SEMESTER – IV

SEC-II BIOINFORMATICS AND BIOSTATISTICS

1. Course Description

Programme: B.Sc.
Course Code: U24/BIT /SEC/401
Type of course: SEC-2
No. of credits: 2

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

2. Course Objectives:

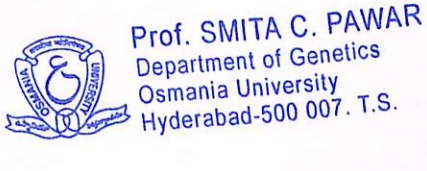
- To learn, summarize and apply the basic concepts of Bioinformatics and its significance in biological data analysis.
- To develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques.

3. Course Outcome:

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

CO1: Remember, interpret, and apply the skills gained, in basic concepts of bioinformatics, manage the different types of biological data and gain an insight into the basics of sequence alignment and analysis **(REMEMBER, UNDERSTAND, APPLY)**

CO2: Define, describe, compute, and examine the basic concepts in biostatistics and use statistical methods for interpreting the results **(REMEMBER, UNDERSTAND, APPLY, ANALYSE)**



4. Course Content:

Module I: Bioinformatics **(15 hrs)**

- Exploring web portals – NCBI, EBI, ExPASy
- Literature search through Pubmed and Pubmed Central
- Sequence retrieval from Genbank, ENA, Swissprot
- Pairwise homology search by BLAST
- Multiple Sequence alignment

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

- Calculation of mean, median, mode, standard deviation, variance, coefficient of variation for a variable
- Construction of bar diagram, pie diagram, line diagram, histogram and box plot for a data.
- Problems on hypothesis testing using Z test and t-test
- Problems on Chi-square test and ANOVA test

5. Reference Books:

1. Khan &Khanum (2004), Fundamentals of Biostatistics, II Revised Edition, Ukaaz Publication
2. Bailey, N.T. J, Statistical methods in Biology, Cambridge Univ.Press
3. Fundamentals of Biostatistics, P Hanmanth Rao and K.Janardhan
4. Danial, W. W, Biostatistics,Wiley
5. Introduction to Bioinformatics by Aurther M lesk
6. Developing Bioinformatics Computer Skills By: Cynthia Gibas, Per Jambeck
7. Bioinformatics second edition By David Mmount
8. Essential Bioinformatics by JinXiong
9. Bioinformatics Computing by Bryan Bergeron
10. Bioinformatics: Concepts, Skills & Applications By R.S.Rastogi

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 Bioinformatics and Biostatistics covers various aspects to give students the information and abilities necessary to make contributions to scientific research, healthcare, and other areas of global importance. Furthermore, because Bioinformatics and Biostatistics are multidisciplinary fields, they encourage cross-border cooperation and innovation, which makes them genuinely internationally significant fields of study.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Exploring web portals, sequence retrieval and sequence alignments	Students retrieve nucleotide and protein sequences using biological databases and perform a sequence similarity search among various biological classes to check for conserved and variable regions on the genome.
Employability	Formulation of hypothesis and analysing the significance of the data	Students collect data using any one of the primary data collection methods and analyse the significance of the data using statistical tools.

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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

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b) Question Paper Pattern

EXTERNAL- MODEL QUESTION PAPER

Course Code: U24/BIT/SEC/401 **Max Time: 1 Hr**
Credits: 2 **Max. Marks: 30**

Answer the following.

I. Major **(15M)**

Solve the given problems using test of significance

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

Write the principle and procedure for nucleotides databases. Retrieve the given gene nucleotide sequence using ENA database/ Identify the given spotters

III. Record **(5M)**

Prepared by	Checked & verified by	Approved by
4/3/24 (Mini Fernandez) Name and Signature of the teaching faculty	4/3/24 (Ms. Shouri Nivedita) Name and Signature of HoD	Name and Signature of Principal

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

SEMESTER IV

SEC-II BIOINFORMATICS

1. Course Description

Programme: B.Sc.
Course Code: U24/BIC/SEC/401
Type of course: SEC
No. of credits: 2

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

2. Course Objectives

- This course aims to provide students with a well-rounded understanding of bioinformatics, combining biological knowledge with computational and analytical skills.
- Equip students with the tools and knowledge needed to tackle complex biological questions using computational approaches.

3. Course Outcomes

CO1: Examine the basics of Bioinformatics with the knowledge of Databases. (L4)

CO 2: choose the data mining of Biological Databases and design sequence analysis techniques. (L5, L6)

4. Course content-

Module I: INTRODUCTION TO BIOINFORMATICS & DATA BASES **(15 hrs)**

Introduction, Definition, Objectives, Scope & application.Biological databases: Primary protein databases – SWISS PROT, TrEMBL, PIR, PDB.Primary Nucleic databases – EMBL, GENBANK, DDBJ.Data mining of biological databases. Explore all the major databases and sequence retrieval from NCBI.

Module II: SEQUENCE ANALYSIS: **(15 hrs)**

Sequence alignment -FASTA, BLAST. Multiple sequence alignment – Clustal W, T-Coffee. Conserved Domains, Phylogenetic analysis and cladograms.2D and 3D models of a given protein structure prediction. SCOP, CATH, OMIM, KEGG, PROSITE, Pfam. Physical Properties and Protein domains, Trans domain and primary structure of proteins. Introduction to Molecular Docking.

5. Reference Books:

1. Sharma, Munjal& Shankar, A Text Book of Bioinformatics (2008), Rastogi Publishers, First Edition, ISBN 978-81-7133-917
2. Zhumur Ghosh &Bibekan and Mallik, Bioinformatics- Principles & Applications (2008) First Edition ISBN-10: 0195692306

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global	With the huge availability of biological data, computational biochemistry facilitates data sharing and research on a global scale.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill	Module 1 & 2	Practicals in Dry Lab

7. Course Assessment Plan

Weightage of Marks in Formative and Summative Assessments

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

EXTERNAL- MODEL QUESTION PAPER
PRACTICAL

Course Code: U24/BIC/SEC/401 **Max Time: 1 Hr**
Credits: 2 **Max. Marks: 30**

Answer the following.

