SEMESTER – III

SEC-I BIOPROCESS TECHNIQUES

1. Course Description

Programme: B.Sc.
Course Code: U24/BIT /SEC/301
Type of course: SEC-1
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 Bioprocess techniques
- To develop competency and understanding of production of fermented products

3. Course Outcome:

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

CO1: Remember and apply the skills gained in basic concepts of microbial growth kinetics **(REMEMBER, APPLY)**

CO2: Summarize and apply the knowledge about the production of various fermentation processes **(UNDERSTAND, APPLY)**

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4. Course Content:

Module I: Bioprocess Kinetics **(15 Hrs)**

- Growth Kinetics of bacteria
- Effect of Temperature on Enzyme Activity
- Effect of pH on Enzyme Activity
- Purification and identification of unknown compound from a mixture of compounds using TLC

Module II: Fermentation Technology **(15Hrs)**

- Production of ethanol by yeast
- Production of Amino Acid
- Determination of kLa by sulphite oxidation method
- Fermentation (Batch, Continuous, Fed Batch)

5. Reference Books:

1. O.P. Ward, 1989. Fermentation Biotechnology: Principles, Processes, and Products. Open University Press, Milton Keynes, UK,
2. G. Szasz. 1974, The Effect of Temperature on Enzyme Activity and on the affinity of enzymes to their Substrates, Z Klin Chem Klin Biochem.
3. Zuiderweg. F. J, 2009, Laboratory Manual of Batch Distillation, Interscience Publishers.
4. "Biotechnology for Beginners" by Reinhard Renneberg, Arnold L. Demain, and Dieter Antranikian.Introduction to Bioinformatics by Aurther M lesk
5. "Principles of Fermentation Technology" by Peter F. Stanbury, Allan Whitaker, and Stephen J. Hall.Bioinformatics second edition By David Mmount
6. "Manual of Industrial Microbiology and Biotechnology" edited by Richard H. Baltz, Julian E. Davies, and Arnold L. Demain.Bioinformatics Computing by Bryan Bergeron
7. "Applied Microbiology" by Alexander H. Glazer.

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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 (Module 1,2)	Bioprocess techniques have broad-reaching implications for addressing global challenges related to sustainability, healthcare, food security, environmental protection, and economic development.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	Production of enzyme, ethanol, and determination of kLa by sulphite oxidation method.	Students will be able to develop skills associated with isolation and application of important microbial strains and production of fermented products during laboratory sessions.
Entrepreneurship Development	Types of fermentation	Field trip/industrial visit to incubation centre to understand the working principle of bioreactors which will make them industry ready.

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/ Assignment/Presentation/ written test	**End Semester exam-30 Marks**

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b) Question Paper Pattern

EXTERNAL- MODEL QUESTION PAPER

Course Code: U24/BIT/SEC/301 **Max Time: 1 Hr**
Credits: 2 **Max. Marks: 30**

Answer the following.

I. Major **(15M)**

Perform Thin layer chromatography for the separation of given mixture. Write the principle and procedure and report the results.

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

Write the principle and procedure for the production of ethanol by yeast/ Identify the given spotters

III. Record **(5M)**

Prepared by	Checked & verified by	Approved by
Shruti 04/03/24 (MS. Shruti Joshi) Name and Signature of the teaching faculty	4/3/24 (Ms. Shouni Niveditha) Name and Signature of HoD	Name and Signature of Principal

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SEMESTER - III
CHEMISTRY PAPER - III

1. Course Description

Programme: B.Sc.
Course Code: U24/CHE/DSC/301
Course Type: DSC
No. of credits: 4

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

2. Course Objectives

- To understand the nature and properties of d & f-block elements.
- To know the basic concepts of thermodynamics and to explain thermodynamic properties
- To classify organic molecules by their functional groups and identify fundamental properties associated with those functional groups
- To foster acquisition of knowledge on the concepts of solutions and phases of different systems.
- To acquire knowledge on qualitative analysis and apply practically.
- To learn structures of amino acids and proteins, synthesis and reactivity of amino acids.

3. Course Outcomes

CO1: Acquire knowledge about the properties of d & f-block elements and their separation techniques.
CO2: Describe the fundamental laws and concepts of thermodynamics.
CO3: Recognize functional groups in organic molecules and predict their reactivity through mechanisms.
CO4: Comprehend the concepts of Qualitative analysis, Phase rule, Amines and Amino acids.

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4. Course Content

MODULE I: INORGANIC CHEMISTRY 15 Hrs

d Block Elements **6 Hrs**

Chemistry of d-block elements: Characteristics of d-block elements with special reference to electronic configuration variable valency, ability to form complexes, magnetic properties. Determination of magnetic susceptibility using Guoy's balance & catalytic properties. Stability of various oxidation states and Standard reduction potential. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu triads. Titanium triad – electronic configuration and reactivity of +3 and +4 states – oxides and halides. Chromium triad – reactivity of +3 and +6 states. Copper triad – reactivity of +1, +2 and +3 states.

Chemistry of f-block elements **5 Hrs**

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behaviour of post lanthanides- complexation- type of donor ligands preferred. Magnetic properties-paramagnetism. Colour and spectra, f-f transitions –occurrence and separation – ion exchange method, solvent extraction. Chemistry of actinides- general features – electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

Theories of bonding in metals **4 Hrs**

Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

MODULE II: PHYSICAL CHEMISTRY 15 Hrs

Thermodynamics **15 Hrs**

Definition of thermodynamic terms: system, surroundings, types of systems, intensive and extensive properties, state and path functions and their differentials. Thermodynamic processes, concept of heat & work. First law of thermodynamics-statement, definition of internal energy & enthalpy, Heat capacity, heat capacities at constant volume & pressure and their relationship. Joule's law, Joule Thomson coefficient and inversion temperature. Calculation of W, q, dU, dH for expansion of ideal gases under isothermal & adiabatic conditions for reversible process. Temperature dependence of Enthalpy- Kirchoff's equation.

Second law of thermodynamics, need for the law, different statements of the law. Carnot's cycle and its efficiency, Carnot theorem, thermodynamic scale of temperature concept of Entropy, Entropy as a state function, entropy changes in cyclic reversible and irreversible phase changes. Entropy as a function of V&T. Entropy as a function of P&T. Entropy change in physical processes.

Gibbs and Helmholtz functions: Gibbs function (G) & Helmholtz function (A) as thermodynamic quantities. A&G as criterion for thermodynamic equilibrium and spontaneity.

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Their advantage over Entropy change. Gibbs equations and Maxwell relations. Variation of G with P, V&T.

