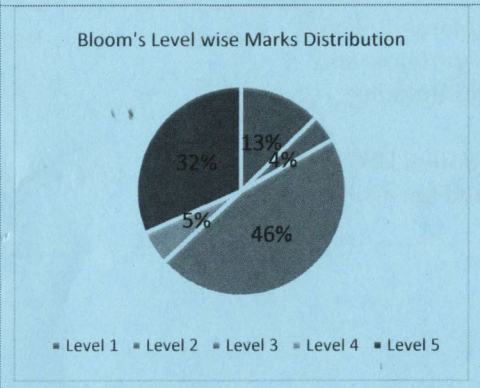
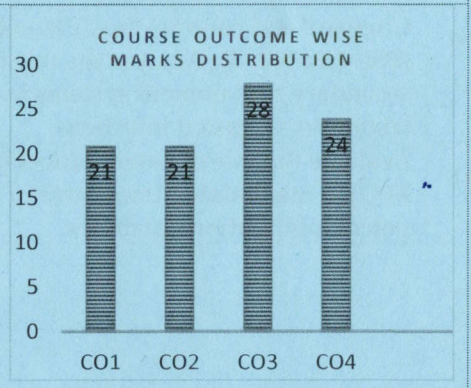
CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Interpret basics of Biosafety and bioethics and its impact on all the biological sciences and the quality of human life
	CO2	Recognize importance of Biosafety practices and guidelines in research
	CO3	Comprehend benefits of GM technology and related issues
	CO4	Recognize importance of protection of new knowledge and innovations and its role in business

GRAPHICAL REPRESENTATION





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NAAC GRADE A
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[19-11-2025]
END SEM EXAMINATION
School of Health & Allied Sciences

Program	**Bachelor of Science-Biotechnology**		
Subject Name	**Bioethics and Biosafety**	**Session**	**Odd, 2025-26**
Semester	**III**	**Year**	**Nov, 2025**
Time: 3 Hour Max. Marks : **60**	• Start writing from 2nd page onwards; **don't Write on the 1st Page Backside** • **Answer all Questions of Section A (Compulsory)** • **Answer Any Four out of Six of Section B** • **Answer Any Two out of Four of Section C** • **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Papers**.		
Knowledge Level (KL)	**K1 :** Remembering	**K3 :** Applying	**K5 :** Evaluating
	K2 : Understanding	**K4 :** Analysing	**K6 :** Creating

Section A (Each question Carry 01 Marks from Q1-i to x) – 10 Marks

Q. N 1	QUESTIONS	Marks	COs	KL
i	Gene therapy aims to: a) Alter the genome of bacteria b) Treat diseases by correcting defective genes c) Produce hybrid seeds d) Eliminate viral infections directly	01	CO1	KL1
ii	The major goal of biosafety is to: a) Promote research secrecy b) Prevent exposure to biohazards c) Increase production d) Promote bioethics	01	CO2	KL2
iii	The Cartagena Protocol deals with: a) Biosafety of GMOs and LMOs b) Pesticide regulation c) Drug manufacturing d) Environmental ethics	01	CO3	KL3
iv	Which of the following is not an IPR type? a) Trademark b) Copyright c) Inheritance right d) Patent	01	CO3	KL2
v	Trade secret refers to: a) Publicly disclosed patent	01	CO3	KL3

	b) Confidential business information c) Expired copyright d) Trademarked logo			
vi	The TRIPS Agreement is related to: a) International trade and IPR b) Plant breeding c) Gene therapy d) Climate change	01	CO3	KL3
vii	The Indian Patent Office functions under: a) Ministry of Commerce and Industry b) CSIR c) DBT d) WHO	01	CO4	KL2
viii	USPTO refers to: a) United States Patent and Trademark Office b) Universal Science Patent Trade Office c) Union of Scientists Patent Organization d) United States Publication Office	01	CO4	KL3
ix	The term of patent in India is: a) 5 years b) 10 years c) 20 years d) 25 years	01	CO4	KL1
x	Patent infringement means: a) Unauthorized use of patented invention b) Filing a new patent c) Modifying an expired patent d) Applying for copyright	01	CO4	KL2

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 5 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
2	Define bioethics and explain its importance in biotechnology.	05	CO1	KL1
3	Define biosafety and mention its main objectives.	05	CO2	KL1
4	What are GMOs and LMOs under biosafety guidelines?	05	CO3	KL3
5	Differentiate between copyright and trademark.	05	CO3	KL3
6	Briefly explain the objective of GATT and WTO in IPR protection.	05	CO4	KL4
7	What is patent infringement? Explain the Turmeric patent case as an example of biopiracy.	05	CO4	KL2