1. Illustrate the Sequence analysis -BLAST/MSA (10M)
2. Categorize the Databases (15M)
3. Record (5M)

SPrepared by Course Teacher [Name & Signature]	Checked & verified by HOD [Name & Signature]	Approved by the Principal
	21/12/24 (C.S. Malathi Varma)	

HOD Biochemistry
St. Francis College for Women
Begumpet, Hyderabad-16.

Professor Karuna Rupella
Department of Biochemistry
University College of Science
Osmania University
Hyderabad-500 007

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 -IV
SYNTHESIS OF ORGANIC COMPOUNDS AND FUNCTIONAL GROUP ANALYSIS

Program: B.Sc.
Course Code: U24/CHE/DSC/401/P
Course: DSC-4
No. of Credits: 1

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

Course Objective

- To prepare simple organic compounds and systematically analyse functional groups based on their nature and chemical reactivity.

Course Outcomes

CO1: Utilise the knowledge of organic reaction mechanisms in their preparations.
CO2: Categorise functional groups present in organic compounds using systematic quantitative analysis.

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, carbohydrate, amide, nitro, amines) and preparation of one derivative.

Synthesis of organic compounds:

a. Acetylation – Preparation of Acetanilide.
b. Halogenation – Preparation of p-Bromo acetanilide.
c. Oxidation – Preparation of Benzoic acid.
d. Esterification - Preparation of n-butyl acetate.
e. Methylation – Preparation β-Naphthyl methyl ether.
f. Nitration – Preparation of Nitrobenzene
g. Reduction – Preparation of m-Nitroaniline

Reference Books:

- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry,* Universities Press.

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Dept. of Chemistry
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	Knowledge of the basic principles of Chemistry to help in day-to-day life.
Regional	Learn about the concepts and significance of carbohydrates and bioinorganic chemistry.
National	Understand the basics of organometallic compounds, non-aqueous solvents and dipole moments.
Global	Application of basic principles of rotational, IR, UV-Vis Spectroscopy techniques, concepts of chemical kinetics, heterocyclic compounds and pericyclic reactions.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Practical syllabus which includes Organic preparations and Qualitative analysis in Organic Chemistry Problem solving in Physical Chemistry	Students perform the experiments based on the procedure and also analyse the unknown compounds. Students solve the problems
ED	Organic preparations and analysis. Structural investigation of organic compounds based on spectroscopy	Students prepare organic compounds, analyse the functional groups and carry out the structural analysis based on spectral data
EMP	Inorganic, Organic, Physical Chemistry and Spectroscopy	Tutorials and assignments

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7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1	Experiential	Experiments, attending seminars/workshops and field visits
2	Participative	Group discussion, quiz, presentations etc.
3	Problem solving	Solving problems in Physical Chemistry and structural elucidation based on spectral data.

8. Course Assessment Plan

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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1-Written Exam	Written Exam
CO2	CIA 2- Skill based test like poster/powerpoint presentation, collage, 3D model making, problem solving and quiz.	
CO3	CIA1-Written Exam	
CO4	CIA 2- Skill based test like poster/powerpoint presentation, collage, 3D model making, problem solving and quiz.	

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b. Model Question Paper - End Semester Exam

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(An Autonomous College Affiliated to Osmania University)

Faculty of Science – Department of Chemistry

MODEL PAPER

B.Sc. II YEAR SEMESTER -IV

CHEMISTRY - PAPER IV

Course Code: U24/CHE/DSC/401

TIME: 2 hrs
Max. Marks: 60

SECTION –A (Essay Questions)

.Answer the following

4X10=40 Marks

1. a) Explain the classification of organometallic compounds based on metal-carbon bonds. (CO1) **L1** 5M
   b) Discuss the reactions in liquid ammonia with suitable examples. (CO1) **L2** 5M

OR

2. a) Describe the preparation, properties and applications of Grignard reagent. (CO1) **L3** 6M
   b) How does fixation of carbon dioxide occur in photosynthesis? (CO1) **L2** 4M
3. a) Derive an expression for the rate constant of first order reaction. (CO2) **L3** 5M
   b) A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion? (CO2) **L5** 5M

OR

4. Explain different methods of experimental determination of order oa a reaction. (CO2) **L2** 10M
5. a) Discuss the open chain structure of Glucose. (CO3) **L2** 5M
   b) Write the equations involved in Killiani-Fischer synthesis. (CO3) **L2** 5M

OR

6. a) Explain the synthesis of Furan, Pyrrole and Thiophene from 1,4-dicarbonyl compounds. (CO3) **L2** 5M
   b) What are pericyclic reactions? Give their classification with an example each. (CO3) **L4** 5M
7. a) What is a dipole moment? Predict the structure of CO_2 and SO_2 based on dipole moment. (CO4) **L4** 5M
   b) Explain the various molecular vibrations seen in IR spectroscopy. (CO4) **L2** 5M

OR

8. a) Describe in detail about the electronic transitions observed in UV-VIS spectroscopy. (CO4) **L2** 5M
   b) Explain the basic principles of Raman spectroscopy. (CO4) **L2** 5M

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SECTION –B

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

9. Write a note on the biological significance of calcium and chloride ions. (CO1) **L1**
10. Give two methods of preparation of ferrocene. (CO1) **L1**
11. Discuss briefly about collision theory. (CO2) **L2**
12. Explain the factors affecting the rate of a reaction. (CO2) **L2**
13. Explain mutarotation taking glucose as an example. (CO3) **L2**
14. Explain the concept of chromophore and auxochrome. (CO4) **L2**