MODULE III: ORGANIC CHEMISTRY 15 Hrs

Carbonyl Compounds 7 Hrs

Aldehydes and ketones: Preparation: from acid chlorides, nitriles and 1,3-dithianes. Reactions – Reaction with HCN, $NaHSO_3$, ROH– hemiacetal and acetal formation, NH$_2$-G derivatives- (a) NH_2 (b) RNH_2 (c) NH_2OH (d) $PhNHNH_2$(e)2,4-DNP. Mechanisms of Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation, Knoevenagel condensation, Reduction reactions (no mechanism required) Clemmensen reduction and Wolff Kishner reduction. Meerwein - Pondorff –Verley reduction. Oxidation: Baeyer – Villiger oxidation.

Carboxylic acids and their derivatives 5 Hrs

Carboxylic acids (aliphatic and aromatic)
Preparation: Acidic and Alkaline hydrolysis of esters (with mechanism). Hydrolysis of Nitriles. Reactions: (no mechanism required) Hell – Volhard – Zelinsky Reaction. Degradation of carboxylic acids by HunsDiecker reaction, Schmidt reaction (decarboxylation), Arndt – Eistert synthesis

Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Reformatsky Reaction (mechanism), Perkin condensation (mechanism).

Synthesis based on Carbanions 3 Hrs

Acidity of Alpha - Hydrogens, Preparation of Aceto-acetic ester by Claisen condensation and synthetic applications of Acetoacetic ester. A) Acid hydrolysis and ketonic hydrolysis. Preparation of i) monocarboxylic acids ii) dicarboxylic acids (iii) ketones (iv) Reaction with urea.

Malonic Ester-synthetic applications. Preparation of i) substituted mono carboxylic acids (ii) substituted dicarboxylic acids (iii). α, β. Unsaturated acids.

MODULE IV: GENERAL CHEMISTRY 15 Hrs

Phase Rule 5 Hrs

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibbs Phase rule, phase equilibria of one component system – water system. Phase equilibria of two- component system – Solid-Liquid equilibria, simple eutectic –Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H_2O system.

General Principles of Inorganic qualitative analysis (Semi-Micro Analysis) 3 Hrs

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions- CO_3^{2-} Cl^-, Br^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}.CH_3COO^-, NO_3^-.

Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations (Hg_2^{2+}, Ag^+, Pb^+)

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with flow chart and chemical equations. Principle involved in separation of group II & IV cations.

General discussion for the separation and identification of group II (Hg^{2+}, Pb^{2+}, Bi^{3+}, Cd^{2+}, Sb^{2+}), III (Al^{3+}, Fe^{3+}), IV ((Mn^{2+}, Zn^{2+}) individual cations with flow chart and chemical equations. Application of concept of hydrolysis in group V cation analysis. General discussion for the separation and identification of group V individual cations (Ba^{2+}, Sr^{2+}, Ca^{2+}) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^{2+}, NH_4^+).

Amines (Aliphatic & Aromatic) **2 Hrs**

Nomenclature & Classification into primary, secondary & tertiary amines & quaternary ammonium compounds. Preparation- 1. ammonolysis of alkyl halides, 2. Gabriel synthesis, 3. Hoffmann's bromamide reaction (mechanism), reduction of amides & Schmidt reaction. Physical properties & basic character – Comparative basic strengths of NH_3, CH_3NH_2, $(CH_3)_2$ NH, $(CH_3)_3N$ & Aniline- Comparative basic strengths of aniline, N-Methylaniline & N,N-Dimethylaniline (in aqueous & non-aqueous media), steric effects & substituent effects. Use of amine salts as phase transfer catalysts. Chemical properties: a) alkylation, b) acylation c) Carbylamine reaction, d) Hinsberg separation, reaction with nitrous acid of 1°,2°,3°(aliphatic & aromatic amines). Electrophilic substitution of aromatic amines- bromination & nitration, oxidation of aryl & tertiary amines, diazotization.

Diazonium salts **2 Hrs**

Preparation & mechanism. Synthetic importance-replacement of diazonium group by OH, X(Cl)-Sandmeyer & Gattermann reaction, by fluorine (Schiemann reaction), By iodine, CN, NO_2, H & aryl groups. Coupling reaction of diazonium salts- with phenols and aromatic amines.

Amino acids **3 Hrs**

Classification: Amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and Leucine) by following methods: a) From halogenated Carboxylic acid b) Malonic ester synthesis c) Strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids: L – configuration, irrespective of sign of rotation. Zwitterion structure – salt like character, solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups – Lactams from gamma and delta amino acids by heating peptide bond (amide linkage).

5. References:

1. Malik, W.U., Tuli G.D., and Madan, R.D. (2004). *Selected Topics in Inorganic Chemistry.* Ram Nagar, New Delhi: S. Chand and Company.
2. Puri, B.R., Sharma, L.R., Kalia, K.C., (2006). *Principles of Inorganic Chemistry.* Pitampura, Delhi: Vallabh Publications.
3. Bahl, A., &Tuli. (2009). *Essentials of physical chemistry: A textbook for B. Sc. classes as per UGC model syllabus* (Rev. multicolored.). New Delhi: S. Chand.
4. Bahl, A. and Bahl, B.S. (2011). *A Textbook of Organic Chemistry.* Ram Nagar, New Delhi: S. Chand and Company.

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5. Jain, M.K., and Sharma, S.C. (2011). *Modern Organic Chemistry*. Jalandhar, Delhi: Vishal Publishing Co.
6. Sharma, Y.R. (2012). *A Textbook of Complete Organic Chemistry*. Bangalore: Kalyani Publishers.
7. Principles of Inorganic Chemistry by Puri, Sharma and Kalia. Vishal Publications 1996.
8. Soni, P. (1979). *A textbook of physical chemistry* (11th ed.). New York: Academic Press.
9. Morrison R.T., Boyd, R.N., and Bhattacharjee S.K. (2011). *Organic Chemistry*. Delhi, Chennai, Chandigarh: Pearson.
10. Ferguson, L. (1966). *The Modern Structural Theory of Organic Chemistry*. New Delhi: Prentice-Hall of India Pvt.
11. Solomons, T., & Fryhle, C. (2008). *Organic chemistry* (9th edn.). Hoboken, NJ: John Wiley.
12. Sharma, Y.R. (2012). *A TextBook of Complete Organic Chemistry*. Bangalore: Kalyani Publishers.
13. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter

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SEMESTER - III

SEC I: LAB REAGENTS AND LAB SAFETY IN CHEMISTRY

1. Course Description

Programme: BSc
Course Code: U24/CHE/SEC/301
Course Type: SEC
No. of credits: 2

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

2. Course Objectives

- To learn the safety rules and regulations to be followed while working in chemistry laboratory.
- To develop the skill of preparation of basic laboratory reagents.