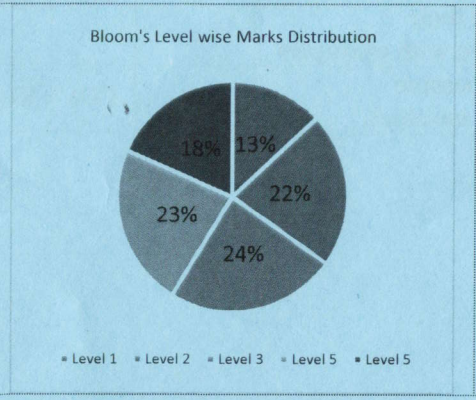
Section C (Answer any TWO out of FOUR) – 30 Marks
(Each question Carry 15 Marks)

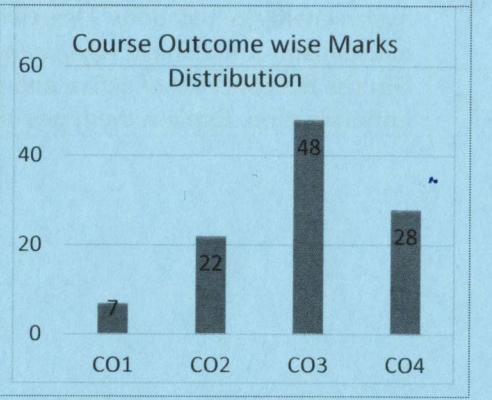
Q. No.	QUESTIONS	Marks	COs	KL
8	Evaluate the ethical, legal, and socioeconomic issues associated with gene therapy and stem cell research. Discuss how these influence policy decisions in biomedical research.	15	CO1	KL5
9	Differentiate between various forms of intellectual property (patents, copyrights, trademarks, trade secrets, GIs) and evaluate their roles in promoting research and development.	15	CO3	KL3
10	Compare and contrast the different biosafety levels (BSL-1 to BSL-4). Analyse the role of primary and secondary containment systems in minimizing laboratory-acquired infections.	15	CO2	KL3
11	Evaluate the role of patent offices (Indian, USPTO, EPO) in maintaining transparency and accessibility of patent information databases.	15	CO4	KL5

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Students will understand the basic concept of innate and acquired immunity.
	CO2	Students will gain knowledge about immunoglobulin structures and diversity of antibodies, morphology and functions of various immune cells such as dendritic cells, macrophages, Neutrophils and their association with MHC molecules will be studied.
	CO3	The main goal of the course is to provide basic understanding of immunology and immune responses in response to various infectious and non-infectious diseases.
	CO4	Students will gain knowledge about Vaccine

GRAPHICAL REPRESENTATION





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[21-11-2025]
END SEM EXAMINATION
School of Health & Allied Sciences

Program	**Bachelor of Science-Biotechnology**		
Subject Name	**Immunology**	**Session**	**Odd, 2025-26**
Semester	**III**	**Year**	**Nov, 2025**
Time: 3 Hour Max. Marks : **60**	• Start writing from 2nd page onwards; **don't Write on the 1st Page Backside** • **Answer all Questions of Section A (Compulsory)** • **Answer Any Four out of Six of Section B** • **Answer Any Two out of Four of Section C** • **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means** and will **Result** in the **Cancellation of the Papers**.		
Knowledge Level (KL)	**K1 :** Remembering	**K3 :** Applying	**K5 :** Evaluating
	K2 : Understanding	**K4 :** Analysing	**K6 :** Creating

Section A (Each question Carry 01 Mark from Q1-i to x) – 10 Marks

Q. N 1	QUESTIONS	Marks	COs	KL
i	Which of the following is not an immunoglobulin class? a) IgA b) IgB c) IgE d) IgG	01	CO2	KL1
ii	The primary lymphoid organs are: a) Thymus and bone marrow b) Lymph node and spleen c) Tonsils and Peyer's patches d) Appendix and spleen	01	CO1	KL3
iii	MHC class II molecules are expressed mainly on: a) All nucleated cells b) Erythrocytes c) Antigen-presenting cells d) Platelets	01	CO2	KL5
iv	Suppressor T-cells are now commonly known as: a) Cytotoxic T-cells b) Regulatory T-cells c) Helper T-cells d) Memory T-cells	01	CO3	KL4