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. II YEAR SEMESTER -IV

TIME: 2 hrs
Max. Marks: 60

Course Code: U24/CHE/DSC/401
Credits: 4

SECTION –A (Essay Questions)
SECTION –A

SECTION A - INTERNAL CHOICE			**4 X 10 M = 40M**	
Question Number	**Question**		**CO**	**BTL**
1	**Module 1**	a) Explain the classification of organometallic compounds based on metal-carbon bonds. 5M b) Discuss the reactions in liquid ammonia with suitable examples. 5M **OR**	**CO 1**	**(Level I,II)**
2	**Module 1**	a) Describe the preparation, properties and applications of Grignard reagent. 6M b) How does fixation of carbon dioxide occur in photosynthesis? 4M	**CO 1**	**(Level III,II)**
3	**Module 2**	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 **OR**	**CO 2**	**(Level III, V)**
4	**Module 2**	Explain different methods of experimental determination of order oa a reaction. 10M	**CO 2**	**(Level II)**
5	**Module 3**	a) Discuss the open chain structure of Glucose. 5M b) Write the equations involved in Killiani-Fischer synthesis. 5M **OR**	**CO 3**	**(Level II)**

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Dept of Chemistry
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6	Module 3	a) Explain the synthesis of Furan, Pyrrole and Thiophene from 1,4-dicarbonyl compounds. (CO3) **L2** 5M b) What are pericyclic reactions? Give their classification with an example each. (CO3) 5M	CO 3	(Level II, IV)
7	Module 4	a) What is a dipole moment? Predict the structure of CO_2 and SO_2 based on dipole moment. 5M b) Explain the various molecular vibrations seen in IR spectroscopy. 5M **OR**	CO 4	(Level II, IV)
8	Module 4	a) Describe in detail about the electronic transitions observed in UV-VIS spectroscopy. 5M b) Explain the basic principles of Raman spectroscopy. 5M	CO 4	(Level II)
SECTION B - ANSWER ANY 4 OUT OF 6				**4 X 5M = 20 M**
9	Module 2	Write a note on the biological significance of calcium and chloride ions.	CO 1	(Level I)
10	Module 1	Give two methods of preparation of ferrocene.	CO 1	(Level I)
11	Module 2	Discuss briefly about collision theory.	CO 2	(Level II)
12	Module 2	Explain the factors affecting the rate of a reaction.	CO 2	(Level II)
13	Module 3	Explain mutarotation taking glucose as an example.	CO 3	(Level II)
14	Module 4	Explain the concept of chromophore and auxochrome.	CO 4	(Level II)

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Dept of Chemistry
Osmania University, Hyd-07.

SEMESTER-1V

ENDOCRINOLOGY & MOLECULAR BIOLOGY

1. Course Description

Programme : B.Sc.
Course Code : U24/BIC/DSC/401
Type of course: DSC
No. of credits : 4

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

2. Course Objectives

- To discuss cellular mechanisms related to the molecular basis of life.
- To infer the molecular, biochemical, and physiological effects of hormone on cells and tissues.

3. Course Outcomes:

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

CO1: Outline the different classes and chemical structures of hormones, glands, organs, tissues, and cells that synthesize and secrete hormones, precursors and associated compounds, synthesis and regulation. (L1)

CO2: Describe the different steps in the central dogma of molecular biology, gene expression and emphasize the enzymes involved in the process. (L2)

CO3: Apply clear knowledge in techniques of Molecular biology which includes PCR, Hybridization, and blotting & sequencing techniques. (L3)

CO4: Analyze the nature of signals, sorting and applications like Recombinant DNA technology. (L4)

4. Course Content

Module I: ENDOCRINOLOGY **(15hrs)**

Organisation of endocrine system. Definition and Classification of Hormones based on composition & mode of action. Outline of chemistry, physiological role and disorders of hormones of hypothalamus, pituitary, thyroid, adrenal, parathyroid, gonads, pancreas, and placenta. Introduction to gastrointestinal hormones. Mechanism of hormone action – Signal transduction pathways for adrenaline, glucocorticoids, and insulin.

Module II: REPLICATION & TRANSCRIPTION **(15hrs)**

General features of mechanism of DNA replication, models of DNA replication, Experimental evidence of semi conservative model - Meselson Stahl experiment. Replicosome. Mechanism of transcription – RNA synthesis, RNA polymerase of prokaryotes. DNA polymerases I, II and III of E. coli, helicase, topoisomerases, primase, ligase. Bidirectional replication model. Okazaki fragments, leading and lagging strands of DNA synthesis. Inhibitors of DNA replication.

Promoters, Initiation - sigma factors and their recognition sites. Elongation – role of core enzymes. Termination – rho dependent and rho independent. RNA polymerase I, II III of eukaryotes Inhibitors of transcription. Post transcriptional modification – 5'α - amanitin.

Comparison of transcription in prokaryotes & eukaryotes.

Module III: PROTEIN SYNTHESIS & REGULATION OF GENE EXPRESSION (15hrs)

Transcription - RNA synthesis, RNA polymerases of prokaryotes. Promoters, Initiation- sigma factors and their recognition sites. Elongation- role of core enzyme. Termination- rho dependent and rho independent. RNA polymerase I, II and III of eukaryotes. Translation machinery, mechanism of translation, polysomes, inhibitors of protein synthesis.

Post translational modifications and their significance. Basic principles of protein sorting, Signal hypothesis & protein secretion. Regulation of gene expression – promoter, operator, repressor binding in DNA. Lac Operon - Control by negative and positive regulatory proteins.