3. Course Outcomes

This SEC paper will help students to enhance their overall skills in preparation and handling of various reagents in laboratory.

CO1: Gain knowledge and interpret various aspects while handling, and storage of various chemicals and calibrations with precautions.

CO2: Summarize the preparation of different lab reagents.

4. Course Content

Module- I: Laboratory Safety Rules and Regulations **15 Hrs**

General rules and regulations for lab safety: Minimizing Risks of Hazards, Personal Protective Equipment (PPE) - Hair, Dressing for the Laboratory, Eye Protection, Eyewash fountain, Gloves, Laboratory Protocols, Labelling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals, Guide to Chemical Hazards, Chemical Spills etc. Accidents- use of fire extinguisher and first aid kit in the laboratory, safety symbols- Preparation of the charts by the students and display of charts in chemistry labs. Calibration of fractional weights, calibration of glassware - burette, pipette, standard flask, Normality/Molarity and specific gravity of concentrated acids – Preparation of dilute solutions (Numerical problems). Precautions to be taken in the preparation of dilute acids and bases and bases. Preparation of stock solutions of salts with specific examples. Properties of primary standard salt and preparation of standard solution. Good laboratory practices- maintenance of observation book records.

Module- 2: Preparation of Lab Reagents **15 Hrs**

Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation titrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc). Preparation of buffers – pH10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents: Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bayer's reagent, Benedict's solution, Bromine water, Dimethylglyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent, Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch's reagent, Nessler's reagent, Neutral $FeCl_3$, Schiff's reagent, Silver nitrate solution, Sodium carbonate solution , Sodium

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hydroxide (Caustic soda) solution, Starch solution, Tollen's reagent. (reference work and submission of assignments). Charts preparation depicting course content.

5. References

1. Vogel's Textbook of Quantitative Chemical Analysis, 5th edition.
2. Vogel's Textbook of macro and semimicro qualitative inorganic analysis. G. Svehla, 5th edition.
3. Chemistry Reagent Manual Prepared by Chemistry Department, SGTB Khalsa College under DBT's Star College Scheme, University of Delhi (Available: online)
4. American Chemical Society Safety in Academic Chemistry Laboratories 8th edition

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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 rules for calibration of instruments and glassware.
Regional	Learn about the concepts involved in preparation of basic laboratory reagents.
National	Acquisition of new horizons in skill development and employability.
Global	A complete idea of rules, regulations and methods for preparation of reagents increases a student's inclination towards the subject.

b. Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	**Module1** Laboratory Safety Rules and Regulations.	This enhances their skill development and employability in the field of chemistry, cosmetology and pharmacy.
EMP		
SD	**Module 2** Preparation of Lab Reagents	To prepare and check the quality parameters of the various laboratory reagents.
ED		
EMP		

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7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1.	Field trips, Internship Opportunities	Students are taken to various institutes like IICT, HCU, IITH, ARCI, Pharma Patashala etc
2.	Seminars/ workshops/ research projects	Students are allowed to participate in seminars and workshops organized in and outside the college. They are encouraged to take up research projects.

8. Course Assessment Plan

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

Continuous Internal Assessments CIA -40%	End Semester Examination- 60%
CIA- 20 Marks	Written Exam 30 Marks

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b. Model Question Paper- End Semester Exam

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(An Autonomous College Affiliated To Osmania University)
CHEMISTRY
Model Paper
B.Sc. II - Semester III
SKILL ENHANCEMENT COURSE I
LAB REAGENTS AND LAB SAFETY IN CHEMISTRY

Time: 1 Hr **Course Code: U24/CHE/SEC/301**
Max. Marks: 30

Answer any six questions

5 x 6 = 30 Marks

1. Summarize the personal protective equipment. (**L2**)
2. Explain the preparation and properties of standard solutions. (**L2**)
3. Describe how calibration of glassware is carried on. (**L2**)
4. Outline the procedure to prepare 2,4-Dinitrophenyl hydrazine reagent, and Eriochrome black-T reagent. (**L1**)
5. Emphasize the role of Phenolphthalein and Diphenylamine indicators in detecting the end point of a reaction. (**L3**)
6. Write a note on ammonical and acetate buffer solutions. (**L2**)
7. Discuss the steps involved in the preparation of Tollens, Fehling's and Benedict's reagents. (**L1**)

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b. Model Question Paper- End Semester Exam

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(An Autonomous College Affiliated To Osmania University)
CHEMISTRY
Model Paper
B.Sc. II - Semester III
SKILL ENHANCEMENT COURSE I
LAB REAGENTS AND LAB SAFETY IN CHEMISTRY

Time: 1 Hr **Course Code: U24/CHE/SEC/301**
Max. Marks: 30

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

Question Number	Question		CO	BTL
1	Module 1	Summarize the personal protective equipment.	CO 1	Level 2
2	Module 1	Explain the preparation and properties of standard solutions.	CO 1	Level 2
3	Module 1	Describe how calibration of glassware is carried on.	CO 1	Level 2
4	Module 2	Outline the procedure to prepare 2,4-Dinitrophenyl hydrazine reagent, and Eriochrome black-T reagent.	CO 2	Level 1
5	Module 2	Emphasize the role of Phenolphthalein and Diphenylamine indicators in detecting the end point of a reaction.	CO 2	Level 3
6	Module 2	Write a note on ammonical and acetate buffer solutions.	CO 2	Level 2
7	Module 2	Discuss the steps involved in the preparation of Tollens, Fehling's and Benedict's reagents.	CO 2	Level 1

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SEMESTER – III

MOLECULAR BIOLOGY- THEORY

1. Course Description

Programme: BSc
Course Code: U24/BIT/DSC/301
Course Type: DSC 3
No. of credits: 4

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

2. Course Objectives:

- To have a deeper understanding of the fundamental principles and processes governing molecular interactions within cells that include the central dogma of the molecular biology and process of replication.
- To interpret the processes of gene expression, regulation, mutations, repair and implement these mechanisms in the research areas of Biotechnology.

