla, G. (1996). Vogel's qualitative inorganic analysis (7th ed.). Prentice Hall.
4. Morrison, R. T., & Boyd, R. N. (2011). Organic chemistry. Pearson Education.
5. Solomons, T. W. G., & Fryhle, C. B. (2016). Organic chemistry. Wiley.
6. Bruice, P. Y. (2017). Organic chemistry. Pearson Education.
7. Soni, P. L. (2012). Textbook of organic chemistry. Sultan Chand & Sons.
8. Levine, I. N. (2009). Physical chemistry (6th ed.). McGraw Hill.
9. Kapoor, K. L. (1994). A textbook of physical chemistry (Vols. 4 & 5). Macmillan India Ltd.
10. Atkins, P., & de Paula, J. (2010). Atkins' physical chemistry (9th ed.). Oxford University Press.
11. McQuarrie, D. A., & Simon, J. D. (1997). Physical chemistry: A molecular approach. Viva Books Pvt. Ltd.
12. Satake, M., Hayashi, Y., Mido, Y., Iqbal, S. A., & Sethi, M. S. (2014). Colloidal and surface chemistry. Discovery Publishing Pvt. Ltd.

6. Syllabus Focus

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

Local/Regional/ National/Global Development Needs	Relevance
Local	Helps individuals understand and safely use everyday chemical products such as fuels, medicines, fertilizers, and cleaning agents.
Regional	Supports regional industries like agriculture, petrochemicals, pharmaceuticals, and environmental monitoring.
National	Contributes to national economic growth through industrial development, technological innovation, and scientific research.
Global	Plays a vital role in addressing global challenges such as climate change, sustainable energy, food security, and healthcare advancements.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED /EMP	Syllabus Content	Description of Activity

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SD	Module I	Encourage them to compare and discuss trends in reactivity and chemical behaviour.
EMP	Module II	Students will create a brief dossier on a hydrocarbon compound, highlighting its structure–property link, synthesis, safety, and industrial uses to build employability skills.
ED	Module III	Students will develop a startup proposal for a light-driven or catalytic process applying concepts of quantum mechanics, chemical kinetics, and photochemistry to assess feasibility and market potential.
EMP **NSQF level 3 & 4**	Module IV	Hands on practical training and field visits.

c. IKS component:

IKS	Syllabus Content	Module
	Introduced Traditional distillation methods in the extraction of perfumes.	**II**

7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1	Experiential Learning	Micro-scale experiments in Volumetric analysis and field visits.
2	Participative Learning	Collage/ Quiz/ JAM/Game based

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-2:** Collage/Quiz/JAM/	
CO3	**CIA-1:** Written Exam	
CO4	**CIA-2:** Assignment/ Game based/ Poster making	

b. Model Question Paper - End Semester Exam Theory

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(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
MODEL PAPER
B.Sc. I YEAR SEMESTER -I
CHEMISTRY - I

Time: 2 hrs **Course Code: U26/DSC/CHE/101**

Max. Marks: 60

SECTION –A (Essay Questions)

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

1. a. Classify the oxides based on the oxygen content. 4M

   b. What are interhalogen compounds? Explain the structure of AX_5 type of molecules. 6M

   OR

2. a. Discuss the structure of Diborane. 5M

   b. What are silicones? Give their classification. 5M

3. a. What is the Mesomeric effect? How does it explain the acidity of phenols? 5M

   b. Explain the acidic strength of carboxylic acids by applying the concept of Inductive effect. 5M

   OR

4. a. Write the mechanism for Friedel Crafts alkylation of benzene. 5M

   b. What are ortho, meta and para directing groups? Explain with one example each. 5M

5. a. Write the Schrodinger wave equation and explain the significance of ψ and ψ^2 and draw shapes of p and d atomic orbitals. 10M

   OR

6. a. Derive an expression for the rate constant of first order reaction. 5M

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b. A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion? 5M

7. Explain the principle involved in Redox titrations? Add a note on the detection of end points. 10M

OR

8. a. Classify various types of colloids. 5M

b. Deduce the expression for Langmuir adsorption isotherms. 5M

SECTION –B (Short Answer Questions)

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

9. Discuss the structure of XeO_3.
10. State and explain Markovnikov's rule with mechanism.
11. What is Huckel's rule? State whether naphthalene, cyclopentadienyl anion and tropylium cation are aromatic or not based on Huckel's rule.
12. Determine the order of reaction using Van't Hoff differential method.
13. State and explain Grothus and Draper's law.
14. Discuss the conformations of n-Hexane. Which is more stable and why?