Module IV: RECOMBINANT DNA TECHNOLOGY **(15hrs)**

Creation of a recombinant molecule – general outline. Restriction endonucleases – types, uses, Ligases, phosphatases, reverse transcriptase, polynucleotide kinases, terminal transferase, nucleases-S1 and RNAase H. Restriction mapping. Salient features of cloning vectors – plasmids, Ti plasmids, cosmids, lambda phage vectors & virus vectors, Insertion vectors, expression vectors, Shuttle vectors. Introduction of Recombinant DNA to host cells by various modes like transformation, transfection, microinjection, liposome, encapsulation etc. selection of

transformed cells. Sequencing of nucleic acids – Sanger's and Maxam – Gilbert methods. Principles & Techniques of hybridization - Colony hybridization, NA Hybridization. Blotting techniques – Southern, Northern and Western blotting techniques. Polymerase chain reaction and its applications.

5. Reference Books

1. Lodish: Molecular Cell Biology, 5th Edition (2003) Freeman, W. H. & Company. ISBN- 13: 2900716743667
2. Devlin : Textbook of Biochemistry with Clinical Correlations (2011), T.M. John Wiley &Sons, Inc. (New York)
3. Campbell, Biochemistry (1995) 3rd Edition, Publisher: John Vondeling. ISBN: 0-03-02-44-269
4. P.K Gupta, Biotechnology and Genomics, Rastogi Publications. (2004) ISBN: 81-7133-67-6-0.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global	Endocrinology is crucial for hormone balance, cell and organ communication, pivotal in understanding and treating medical conditions.
Global	The knowledge of molecular mechanisms helps in identifying the underlying causes of health and disease.

b) Components on Skill Development/Entrepreneurship, Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD-Module 1	Chemistry of various hormones in the body and their physiological role	Lecture- Identifying, analyzing and troubleshooting the hormonal defects
ED Module 2,3	Molecular biology techniques	Practicals
Entrepreneurship Module 4	Sequencing of nucleic acids Techniques of hybridization Blotting techniques Polymerase chain reaction	Lecture-Equip the students with the knowledge of the most important tools in biochemistry

7. Pedagogy

S. No	Type/Description of Activity	Student Centric Methods Adopted
1.	Seminar	Participative Learning
2.	Model making/Art projects	Experiential 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 test	
C04	CIA-2 - Assignment/ model making/ PPT	

b) Model Question Paper

ENDOCRINOLOGY & MOLECULAR BIOLOGY

Code : U24/BIC/DSC/401
Credits: 4

Max Marks : 60
Time : 2hrs

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

1. (a)Outline and discuss the hormones involved in calcium metabolism.
   (OR)
   (b)Explain the mechanism involved in hormone action.

2. (a)Discuss in detail the different enzymes involved in DNA replication.
   (OR)
   (b)Explain the mechanism of transcription in prokaryotes.

3. (a)Explain the initiation process of protein synthesis in prokaryotes.
   (OR)
   (b)Summarise signal peptide hypothesis with diagram.

4. (a)Assess the principle, procedure and applications of southern blotting.
   (OR)
   (b)Examine in detail the sequencing of nucleic acids by Maxum and Gilbert's method.

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

5. Classification of Hormones
6. Gastro intestinal Hormone
7. Post transcriptional modifications
8. Clover leaf model of t-RNA
9. Lac operon
10. Chaperons

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

Semester IV: Molecular Biology & Endocrinology

SECTION A - INTERNAL CHOICE (4 X 10 M = 40 M)				
Question Number	**Question**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	Outline and discuss the hormones involved in calcium metabolism	CO 1	1,2
2	Module 1	Explain the mechanism involved in hormone action.	CO 1	2
3	Module 2	Discuss in detail the different enzymes involved in DNA replication.	CO 2	2
4	Module 2	Explain the mechanism of transcription in prokaryotes.	CO 2	2
5	Module 3	Explain the initiation process of protein synthesis in prokaryotes.	CO 3	2
6	Module 3	Summarise signal peptide hypothesis with diagram.	CO 3	2
7	Module 4	Describe the principle, procedure and applications of southern blotting	CO 4	2
8	Module 4	Explain in detail the sequencing of nucleic acids by Maxum and Gilbert's method.	CO 4	2
SECTION B - ANSWER ANY 4 OUT OF 6 (4Q X 5M = 20M) (To compulsorily have **ONE** question from **each** module)				
9	Module 1	Classification of Hormones	CO 1	1
10	Module 2	Gastro intestinal Hormone	CO 1	1
11	Module 3	Post transcriptional modifications	CO 2	2
12	Module 2	Clover leaf model of t-RNA	CO 3	2
13	Any Module	Lac operon	CO 4	3
14	Any Module	Chaperons	CO3	3

PRACTICAL
ENDOCRINOLOGY & MOLECULAR BIOLOGY

1. Course Description:

Programme: B.Sc.
Course Code: U24/BIC/DSC/401/P
Type of course: DSC 4
No. of credits: 1

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

2. Course objective:

- To demonstrate the knowledge of molecular biology and related techniques in the current research fields.

3. Course Outcome:

This course will help the students to-

CO1: Apply the knowledge of different electrophoresis to separate DNA, RNA and protein molecules. (L3)

CO2: Probe the skills of various molecular biology techniques(L4).