3. **Course outcomes**:

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

CO1: Recall, interpret, and analyse the basics of nucleic acids and comprehend the cellular processes like genome organization and replication. **(REMEMBER, UNDERSTAND, ANALYZE)**

CO2: Comprehend and examine the structure & functions of RNA, process of transcription in Prokaryotes and Eukaryotes along with the post transcriptional modifications in synthesizing an active mRNA transcript. **(UNDERSTAND, ANALYSE)**

CO3: Understand, apply and analyse the process of translation, post translational modifications and regulation of gene expression in protein synthesis. **(UNDERSTAND, APPLY, ANALYSE)**

CO4: Summarize, infer and assess the various types of DNA mutations and their consequences on cellular function, compare various DNA Damage and repair mechanisms in terms of efficiency and accuracy. **(UNDERSTAND, ANALYZE, EVALUATE)**

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4. Course content

MODULE-I: DNA STRUCTURE AND REPLICATION **15 Hrs**

- Nucleic acids – Introduction
- DNA- hereditary material in living organisms: Structure of DNA- Chemical composition, Molar ratio of nitrogenous bases, Molecular structure of DNA, Watson and Crick's double helical model of DNA, forms of DNA (A,B and Z)
- Denaturation- Hyperchromicity, Effects of pH and Temperature on denaturation
- Renaturation of DNA.
- Genome organization: Viral genome, prokaryotes (positive and negative supercoiling, circular DNA).
- Nuclear genome in Eukaryotes (Nucleosomes, chromatin, scaffold proteins and formation of condensed metaphase DNA)
- DNA as genetic material and evidence to prove DNA as genetic material. (Griffith's experiment, Mc Avery, Mc Load and Mc Carty experiment, Hershey and Chase's experiment
- Replication of DNA: Semi conservative mode of Replication: leading and lagging strands. Replication in prokaryotes-Initiation, Elongation and Termination, Enzymology of DNA replication (topoisomerases, helicases, single stranded binding proteins, DNA polymerases, ligases).
- Replication of eukaryotes- Initation, Elongation and Termination (Replication of the ends of Eukaryotic chromosomes) Unidirectional and Bidirectional replication.
- Replication models: Theta θ model, Rolling Circle model, D- Loop model of Replication.

MODULE -II: TRANSCRIPTION AND RNA PROCESSING **15 Hrs**

- RNA structure: Chemical composition, Molar ratio of nitrogenous bases, Molecular structure of RNA, types of RNA (mRNA, rRNA and tRNA).
- Transcription in prokaryotes: Prokaryotic RNA polymerases (Core enzyme and Sigma subunit), role of sigma factor, Functions of RNA polymerases, Promoter.
- Mechanism of Transcription in Prokaryotic cells: Initiation, elongation and termination of RNA chains (Rho-protein dependent and independent Termination).
- Transcription in eukaryotes-Eukaryotic RNA polymerases, Transcription factors, Functional sequences in promoter region in Eukaryotes.
- Mechanism of Transcription in Eukaryotic cells: Initiation, elongation and termination.
- Post transcriptional modification: Processing of pre mRNA, 5′- cap formation, polyadenylation, RNA splicing.

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MODULE -III: REGULATION OF GENE EXPRESSION AND TRANSLATION 16 Hrs

- Regulation of prokaryotic gene expression (lac operon- Functioning of Lac operon, Structure of operon, Allosteric regulation of Lac repressor, Role of Cyclic AMP in Catabolite Repression.
- trp operon- A repressible operon system, Attenuation, Structure of Leader mRNA, Mechanism of attenuation.
- Genetic code-Nature and characteristics of Genetic code.
- Translation- prokaryotes and eukaryotes, ribosome structure and assembly, charging of tRNA, aminoacyl tRNA synthetases, mechanism of initiation, elongation and termination of polypeptides.
- Inhibitors of translation (Tetracyclin, streptomycin, Neomycin, Chloramphenicol, Erythromycin).
- Post translational modifications (Protein folding and Biochemical modifications).

MODULE -IV: DNA MUTATION, DAMAGE AND REPAIR 14 Hrs

- DNA mutations: Spontaneous and induced mutations, Types of mutagens: Physical- Effect of pH, Radiations- ionizing (X-rays, gamma rays) and non-ionizing (UV rays).
- Chemical mutagens- Incorporation of base analogues, nitrous acid, Hydroxylamine, Alkylating agents, Effect of dyes on nucleotide sequence (Acridine dyes).
- DNA damage: Types of DNA damage- Single base substitution, Transition, Transversion, Frame shift mutation, Silent, missense, nonsense mutation.
- Repair mechanisms- Photoreactivation, SOS, base excision repair, Nucleotide excision repair, mismatch repair.

5. Reference books

1. Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments.* (VI Edition): John Wiley & Sons. Inc.
2. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell.* (VII Edition). San Francisco: Pearson Benjamin Cummings Publishing.
3. Peter J. Russell. (2009). *Genetics- A Molecular Approach.* (III Edition). San Francisco, United States of America: Benjamin Cummings.
4. Satyanarayana U. (2008). *Biotechnology*: Books & Allied (P) Ltd.
5. Veer Bala Rastogi. (2008*). Fundamentals Of Molecular Biology*: Ane Books Pvt Ltd.
6. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R. (2008) *Molecular Biology of the Gene* (VI Edition.): Cold Spring Harbour Lab. Press, Pearson Pub.

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7. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. (VIII Edition). Philadelphia: Lippincott Williams and Wilkins.
8. Malacinski, George M.; Freifelder, David (1998). *Essentials of Molecular Biology*. (III Edition) Jones & Bartlett Pub.

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.	With its sophisticated biotechnological approaches in cutting edge research, the concepts of Molecular Biology provide students with profound insights into genetic mechanisms involving the fundamental principles of life.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill development	Module 1, 2	Seminar presentations, role play and Case studies to assess the process of replication and gene expression studies.
Employability	Module 3,4	Field visit to reputed research laboratories to assess the mechanism of gene expression and regulation studies.

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7. Pedagogy

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

8. Course Assessment Plan

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

CO	Continuous Internal Assessments - CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1 Written exam	Written Exam
CO2	CIA-1 Written exam	
CO3	CIA-2 Quiz/ Presentations/ Assignment	
CO4	CIA-2 Art Projects/ Presentations/ Case studies	

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b. Question Paper Pattern

MOLECULAR BIOLOGY

MODEL QUESTION PAPER- THEORY

Course Code: U24/BIT/DSC/301 **Max. Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION – A

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

1. Outline the process of Eukaryotic Genome organization.

OR

2. How would you explain the mechanism of DNA replication in Prokaryotes.
3. Classify the different types of RNA and summarize their functions.