v	The first antibody produced during a primary immune response is: a) IgG b) IgA c) IgM d) IgE	01	CO3	KL3
vi	Antibody diversity is mainly generated by: a) Somatic recombination b) Clonal selection c) Allelic exclusion d) Antigen processing	01	CO3	KL3
vii	The Arthus reaction is an example of: a) Type I hypersensitivity b) Type II hypersensitivity c) Type III hypersensitivity d) Type IV hypersensitivity	01	CO4	KL2
viii	The organism that hides within host cells to avoid immune recognition is: a) Mycobacterium tuberculosis b) E. coli c) Clostridium botulinum d) Vibrio cholerae	01	CO1	KL1
ix	AIDS is caused by depletion of: a) $CD8^+$ T-cells b) B-cells c) $CD4^+$ T-cells d) NK cells	01	CO4	KL5
x	The component added to vaccines to enhance immune response is called: a) Antigen b) Adjuvant c) Hapten d) Epitope	01	CO4	KL1

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 5 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
2	Explain how pathogens evade host immune responses.	05	CO2	KL1
3	Describe delay type hypersensitivity reaction.	05	CO3	KL2
4	Draw label diagram of T-cell receptor.	05	CO3	KL4
5	Differentiate between innate and adaptive immunity with examples.	05	CO1	KL3
6	What are autoimmune diseases? Give two examples with causes.	05	CO3	KL1
7	Describe the principle and application of ELISA.	05	CO4	KL2

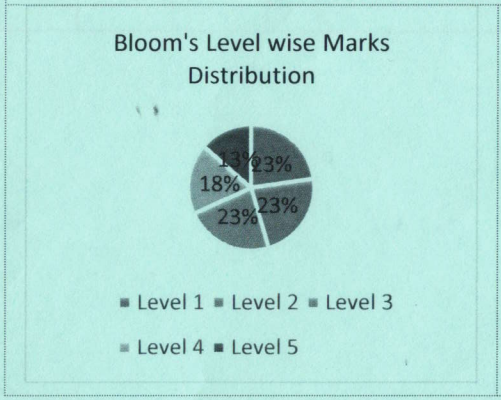
Section C (Answer any TWO out of FOUR) – 30 Marks
(Each question Carry 15 Marks)

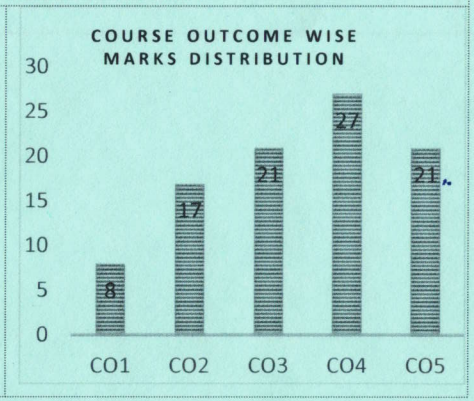
Q. No.	QUESTIONS	Marks	COs	KL
8	Explain the molecular structure and functional significance of different immunoglobulin with neat diagrams.	15	CO2	KL2
9	Elaborate on the differentiation, maturation, and activation of T-lymphocytes. Describe the roles of cytotoxic, helper, and suppressor T-cells in cell-mediated immunity.	15	CO3	KL4
10	Classify and explain the different types of hypersensitivity reactions. Describe their mechanisms and clinical significance with examples	15	CO3	KL5
11	Discuss the concepts of active and passive immunization. Explain the types of vaccines.	15	CO4	KL3

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Apply the knowledge to understand the microbial physiology and to identify the microorganisms.
	CO2	Comprehend the concept of various pathways in the microbial metabolism
	CO3	Understand the regulation of biochemical pathway in microorganisms
	CO4	Attain knowledge about possible process modifications for improved control over microorganisms for microbial product synthesis.