CO3: To assess the importance of various Hormones(L5)

PRACTICAL SESSION

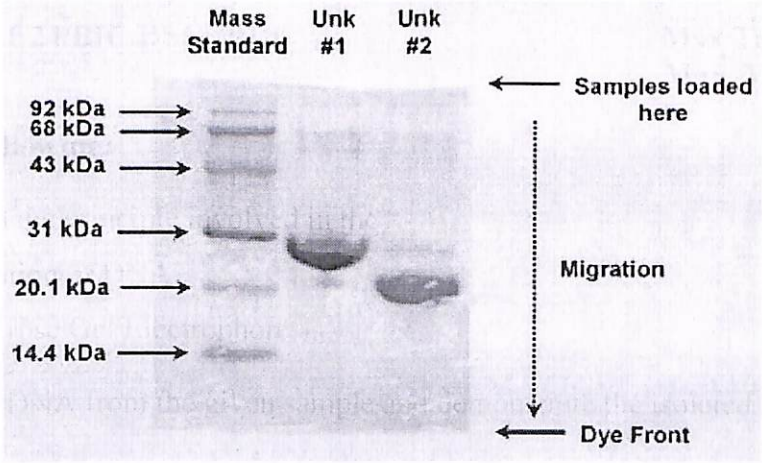
1. Detection of HCG/TSH Hormone.
2. Estimation of DNA by DPA Method
3. Estimation of RNA by Orcinol Method
4. Isolation of DNA from Rice Leaves
5. Determination of Purity of Isolated DNA by UV Spectrophotometer
6. Isolation of DNA from Goat Liver
7. Electrophoresis of Standard DNA.
8. Restriction Digestion of DNA and their Size Determination.
9. Isolation of Plasmid
10. Separation of Proteins by SDS – PAGE
11. PCR (Demo)

MODEL QUESTION PAPER
PRACTICAL

Course Code: U24/BIC/DSC/401/P **Max Time: 2 Hrs**
Credits: 1 **Max. Marks: 50**

Answer the following:

1. Explain the principle involved in the
   a. Isolation of DNA (5 M)
   b. Agarose Gel Electrophoresis (5 M)
2. Isolate DNA from the given sample and demonstrate the isolated DNA on Agarose gel (20 M)
3. Determine the molecular weight of unknown using the SDS-PAGE given below (10 M)



4. Record (5 M)
5. Viva (5 M)

Prepared by Course Teacher [Name & Signature]	Checked &verified by HOD [Name & Signature]	Approved by the Principal
(S. Malathi Varma)	(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- IV
INTELLECTUAL PROPERTY RIGHTS

1. Course Description

Programme: B. Sc.
Course Code: U24/CHE/SEC/401
Course Type: SEC
No. of credits: 2

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

2. Course Objectives

- To create awareness on the concept of Intellectual Property Rights that has assumed a great importance in recent times because of the recognition that "knowledge is property".
- To understand the importance of international treaties and organizations involved in the protection of Intellectual property.
- To enable students to comprehend the various aspects of Patent.

3. Course Outcomes

CO 1: Recall the various types of Intellectual properties and their importance.

CO 2: Recognise the importance of international treaties and organisations in promoting and protecting intellectual property rights.

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4. Course Content

MODULE I: INTRODUCTION TO I.P.R & INTERNATIONAL TREATIES **15 Hrs**

Concept of Property, Kinds of Property, General concept and Significance of Intellectual Property (IP), Introduction to Intellectual Property Rights (IPR) and their protection, Recent Developments, Introduction to Patents, Trademarks, Copyrights, Trade secrets, Industrial designs and Geographical indications. Paris Convention for the Protection of Industrial Property, Trade Related Aspects of Intellectual Property TRIPS, TRIMS, WIPO, Budapest treaty on the international recognition of the deposit of microorganisms for the purpose of patent procedure.

MODULE 2: PATENTS **15 Hrs**

Introduction, The Patent's act 1970, Protectable Subject Matter- patentable invention, Procedure for Obtaining patent, Provisional And Complete Specifications, Rights conferred on a Patentee, Transfer of Patent, Revocation and surrender of Patents, Infringement of patents, Action for Infringement, Patent Agents, Patent Cooperation Treaty (PCT) Brief Discussion on Case Law on Patents.

5. References

1. Dhyani, *Fundamentals of Jurisprudence*: Allahabad Publication, Central Law.
2. Dwivedi S.P. *Jurisprudence of Legal Theory.* Allahabad Central Law Agency.
3. *Treaties on Intellectual Property Rights* Blackstone.
4. Myneni. T.O. Asia Law House.
5. Wadhera B.L., *Intellectual property rights* Universal Law Publications.
6. Narayana P, *Patent Law* Eastern Book Company.
7. Acharya, N.K.: *Textbook on intellectual property rights*, (2001) Asia Law House.
8. Guru M., Rao M.B. (2003). *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications.
9. Ganguli P. (2001)., *Intellectual Property Rights: Unleashing the Knowledge Economy*, Tata McGraw-Hill.
10. Miller A.R., Davis M. (2000): *Intellectual Property: Patents, Trademarks and Copyright in a Nutshell,* West Group Publishers.
11. Watal J., *Intellectual property rights in the WTO and developing countries*, Oxford University Press.

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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, Regional	Allow students to own their innovations in the same way that physical property can be owned.
National, Global	Enables students to develop innovative and valuable work with a strong IP system.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	All	Establish guidelines for creating intellectual property and analyse third party interactions.
ED	All	IPR can be used to protect the technology, brand name, design and creativity behind the concept.
EMP	All	Multifacet involves a variety of responsibilities like research and development, experimentation, data analysis, documentation, collaboration and innovation.