OR

4. How would you illustrate the mechanism of Eukaryotic transcription with well labelled diagrams.

5. How would you apply lac operon system and its regulatory components in gene regulation studies.

OR

6. Summarise the process of translation in prokaryotes in detail
7. Categorize the types of DNA mutagens and their role in causing mutations.

OR

8. How would you assess DNA repair mechanism.

SECTION –B

II. Answer any Four out of the following: **4 x 5 = 20M**

9. Outline Hershey and Chase experiment.
10. Explain about RNA splicing.
11. Compare the Inhibitors of translation.
12. Interpret SOS repair
13. Describe Wobble hypothesis
14. Describe the Structure of RNA polymerase

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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	Outline the process of Eukaryotic Genome organization.	CO 1	II
2	Module 1	How would you explain the mechanism of DNA replication in Prokaryotes.	CO 1	I
3	Module 2	Classify the different types of RNA and summarize their functions	CO 2	IV
4	Module 2	How would you illustrate the mechanism of Eukaryotic transcription with well labelled diagrams.	CO 2	II
5	Module 3	How would you apply lac operon system and its regulatory components in gene regulation studies.	CO 3	III
6	Module 3	Summarise the process of translation in prokaryotes in detail	CO 3	II
7	Module 4	Categorize the types of DNA mutagens and their role in causing mutations	CO 4	IV

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8	Module 4	How would you assess DNA repair mechanism	CO 4	V
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	Outline Hershey and Chase experiment	CO 1	II
10	Module 2	Explain about RNA splicing	CO 2	II
11	Module 3	Compare the Inhibitors of translation	CO 3	IV
12	Module 4	Interpret SOS repair	CO 4	V
13	Any Module	Describe Wobble hypothesis	CO 3	II
14	Any Module	Describe the Structure of RNA polymerase	CO 2	II

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SEMESTER – III
MOLECULAR BIOLOGY – PRACTICAL

1. Course description

Programme: B.Sc

Course Code: U24/BIT/DSC/301/P

Course Type: DSE-3

No. of credits: 1

Max. Hours: 30

Hours per week:2

Max. Marks: 50

2. Course Objective:

- To prepare students for employment in biotechnology and related fields by emphasizing hands-on experience, data interpretation, and critical thinking in Molecular Biology experiments.
- To provide fundamental laboratory skills necessary for molecular biology research emphasizing on handling equipment in DNA & protein analysis.

3. Course outcomes:

CO-1: Interpret the process and apply skills in isolation of plasmid, chromosomal DNA from *E.coli*, plants and blood. (**UNDERSTAND, APPLY**)

CO-2: Infer and analyse DNA by AGE, and proteins by SDS-PAGE (**UNDERSTAND, ANALYSE**)

CO-3: Inspect and evaluate the process of quantifying DNA in the sample using UV-VIS spectrophotometry and screening of mutations by UV rays in *E.coli.* (**ANALYSE, EVALUATE**)

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PRACTICAL SESSIONS

1. Isolation of plasmid DNA from *E.coli*.
2. Isolation of chromosomal DNA from *E.coli*.
3. Isolation of DNA from plant.
4. Isolation of DNA from blood.
5. Quantification of DNA by UV-Vis Spectrophotometer.
6. Agarose gel electrophoresis
7. SDS-PAGE
8. Screening of mutations by UV rays in *E.coli*.

Spotters:

1. PCR
2. RNA Polymerase
3. Okazaki fragments.
4. Plasmid vector
5. Prokaryotic gene
6. Eukaryotic gene
7. Splicing
8. Post transcriptional modifications
9. Point mutations
10. Lac operon
11. Post translational modifications (PTMS)

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SEMESTER-III

MOLECULAR BIOLOGY-PRACTICAL

Course Code: U24/BIT/DSC/301/P
Credits: 1

Max. Marks: 50
Time: 2 Hrs

I. MAJOR: (20M)

Explain the principle and procedure for isolation of plasmid DNA from E.coli. Perform the experiment with the given sample and report the result.

II. MINOR: (10M)

Perform gel electrophoresis using given sample and report the results. Write the principle and procedure.

III. IDENTIFY THE GIVEN SPOTTERS: (10M)

IV. VIVA (5M)

V. RECORD (5M)

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

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SEMESTER – III

MUSHROOM CULTIVATION

1. Course Description:

Programme: B.Sc.
Course Code: U24/MIC/SEC/301
Course Type: SEC
No. of credits: 2

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

2. Course Objectives:

- To understand the basics of Mushroom production technology and learn the Structural layout of mushroom cultivation.
- To enhance the skill in cultivation of various commercially used mushrooms and acquire basic knowledge of sterilization techniques, spawn development and compost preparation.

3. Course Outcomes:

CO1: Understand the process and steps involved in Mushroom production, various methods of culture media, spawn and compost preparation.

CO2: Evaluate the importance of different types of Mushrooms and their cultivation.

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4. Course Content:

MODULE I- INTRODUCTION TO MUSHROOM CULTIVATION: **(15 Hrs)**

1. Different parts of a typical mushroom & variations in mushroom morphology.
2. Sterilization of glassware, equipments, and culture media used in mushroom cultivation .
3. Preparation of culture media: Potato Dextrose medium, Richards medium .
4. Preparation of spawn: Grain spawn, Straw spawn, Sawdust spawn.
5. Preparation of compost and known compost formulations.
6. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves.

MODULE II-TYPES OF MUSHROOM CULTIVATIONS: **(15 Hrs)**

1. Cultivation of White button mushroom.
2. Cultivation of Paddy straw mushroom.
3. Cultivation of Oyster mushroom.
4. Cultivation of Milky mushroom.
5. Nutrient profiling and Medicinal value of mushrooms.
6. Diseases of Mushrooms.
7. Introduction to value added products such as Powders and Sauces.

5. References

1.Kannaiyan, S. Ramasamy, K. (1980). A hand book of edible mushroom, Today & Tomorrows Printers &Publishers, New Delhi.

2.Pandey. B. P. (1996). A textbook of fungi.Chand and Company N Delhi.