Question Paper Format - Blooms Taxonomy Level

SECTION A - INTERNAL CHOICE				4 X 10 = 40 M
Question Number	**Module**	**Question**	**CO**	**BTL**
1	I	a. Classify the oxides based on the oxygen content. 4M b. What are interhalogen compounds? Explain the structure of AX_5 type of molecules. 6M OR	CO1	Level 1 & 2
2	I	a. Discuss the structure of Diborane. (CO1) 5M b. What are silicones? Give their classification. 5M	CO1	Level 1 & 2

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3	II	a. What is the Mesomeric effect? How does it explain the acidity of phenols? 5M b. Explain the acidic strength of carboxylic acids by applying the concept of Inductive effect. 5M OR	CO2	Level 3
4	II	a. Write the mechanism for Friedel Crafts alkylation of benzene. 5M b. What are ortho, meta and para directing groups? Explain with one example each. 5M	CO2	Level 2 & 3
5	III	a. Write the Schrodinger wave equation and explain the significance of ψ and ψ^2 and draw shapes of p and d atomic orbitals. 10M OR	CO3	Level 2
6	III	a. Derive an expression for the rate constant of first order reaction. 5M b. A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion? 5M	CO3	Level 4 & 5
7	IV	Explain the principle involved in Redox titrations? Add a note on the detection of end points. 10M OR	CO4	Level 2
8	IV	a. Classify various types of colloids. 5M b. Deduce the expression for Langmuir adsorption isotherms. 5M	CO4	Level 2 & 4
SECTION B - Short answer questions **ANSWER ANY 4 OUT OF 6**				**4 x 5 = 20M**
9	I	Discuss the structure of XeO_3.	CO1	Level 2
10	II	State and explain Markovnikov's rule with mechanism.	CO2	Level 1 & 4
11	II	What is Huckel's rule? State whether naphthalene, cyclopentadienyl anion	CO2	Level 3

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		and tropylium cation are aromatic or not based on Huckel's rule.		
12	**III**	Determine the order of reaction using Van't Hoff differential method.	**CO3**	**Level 3**
13	**III**	State and explain Grothus and Draper's law.	**CO3**	**Level 2**
14	**IV**	Discuss the conformations of n-Hexane. Which is more stable and why?	**CO4**	**Level 2 & 4**

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	CO1	2	10	6 (By taking at least one question from each module)	4x5=20
2	15	CO2	2	10		
3	15	CO3	2	10		
4	15	CO4	2	10		

9. CO-PO Mapping

CO	PO	Cognitive Level	Classroom sessions (h)
1	1,3	Understand	15
2	1,2	Analyse	15
3	1,2	Apply	15
4	1,7	Remember	15

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(An Autonomous College Affiliated To Osmania University)
FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
SEMESTER -I
LABORATORY COURSE-I - QUANTITATIVE ANALYSIS

1. Course description

Program: B.Sc.
Course Code: U26/CHE/DSC/101/ P
Course type: DSC-1
No. of Credits: 1

Max. Hours: 20
Max. Marks: 50
Hours per week: 2

2. Course Objective

- To enable students to understand the principles of volumetric analysis and apply titrimetric methods for precise quantitative estimation of chemical substances.

3. Course outcomes

CO 1: Students will be able to accurately prepare and standardize solutions, select suitable indicators, and perform various titrimetric methods with proper laboratory technique.

CO 2: Students will be able to apply volumetric analysis techniques to determine the composition or strength of constituents in market samples and interpret the results with appropriate calculations.

4. Course content

QUANTITATIVE ANALYSIS

Acid-Base Titrations

1. Estimation of Carbonate in Washing Soda.
2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.
4. Estimation of Alkali content in Antacid using HCl.

Redox Titrations

1. Determination of Fe(II) using $K_2Cr_2O_7$
2. Determination of Fe(II) using $KMnO_4$ with sodium oxalate as primary standard.
3. Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard

Complexometric Titrations

1. Estimation of Mg^{2+} by EDTA
2. Estimation of Cu^{2+} by EDTA

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5. Reference Books

1. Jeffery, G. H., Bassett, J., Mendham, J., & Denney, R. C. (1999). Vogel's textbook of quantitative chemical analysis (5th ed.). Addison Wesley Longman Inc.
2. Vogel, A. I. Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2000. ISBN: 9780582226289
3. Giri, A. N. (2010). A textbook of practical chemistry. Himalaya Publishing House.
4. O.P. Pandey, D.N. Bajpai, & S. Giri. (2020). Practical chemistry. 10th Revised Edition, S. Chand Publishing. ISBN: 9789352535859
5. Gopalan, R., Subramanian, P. S., & Raghavan, K. (2004). Elements of analytical chemistry. Sultan Chand & Sons.
6. Gopalan, R., Venkappayya, D., and Nagarajan, S. (2012). Textbook of Inorganic Chemistry (Lab Manual), 3rd Edition, Universities Press, Hyderabad, ISBN: 9788173718204 7. Ahluwalia, V. K., and Sunita Dhingra, (2005). A Laboratory Manual of Organic and Inorganic Chemistry, 1st Edition, University Press, Hyderabad, ISBN: 9788173715623

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6. Model Question Paper - End Semester Exam Practical

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Faculty of Science – Department of Chemistry
MODEL PAPER
B.Sc. I YEAR SEMESTER -I
LABORATORY COURSE-I - QUANTITATIVE ANALYSIS

Program: B.Sc. **Course Code: U26/DSC/CHE/101/P**
Type of course: DSC-1 **Time: 2 hrs**
No. of credits: 1 **Max. Marks: 50**

1. Estimate the amount of Oxalic acid present in 100 mL of the given unknown solution. You are provided with a pure sample of sodium oxalate and $KMnO_4$ solution of 0.02 M approximately. 30M

2. Viva 10 M
3. Record & attendance 10 M

Prepared by	Checked & Verified by	Approved by
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