7. 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-Mock courts	Written Exam

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CO2	CIA1-Case Studies	

b). Question Paper Pattern

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(AN AUTONOMOUS COLLEGE AFFILIATED TO OSMANIA UNIVERSITY)
CHEMISTRY
Model Paper
B.Sc. II - Semester IV
SKILL ENHANCEMENT COURSE
INTELLECTUAL PROPERTY RIGHTS (IPR)

Time: 1 Hr **Course Code: U24/CHE/SEC/401**
Max. Marks: 30

SECTION A - Answer any six questions			**6 x 5 = 30 Marks**	
Question Number	**Question**		**CO**	**BTL**
1	**Module 1**	1.Illustrate the importance of Trademarks and Geographical indications.	**CO 1**	**(Level II)**
2	**Module 1**	2. Explain the significance of intellectual property rights.	**CO 1**	**(Level I)**
3	**Module 2**	3. Outline the importance of TRIPS in promoting IPR. (CO 2) **L2**	**CO 2**	**(Level I)**
4	**Module 1**	4. What is the Budapest treaty on the international recognition of microorganisms?	**CO 1**	**(Level I)**
5	**Module 1**	5. Describe in brief the role of WTO in promoting IP.	**CO 1**	**(Level I)**
6	**Module 2**	6. Summarize a note on rights conferred on a patentee.	**CO 2**	**(Level II)**

7	Module 2	7. Give a description on patentable subject matter.	CO 2	(Level I)
8	Module 2	8. Explain briefly the action for infringement of patents.	CO 2	(Level I)

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CHEMISTRY
Model Paper
B.Sc. II - Semester IV
SKILL ENHANCEMENT COURSE
INTELLECTUAL PROPERTY RIGHTS (IPR)

Time: 1 Hr **Course Code: U24/CHE/SEC/401**
Max. Marks: 30

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

1.Illustrate the importance of Trademarks and Geographical indications. (CO 1)**L2**
2. Explain the significance of intellectual property rights. (CO 1)**L1**
3. Outline the importance of TRIPS in promoting IPR. (CO 2)**L2**
4. What is the Budapest treaty on the international recognition of microorganisms? (CO 1)**L1**
5. Describe in brief the role of WTO in promoting IP. (CO 1)**L1**
6. Summarize a note on rights conferred on a patentee. (CO 2)**L2**
7. Give a description on patentable subject matter. (CO 2) **L1**
8. Explain briefly the action for infringement of patents. (CO 2)**L1**

Prepared by	Checked & verified by	Approved by
Name and Signature of the teaching faculty Dr. Shikha Chander Ms. Deepthi	Name and Signature of the HoD Dr. D. Sumalatha	Name and Signature of the Principal Dr. Uma Joseph

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SEMESTER - IV

rDNA TECHNOLOGY

1. Course Description

Programme: BSc
Course Code: U24/BIT/DSC/401
Course Type: DSC 4
No. of credits: 4

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

2. Course Objectives

- To understand the role of enzymes and different types of vectors commonly used in rDNA technology, including plasmids, bacteriophages, cosmids, and viral vectors.
- To learn the significance of screening methods in identifying desired recombinant clones and analyze the role of rDNA technology in revolutionizing science and technology.

3. Course Outcomes

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

CO1: Recall and understand the importance of fundamental principles of enzyme function in the context of rDNA technology. **(REMEMBER, UNDERSTAND)**

CO2: Interpret and utilize the usage of vectors in rDNA technology **(UNDERSTAND, APPLY)**

CO3: Relate and apply knowledge of screening methodologies and evaluate the efficiency and reliability of screening methods. **(REMEMBER, APPLY, EVALUATE)**

CO4: Understand and apply skills in the production of recombinant products **(UNDERSTAND, APPLY)**

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4. Course Content

MODULE -I: ENZYMES IN rDNA TECHNOLOGY **12 Hrs**

- Introduction to rDNA technology: Recombinant DNA technology definitions, Steps in Gene cloning.
- Enzymes used in rDNA technology:
- Ligases.
- Reverse Transcriptase (RTase).
- Restriction endonucleases: Types of restriction endonucleases, Nomenclature, Recognition sequences, Cleavage patterns, Frequency of recognition sites, Modification of cut ends (Linkers and Adaptors).
- Exonucleases.
- Polymerases.
- DNA modifying enzymes: Alkaline phosphatase, Poly nucleotide kinase, Terminal deoxynucleotidyl transferase.

MODULE -II: VECTORS USED IN rDNA TECHNOLOGY **16 Hrs**

- Cloning vectors: Properties of a good vector, Nomenclature of plasmid cloning vectors.
- Plasmids- Size and copy number.
- Classification of plasmids: Stringent plasmids, Relaxed plasmids, Resistance or R plasmids, Col plasmids, Degradative plasmids, Virulence plasmids, Ti plasmids.
- pBR322- Nomenclature of pBR322, Structure and Useful properties of pBR322, pedigree of pBR322, Recombinant selection of pBR322 using Replica plating technique.
- pUC18- Nomenclature and structure of pUC18, a Lac selection plasmid.
- pGEM3Z- Nomenclature and structure of pGEM3Z- in vitro transcription of cloned DNA.
- Cosmids- cloning of Long DNA fragments using a cosmid.
- Expression vectors, phages- λ genetic map, insertional and replacement vectors, cloning experiment with λ based vectors.
- Yeast vectors (shuttle vectors): 2μm plasmid, YEps, YRps, YCps, YAC.
- Isolation of plasmid DNA- Alkaline denaturation method, Restriction digestion and Gel analysis.

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MODULE -III: SCREENING OF RECOMBINANTS

16 Hrs

- Integration of DNA insert into vectors: Both ends cohesive and compatible, Both ends cohesive and separately matched, Both ends cohesive and unmatched, Both ends flush / blunt one end cohesive and compatible while the other end Blunt.
- Introduction of recombinant DNA into suitable host: Increased Competence of *E.coli* by Cacl2 treatment, infection by vectors packed as virions.
- Screening of expression libraries- Hybrid arrested translation, Hybrid selection.
- Polymerase Chain Reaction - Procedure of PCR (denaturation, annealing and primer extension), designing of primers, calculation of Tm of primer-template hybrid, Variations of PCR (Inverse, Anchored, RT-PCR, Asymmetric, Nested and ARMS PCR), Analysis of PCR products, Advantages and limitations of PCR, Applications of PCR.
- Hybridization techniques: Southern and northern hybridization.
- cDNA library- Preparation of cDNA, cloning of cDNAs, problems in cDNA preparation, Properties of cDNA, Applications of cDNA library.
- Genomic library: Construction of genomic library and Applications.