3. Subrata Biswas, M. Datta, S. V. Ngachan.(2012) Mushrooms: A Manual for Cultivation. PHI Learning Pvt Ltd.

4. R. Gogoi, Y. Rathaiah, T.R. Borah. (2006).Mushroom cultivation technology. Scientific Publishers, Jodhpur, India.

5. M. H. Pinkerton. (2013). Commercial Mushroom Growing. British Library Cataloguing-in-Publication data.

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6. O.P. Ahlawat, R.P. Tewari (2007).Cultivation technology of Paddy straw Mushroom.National Research Centre for Mushroom (ICAR),Chambaghat, Solan, India.
7. Board NIIR. Handbook on Mushroom Cultivation and Processing. Centre for Information Technology.
8. Tripathi, D.P. (2005).Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt .Ltd, New Delhi.
9. PathakYadavGour.(2010).Mushroom Production and Processing Technology. Published by Agrobios (India).
10. S.Kannaiyan&K.Ramasamy (1980). A hand book of edible mushroom.Today & Tomorrows printers& publishers, New Delhi.
11. Nita Bahl.(1984-1988). Handbook on Mushrooms. II Edition, Vol. I & Vol. II. Oxford & IBH Publishing Co.
12. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
13. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., Mysore Road, Bangalore.
14. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation. Mittal Publications, Delhi.
15. Pathak, V. N. and Yadav, N. (2010). Mushroom Production and Processing Technology.Agrobios, Jodhpur, India.
16. Mushroom Production and Processing Technology, PathakYadavGour (2010) Published by Agrobios (India).
17. Harander Singh 1991. Mushrooms-The art of cultivation- Sterling Publishers.

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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	Training, technology, market access, sustainable practices for global mushroom cultivation's socio-economic and environmental impact.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
ED	Module II	Cultivation of paddy straw mushroom in lab.

7. Course Assessment Plan:

Weightage of Marks in Continuous Internal Assessments and End Semester Examination

Continuous Internal Assessments CIA 20%	End Semester Examination-30%
Written Exam / Case studies	Written Exam

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MUSHROOM CULTIVATION
MODEL QUESTION PAPER
INTERNAL EXAM

Max. Marks: 20
Time: 1 Hrs

1. Assignment/ SBT

MUSHROOM CULTIVATION

MODEL QUESTION PAPER- SEM END EXAM

Course Code: U24/MIC/SEC/301 **Max.Marks: 30**

No. of credits: 2 **Time: 1Hrs**

I. Major **(8 marks)**

1. Demonstrate the preparation of grain spawn for mushroom cultivation.

II. Minor **(5 marks)**

2. Identify the disease of mushroom in the given sample.

III. Comment on given specimens C, D and E **(3x4=12 marks)**

IV. Viva / Record **(5 marks)**

Prepared by Faculty	Checked &Verified by HoD	Approved by the Principal
K. Swathi	Roselin	
Ms.K. Swathi	**Dr.P.Roselin**	**Dr.Uma Joseph**

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St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
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FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -III
QUALITATIVE ANALYSIS
(Semi-micro Analysis)

Program: B.Sc. Max. Hours: 20 Hrs

Course Code: U24/CHE/DSC/301/P Max. Marks: 50

Course: DSC-3 Hours per week: 2 Hrs

No. of Credits : 1

Course Objectives

- To study the systematic analysis of anions and cations in an inorganic salt mixture

Course Outcomes

CO 1: Apply the principles of common ion effect and solubility product in Semi micro qualitative analysis.
CO 2: Analyse and report ions in a mixture of salts based on their chemical reactions with group reagents

Qualitative Analysis - Semi micro analysis of mixtures: Analysis of two anions (one simple, one interfering) and two cations in the given mixture.

Anions: CO_3^{2-}, S^{2-}, SO_3^{2-}, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}

Cations: NH_4^+, Pb^{2+}, Ag^+, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}

References:

1. Svehla, G, *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Gurdeep R. Chatwal, *College Practical Chemistry-II*, Himalaya Publishing House, 2005.

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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	To Learn about basic concepts of d and f block elements
National	Application of principles of qualitative analysis in identifying Functional groups /in identifying anions and cations in Salt mixture
Global	Various organic synthetic procedures learnt by students incline them towards research, enable them to synthesize Novel organic compounds with Multiple application

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

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module 2	Deriving equations, solving theoretical problems and interpreting results
ED	Module 4	Qualitative analysis of Metal ions is extensively in Analytical research laboratories in testing Purity of samples
EMP	Module 3	The various organic synthetic procedures learnt by students are widely applicable in industries thus increasing their employability

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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 elucidation of mechanisms in Organic Chemistry.

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	CIA 1 -Written exam	
CO3	CIA 2: poster/powerpoint presentation, collage, 3D model making, problem solving and quiz.	
CO4	CIA 2: 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 -III

TIME: 2hrs **Course Code**: U24/CHE/DSC/301
Max. Marks: 60

SECTION –A (Essay Questions)

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

1. a) What is Lanthanide contraction? Explain its Consequences. (CO1) **L2** 5M
   b) Explain Free electron theory of Metallic bonding. (CO1) **L1** 5M

OR

2. What are Transition elements? Explain the general properties with reference to Complex formation, magnetic properties and variable oxidation states. (CO1) **L1** 10M
3. a) Derive an expression for Work done in reversible isothermal expansion of an ideal gas. (CO2) **L3** 5M
   b) Show that for one mole of an ideal gas Cp-Cv = R (CO2) **L3** 5M

OR

4. Describe in detail the Carnot cycle. (CO2) **L2** 10M
5. a) Elucidate the mechanism of Aldol condensation. (CO3) **L2** 5M
   b) Explain the Reaction mechanism for Wittig Reaction. (CO3) **L2** 5M

OR

6. a) Explain Perkin's Condensation with a suitable mechanism. (CO3) **L2** 5M
   b) What is Claisen condensation? Give the mechanism. (CO3) **L2** 5M
7. a) Illustrate one component system with a phase diagram. (CO4) **L2** 5M
   b) What is the Common ion effect? Discuss its application in the separation of cations. (CO4) **L2** 5M

OR

8. a) Explain Hoffmann Bromamide reaction with Mechanism. (CO4) **L2** 5M
   b) How are valine and glycine synthesized by Strecker's synthesis? (CO4) **L3** 5M

SECTION – B (Short Answer Questions)

II. Answer any FOUR questions. **4×5 =20 Marks**

9. Describe the separation of lanthanides using the ion exchange method. (CO1) **L2**
10. Prove that Joule Thomson effect is an isenthalpic process. (CO2) **L3**
11. Calculate the work done in an isothermal reversible expansion of one mole of an ideal gas at 27°C from a volume of 10dm^3 to 20dm^3. (CO2) **L4**
12. Explain Hell Volhard Zelensky (HVZ) reaction with suitable examples. (CO3) **L2**
13. Define terms a) component b) degrees of freedom c) eutectic point. (CO4) **L1**
14. What is a Solubility product? Explain why Zn^{+2} ions do not precipitate when H_2S is added in Group II. (CO4) **L1**

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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
B.SC. II YEAR SEMESTER -III

TIME: 2hrs **Course Code: U24/CHE/DSC/301**
Max. Marks: 60 **Credits: 4**

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

Question Number	Question		CO	BTL
1	Module 1	a) What is Lanthanide contraction? Explain its Consequences. 5M b) Explain Free electron theory of Metallic bonding. 5M **OR**	CO 1 CO1	Level II Level I
2	Module 1	What are Transition elements? Explain the general properties with reference to Complex formation, magnetic properties and variable oxidation states. 10M	CO 1	Level I
3	Module 2	a) Derive an expression for Work done in reversible isothermal expansion of an ideal gas. 5M b) Show that for one mole of an ideal gas Cp-Cv = R 5M **OR**	CO 2 CO2	Level III Level III
4	Module 2	Describe in detail the Carnot cycle. 10M	CO 2	Level II
5	Module 3	a) Elucidate the mechanism of Aldol condensation. 5M b) Explain the Reaction mechanism for Wittig Reaction.5M **OR**	CO 3 CO 3	Level II Level II
6	Module 3	a) Explain Perkin's Condensation with a suitable mechanism. 5M b) What is Claisen condensation? Give the mechanism. 5M	CO 3 CO 3	Level II Level II
7	Module 4	a) Illustrate one component system with a phase diagram. 5M	CO 4 CO 4	Level II Level II

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		b) What is the Common ion effect? Discuss its application in the separation of cations. 5M **OR**		
8	**Module 4**	a) Explain Hoffmann Bromamide reaction with Mechanism. 5M b) How are valine and glycine synthesized by Strecker's synthesis? 5M	**CO 4** **CO 4**	**Level II** **Level III**

SECTION B – (Short answer questions)

SECTION B - ANSWER ANY 4 OUT OF 6 **4 X 5 = 20 M**

9	**Module 1**	Describe the separation of lanthanides using the ion exchange method.	**CO 1**	**Level II**
10	**Module 2**	Prove that Joule Thomson effect is an isenthalpic process.	**CO 2**	**Level III**
11	**Module 2**	Calculate the work done in an isothermal reversible expansion of one mole of an ideal gas at 27°C from a volume of $10dm^3$ to $20dm^3$.	**CO 2**	**Level IV**
12	**Module 3**	Explain Hell Volhard Zelensky (HVZ) reaction with suitable examples.	**CO 3**	**Level II**
13	**Module 4**	Define terms a) component b) degrees of freedom c) Eutectic point.	**CO 4**	**Level I**
14	**Module 4**	What is a Solubility product? Explain why Zn^{+2} ions do not precipitate when H_2S is added in Group II.	**CO 4**	**Level I**

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SEMESTER – III
VIROLOGY AND IMMUNOTECHNIQUES - THEORY

1. Course Description:

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

Course Code:U24/MIC/DSC/301 **Hours per week: 4**

Course Type: DSC **Max. Marks: 100**

No. of credits: 4

2. Course Objectives:

- To provide a contemporary understanding of viruses – their discovery, morphology, symmetry, mode of infection, replication and cultivation methods.
- To understand the basic concepts of Immunology, Immune system, Antigen-Antibody reactions, vaccines and Immunoprophylaxis.

3. Course Outcomes:

CO1: Understand and review the morphological elements of the viral life cycle and the cultivation methods. (LII)

CO2: Study and analyze replication strategies of bacterial, plant and human viruses. (LI, LIV)

CO3: Understand the importance of Cells and Organs of Immune system, types of Immunity and Immunoglobulins. (LII)

CO4: Evaluate the adverse effect of immune system including Allergy, Hypersensitivity, Autoimmunity and aware of different vaccinations. (LV)

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4. Course Content:

MODULE I - INTRODUCTION TO VIRUSES: **(15 Hrs)**

Discovery of viruses; Properties of viruses: General nature and important features;

Morphological characters: Capsid symmetry and different shapes of viruses with examples:

RNA viruses – Naked (Polio virus), Enveloped (Rabies virus);

DNA viruses – Naked (Human Papilloma Virus - HPV), Enveloped (Pox virus)

Subviral particles: Satellites, Virions, Viroids and Prions - Their importance;

Cultivation of viruses: In vivo methods: Embryonated chicken egg, Tissue Culture, Laboratory animals.

MODULE II - STRUCTURE, REPLICATION AND LIFE-CYCLE : **(15Hrs)**

Bacterial viruses: T4 & Lambda.

Plant viruses: T*obacco Mosaic Virus (*TMV) & Cauliflower Mosaic Virus (CaMV).

Human RNA viruses: Human Immunodeficiency virus (HIV) &Influenza virus.

Human DNA viruses: Adenovirus & Hepatitis B virus (HBV).

MODULE III - BASIC IMMUNOLOGY: **(15 Hrs)**

Concept of innate and adaptive immunity.

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell .

Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT

Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity) Haptens.

Structure, Types, Functions and Properties of antibodies.

MODULE IV - APPLIED IMMUNOLOGY: **(15 Hrs)**

Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluoresence.

Hypersensitivity and its types.

Autoimmunity- Mechanisms, Types of autoimmune diseases.

Vaccines- Live, Killed and Toxoids.

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5. Resources:

Text books:

1. Jawetz, Melnick and Adelberg's (2007). Medical Microbiology. 24th ed. McGraw HillMedical.
2. Edward K. Wagner and Martinez J. Hewlett (2007). Basic Virology. 2nd ed. Blackwell Science.
3. Biswas SB and Amita Biswas (1976). An introduction to viruses. 4th ed. Vikas Publishing House.
4. Goldsby RA, Kindt TJ, Osborne BA (2007).Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
5. Medical microbiology by Panikar (2013) 9thedition.University Press.

Reference books:

1. Bos L. (1999). Plant viruses-A text book of plant virology. Backhuys Publishers.
2. Nayudu MV. (2008). Plant Viruses. Tata McGraw Hill, India.
3. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th Edition Saunders Publication, Philadelphia.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Collee, J.G.Fraser, A.G.Marmion, B.P.Simmons,A.(1996) Mackie and Maccartney's Practical medical microbiology 14th ed. Churchill Livingstone.
6. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.
7. Gopal Reddy et al. (2008). Laboratory experiments in Microbiology. Himalaya Publishers.
8. Prescott, Harley and Klein Wim .(2002),Microbiology lab manual. Mc.Graw Hill Publishers.
9. Mukherjee Kanai L., (2003). Medical lab technology. Vol I, II, III, TataMcGraw Hill.