MODULE-IV: APPLICATIONS OF rDNA TECHNOLOGY

16 Hrs

- Recombinant insulin- Structure of Insulin molecule (A chain and B chain), formation of preproinsulin, Synthesis and expression of recombinant insulin genes.
- Growth hormones: recombinant production of somatostatin and somatotrophin
- Recombinant production of HBsAg (Hepatitis B surface antigen).
- DNA vaccines- Producing vaccines as recombinant proteins, Live recombinant virus vaccines (vaccinia virus).
- Recombinant Hirudin production in Brassica napus using olesin protein.
- Recombinant chymosin in cheese production.

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5. Reference books

1. Clark D.P. and Pazdernik N.J. (2009). *Biotechnology-Applying the Genetic Revolution*. USA: Elsevier Academic Press.
2. Brown T.A. (2006). *Gene Cloning and DNA Analysis*. (V Edition). Oxford, U.K.: Blackwell Publishing.
3. Primrose S.B and Twyman R.M. (2006). *Principles of Gene Manipulation and Genomics* (VII Edition). Oxford, U.K : Blackwell Publishing.
4. Glick, B.R., Pasternak, J.J. (2003). *Molecular Biotechnology- Principles and Applications of recombinant DNA*. Washington: ASM Press.
5. Sambrook J, Fritsch E.F. and Maniatis T. (2001). *Molecular Cloning-A Laboratory Manual*. (III Edition). Cold Spring Harbor Laboratory Press.

6. Syllabus Focus

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

Local /Regional/National /Global Development Needs	Relevance
Global (Module 1,2,3 & 4)	Recombinant DNA technology contributes to addressing key global challenges and sustainable development goals. Continued innovation and responsible deployment of this technology are essential for advancing human well-being and promoting equitable development worldwide.

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b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Module I, II	Practical sessions for students on role of vectors, enzyme action and analysis.
Employability	Module III	Students will be given hands-on training on screening methods and handling of thermocycler
Entrepreneurship Development	Module IV	Field trip to research institutes and incubation centers which will enhance their experiential learning

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Seminar
2.	Experiential Learning	Quiz
3.	Participative Learning	Group discussions
4.	Participative Learning	Presentations
5.	Problem Solving	Research Projects
6.	Experiential Learning	Field trips

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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	CIA-2 Quiz/ Article writing/Assignment	
CO4	CIA-2Model/ Assignment/Role play	

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b) Model Question Paper- End Semester Exam

rDNA TECHNOLOGY
MODEL QUESTION PAPER

Course Code: U24/BIT/DSC/401
Credits: 4

Max. Marks: 60
Time: 2 Hrs

SECTION – A

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

1. What is rDNA technology? Classify DNA modifying enzymes

OR

2. Explain the use of Restriction endonucleases in rDNA technology.
3. Summarize the role of pUC18 as cloning vector.

OR

4. How would use bacteriophages as expression vectors.
5. How would you evaluate the role of PCR technique for DNA amplification.

OR

6. How can you make use of cDNA in library preparation?
7. What approach would you use to produce insulin using rDNA technology.

OR

8. How would you summarize DNA vaccines.

SECTION –B

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

9. Describe the steps involved in gene cloning
10. Outline the screening by replica plating method
11. How would you use Hybrid arrested translation in selection of recombinants?
12. Summarize about recombinant growth hormones.
13. Describe the key features of YAC vector
14. Explain the role of Ligases.

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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	What is rDNA technology? Classify DNA modifying enzymes	CO 1	I
2	Module 1	Explain the use of Restriction endonucleases in rDNA technology.	CO 1	II
3	Module 2	Summarize the role of pUC18 as cloning vector.	CO 2	II
4	Module 2	How would you use bacteriophages as expression vectors.	CO 2	III
5	Module 3	How would you evaluate the role of PCR technique for DNA amplification.	CO 3	V
6	Module 3	How can you make use of cDNA in library preparation?	CO 3	III
7	Module 4	What approach would you use to produce insulin using rDNA technology.	CO 4	III

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8	Module 4	How would you summarize DNA vaccines.	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 the steps involved in gene cloning	CO 1	I
10	Module 2	Outline the screening by replica plating method	CO 2	II
11	Module 3	How would you use Hybrid arrested translation in selection of recombinants?	CO 3	III
12	Module 4	Summarize about recombinant growth hormones.	CO 4	II
13	Any Module	Describe the key features of YAC vector	CO 2	I
14	Any Module	Explain the role of Ligases.	CO 1	II

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SEMESTER – IV

rDNA TECHNOLOGY - PRACTICAL

1. Course Description

Programme: BSc
Course Code: U24/BIT/DSE/401/P
Course Type: DSE
No. of credits: 1

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

2. Course Objective

- To acquire skills about restriction digestion and ligation of the DNA.
- To learn and apply basic understanding in handling PCR and Southern blotting techniques

3. Course Outcomes

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

- To Understand, perform, and analyze DNA by AGE, PCR and Ligation **(UNDERSTAND, ANALYZE)**
- To Understand, perform, and evaluate the process of transformation in bacteria. **(UNDERSTAND, EVALUATE)**

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PRACTICAL SESSIONS

1. Introduction to Biosafety methods and GLP
2. Restriction digestion of Lambda DNA.
3. Problems based on restriction digestion.
4. Transformation of DH5α cells.
5. Polymerase chain reaction.
6. Ligation test.
7. Cloning of Green fluorescent protein.
8. Phage titration.
9. Southern blotting.

Spotters:

1. Blue white screening
2. PCR
3. Agarose gel
4. Southern Blotting
5. Restriction digested bands
6. Ligated bands
7. Cloning

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SEMESTER-IV

rDNA TECHNOLOGY-PRACTICAL

Course Code: U24/BIT/DSC/401/P **Max. Marks: 50**
Credits: 1 **Time: 2 Hrs**

I. MAJOR: (20M)

Discuss the principle and procedure for ligation. Perform the experiment with the given sample and report the result.

II. MINOR: (10M)

Solve the given problems on restriction digestion.

III. IDENTIFY THE GIVEN SPOTTERS: (10M)

IV. VIVA (5M)

V. RECORD (5M)

Prepared by	Checked & verified by	Approved by
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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 -IV
SYNTHESIS OF ORGANIC COMPOUNDS AND FUNCTIONAL GROUP ANALYSIS

Program: B.Sc.
Course Code: U24/CHE/DSC/401/P
Course: DSC-4
No. of Credits: 1

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

Course Objective

- To prepare simple organic compounds and systematically analyse functional groups based on their nature and chemical reactivity.

Course Outcomes

CO1: Utilise the knowledge of organic reaction mechanisms in their preparations.
CO2: Categorise functional groups present in organic compounds using systematic quantitative analysis.

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, carbohydrate, amide, nitro, amines) and preparation of one derivative.

Synthesis of organic compounds:

a. Acetylation – Preparation of Acetanilide.
b. Halogenation – Preparation of p-Bromo acetanilide.
c. Oxidation – Preparation of Benzoic acid.
d. Esterification - Preparation of n-butyl acetate.
e. Methylation – Preparation β-Naphthyl methyl ether.
f. Nitration – Preparation of Nitrobenzene
g. Reduction – Preparation of m-Nitroaniline

Reference Books:

- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.
- Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry,* Universities Press.

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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	Knowledge of the basic principles of Chemistry to help in day-to-day life.
Regional	Learn about the concepts and significance of carbohydrates and bioinorganic chemistry.
National	Understand the basics of organometallic compounds, non-aqueous solvents and dipole moments.
Global	Application of basic principles of rotational, IR, UV-Vis Spectroscopy techniques, concepts of chemical kinetics, heterocyclic compounds and pericyclic reactions.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Practical syllabus which includes Organic preparations and Qualitative analysis in Organic Chemistry Problem solving in Physical Chemistry	Students perform the experiments based on the procedure and also analyse the unknown compounds. Students solve the problems
ED	Organic preparations and analysis. Structural investigation of organic compounds based on spectroscopy	Students prepare organic compounds, analyse the functional groups and carry out the structural analysis based on spectral data
EMP	Inorganic, Organic, Physical Chemistry and Spectroscopy	Tutorials and assignments

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7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1	Experiential	Experiments, attending seminars/workshops and field visits
2	Participative	Group discussion, quiz, presentations etc.
3	Problem solving	Solving problems in Physical Chemistry and structural elucidation based on spectral data.

8. Course Assessment Plan

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

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA1-Written Exam	Written Exam
CO2	CIA 2- Skill based test like poster/powerpoint presentation, collage, 3D model making, problem solving and quiz.	
CO3	CIA1-Written Exam	
CO4	CIA 2- Skill based test like poster/powerpoint presentation, collage, 3D model making, problem solving and quiz.	

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b. Model Question Paper - End Semester Exam

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Faculty of Science – Department of Chemistry

MODEL PAPER

B.Sc. II YEAR SEMESTER -IV

CHEMISTRY - PAPER IV

TIME: 2 hrs **Course Code: U24/CHE/DSC/401**

Max. Marks: 60

SECTION –A (Essay Questions)

.Answer the following

4X10=40 Marks

1. a) Explain the classification of organometallic compounds based on metal-carbon bonds. (CO1) **L1** 5M
   b) Discuss the reactions in liquid ammonia with suitable examples. (CO1) **L2** 5M

OR

2. a) Describe the preparation, properties and applications of Grignard reagent. (CO1) **L3** 6M
   b) How does fixation of carbon dioxide occur in photosynthesis? (CO1) **L2** 4M
3. a) Derive an expression for the rate constant of first order reaction. (CO2) **L3** 5M
   b) A first order reaction is 50% complete in 100 minutes. How long will it take for 90% completion? (CO2) **L5** 5M

OR

4. Explain different methods of experimental determination of order oa a reaction. (CO2) **L2** 10M
5. a) Discuss the open chain structure of Glucose. (CO3) **L2** 5M
   b) Write the equations involved in Killiani-Fischer synthesis. (CO3) **L2** 5M

OR

6. a) Explain the synthesis of Furan, Pyrrole and Thiophene from 1,4-dicarbonyl compounds. (CO3) **L2** 5M
   b) What are pericyclic reactions? Give their classification with an example each. (CO3) **L4** 5M
7. a) What is a dipole moment? Predict the structure of CO_2 and SO_2 based on dipole moment. (CO4) **L4** 5M
   b) Explain the various molecular vibrations seen in IR spectroscopy. (CO4) **L2** 5M

OR

8. a) Describe in detail about the electronic transitions observed in UV-VIS spectroscopy. (CO4) **L2** 5M
   b) Explain the basic principles of Raman spectroscopy. (CO4) **L2** 5M

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SECTION –B

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

9. Write a note on the biological significance of calcium and chloride ions. (CO1) **L1**
10. Give two methods of preparation of ferrocene. (CO1) **L1**
11. Discuss briefly about collision theory. (CO2) **L2**
12. Explain the factors affecting the rate of a reaction. (CO2) **L2**
13. Explain mutarotation taking glucose as an example. (CO3) **L2**
14. Explain the concept of chromophore and auxochrome. (CO4) **L2**

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