Online Resources:

1. https://microbiologynotes.org/virus-introduction-properties-and-classifications/
2. https://www.ncbi.nlm.nih.gov/books/NBK8174/
3. https://bio.libretexts.org/Courses/Mansfield_University_of_Pennsylvania/BSC_3271%3A__Sp21_(Kagle)/03%3A_Viruses/3.01%3A_Viral_Replication
4. https://www.cliffsnotes.com/study-guides/biology/microbiology/the-viruses/viral-structure-and-replication
5. https://www.slideshare.net/meducationdotnet/immunology-notes-57498237
6. https://www.ncbi.nlm.nih.gov/books/NBK10779/
7. https://www.onlinebiologynotes.com/autoimmune-disease-mechanism-of-autoimmunity-types-and-examples/
8. https://www.biologydiscussion.com/biochemistry/immunochemical-techniques/top-7-types-of-immunochemical-techniques-used-in-biochemistry/12525

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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 needs	It is relevant to Global needs as Immunological techniques include both experimental methods to study the immune system and methods to generate or use immunological reagents as experimental tools. It also deals with the development of vaccines and therapeutics against viral pathogens.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
Skill Development	MODULE IV	Immunological tests will be performed which is used to diagnose different diseases, aims at developing the skills necessary to analyze the most common immunological methods relate to the production and use of antibodies to detect specific proteins in biological samples.

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7. Pedagogy:

S. No	Type/Description of Activity	Student Centric Methods Adopted
1.	Interactive class session	Participative Learning
2.	Model presentation	Experiential Learning
3.	Group Discussion	Participative 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	
CO3	CIA-2 Presentation, Quiz	
CO4	CIA-2 Assignment	

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b) Question Paper Pattern:

VIROLOGY AND IMMUNOTECHNIQUES
MODEL QUESTION PAPER- THEORY

Course Code: U24/MIC/DSC/301 **Max Marks: 60**
Credits: 4 **Time: 2 Hrs**

SECTION A

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

1. How can you explain the general properties of viruses.
(OR)
2. How would you summarize the cultivation of virus in tissue culture including the key steps and techniques utilized?

3. Contrast and compare the life cycle of lytic and lysogenic cycle.
(OR)
4. What is the structure of HIV virus and the steps involved in its replication.

5. What conclusion can you draw from the concept of Innate and Adaptive immunity
(OR)
6. Describe Antigen and write in detail its characteristic features.

7. Appraise the principles and application of precipitation and agglutination reactions.
(OR)
8. How would you prioritize different types of vaccine with examples.

SECTION -B

Answer any FOUR **4x5=20 M**

9. What are Sub-viral agents?
10. Describe TMV- Structure
11. What are the features of Adenovirus?
12. What are facts of Immunoglobulin G?
13. Compare different types of Hypersensitivity.
14. How can you assess the importance of Monoclonal antibodies?

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SECTION A - INTERNAL CHOICE			4Q X 10 M = 40 M	
Question Number	**Module**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	Module 1	How can you explain the general properties of viruses.	CO 1	Level II
2	Module 1	How would you summarize the cultivation of virus in tissue culture including the key steps and techniques utilized?"	CO 1	Level II
3	Module 2	Contrast and compare the life cycle of lytic and lysogenic cycle.	CO 2	Level I, IV
4	Module 2	What is the structure of HIV virus and the steps involved in its replication	CO 2	Level I, IV
5	Module 3	What conclusion can you draw from the concept of Innate and Adaptive immunity	CO 3	Level II
6	Module 3	Describe Antigen and write in detail its characteristic features	CO 3	Level II
7	Module 4	Appraise the principles and application of precipitation and agglutination reactions.	CO 4	Level V
8	Module 4	How would you prioritize different types of vaccine with examples	CO 4	Level V
SECTION B - ANSWER ANY 4 OUT OF 6 (To compulsorily have **ONE** question from **each** module)			**4 Q X 5M = 20M**	
9	Module 1	What are Sub-viral agents	CO 1	Level II
10	Module 2	Describe TMV- Structure	CO 2	Level I
11	Module 2	What are the features of Adenovirus	CO 2	Level IV
12	Module 3	What are facts of Immunoglobulin G	CO 3	Level II
13	Module 4	Compare different types of Hypersensitivity	CO 4	Level V
14	Module 4	How can you assess the importance of Monoclonal antibodies	CO 4	Level V

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SEMESTER III
VIROLOGY AND IMMUNOTECHNIQUES –PRACTICAL

1. Course Description:

Course Code: U24/MIC/DSC/301/P **Max. Hours: 30**
Course Type: DSC **Hours per week: 2**
No. of credits: 1 **Max. Marks: 50**

2. Course Objectives:

- The practical work will cover demonstrations and experimental aspects of virus isolation methods, study of morphology, growth and cytopathic effects of viruses.
- Students will learn serum separation and various methods involving study of cells in blood samples, Ouchterlony double diffusion assay for checking identity of antigens.

3.Course Outcomes:

CO1: Understand and perform isolation of viruses from various sources.

CO2: Enumerate manual counting of White Blood Cells (WBCs) and Red Blood Cells (RBCs).

List of Practicals

1. Isolation of phage from different soil samples using laboratory bacterial cultures (*Staphylococcus, Bacillus sp.*)
2. Isolation of phage from sewage using *E. coli* as host.
3. Estimation of chlorophyll pigments in healthy and viral diseased plants.
4. The observation of the characters of following specimen / slides:.Rhabdo, Influenza, Retroviruses, Adeno virus, Cytopathic effects of viruses, Tobacco Mosaic Virus, T4 Bacteriophage.
5. Identification of human blood groups.
6. Total Leukocyte Count of the given blood sample.
7. Total Erythrocyte Count of the given blood sample.
8. Differential Leukocyte Count of the given blood sample.
9. Immunodiffusion by Ouchterlony method.
10. Separation of serum from blood (Demonstration).

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MODEL QUESTION PAPER – PRACTICAL

Course Code: U24/MIC/DSC/301/P **Max Marks: 50**

Credits: 1 **Time: 2 Hrs**

I . MAJOR **20M**

1 Perform the Total count of RBC in the given blood sample by using haemocytometer.

II. MINOR **10M**

2. Perform the blood typing and report the blood group of the given blood sample

(OR)

3. Analyse the given data, calculate and interpret the results of chlorophyll estimation.

III. Identify the given spots (A-E) and write few significant points **5x2=10 M**

IV. Record **5M**

V. Viva **5M**

Prepared by Faculty	Checked &Verified by HoD	Approved by the Principal
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