GRAPHICAL REPRESENTATION





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[24-11-2025]
END SEM EXAMINATION
School of Health & Allied Sciences

Program	**Bachelor of Science (Biotechnology)**		
Subject Name	**Microbial Metabolism**	**Session**	**Odd, 2025-26**
Semester	**III**	**Year**	**Nov, 2025**
Time: 3 Hour Max. Marks : **60**	• Start writing from 2nd page onwards; **don't Write on the 1st Page Backside** • **Answer all Questions of Section A (Compulsory)** • **Answer Any Four out of Six of Section B** • **Answer Any Two out of Four of Section C** • **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means**and will **Result** in the **Cancellation of the Papers**.		
Knowledge Level (KL)	**K1 :** Remembering	**K3 :** Applying	**K5 :** Evaluating
	K2 : Understanding	**K4 :** Analysing	**K6 :** Creating

Section A (Each question Carry 01 Mark from Q1-i to x) – 10 Marks

Q. N 1	QUESTIONS	Marks	COs	KL
i	Which nutrient classification includes bacteria that can grow on CO_2 as a sole carbon source? a) Heterotrophs b) Autotrophs c) Chemotrophs d) Organotrophs	01	CO1	KL1
ii	Growth kinetics of microorganisms is usually represented by: a) Linear graph b) Exponential curve c) Sigmoid curve d) Parabolic curve	01	CO1	KL3
iii	Iron is taken up by bacteria in the form of: a) Siderophore complexes b) Free Fe^{3+} ions c) Iron sulfide d) Iron oxide	01	CO3	KL5
iv	Transport of compounds across membranes occurs via: a) Diffusion b) Active transport c) Facilitated diffusion d) All of these	01	CO1	KL4
v	Neuberg's scheme of glucose fermentation mainlyinvolves: a) Pyruvate decarboxylation b) Acetaldehyde formation c) Alcohol fermentation d) All of these	01	CO2	KL3

vi	Fed-batch culture is a combination of: a) Batch and continuous systems b) Aerobic and anaerobic systems c) Fed and static systems d) Open and closed systems	01	CO3	KL3
vii	Feedback inhibition involves: a) Inhibition of the first enzyme in a pathway by the end product b) Activation of last enzyme c) Degradation of enzyme d) Induction of enzyme synthesis	01	CO4	KL2
viii	Stickland reaction involves: a) Degradation of carbohydrates b) Paired degradation of amino acids c) Deamination of nucleotides d) Hydrolysis of peptides	01	CO2	KL1
ix	The glyoxylate cycle is a variation of: a) Glycolysis b) TCA cycle c) Pentose phosphate pathway d) Calvin cycle	01	CO4	KL5
x	Butyric acid fermentation is typically carried out by: a) Lactobacillus b) Clostridium c) Pseudomonas d) Bacillus subtilis	01	CO5	KL1

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 5 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
2	Differentiate between Archaebcteria and eubacteria.	05	CO3	KL1
3	Outline the steps of glycolysis and mention the energy yield per glucose molecule.	05	CO1	KL2
4	Draw Krebs cycle and write its roles in microbial energy metabolism.	05	CO5	KL4
5	Differentiate between Trophophase and Idiophase.	05	CO4	KL3
6	Describe Entner–Doudoroff pathway and it's significance.	05	CO3	KL1
7	What is Stickland reaction? Explain its role in amino acid metabolism under anaerobic conditions.	05	CO4	KL2

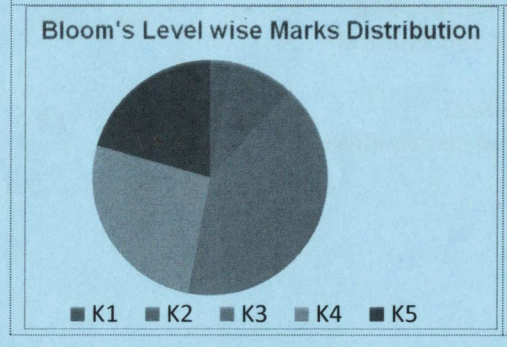
Section C (Answer any TWO out of FOUR) – 30 Marks
(Each question Carry 15 Marks)

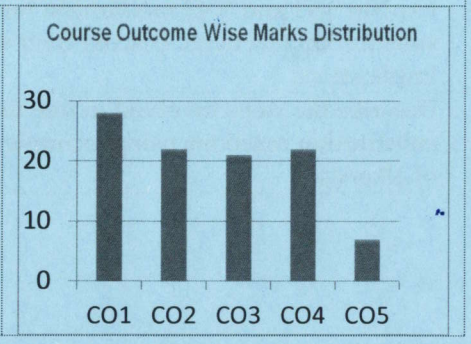
Q. No.	QUESTIONS	Marks	COs	KL
8	Classify bacteria on basis of nutrition and oxygen requirement.	15	CO4	KL2
9	Discuss in detail the phases of microbial growth curve and factors affecting growth rate.	15	CO3	KL4
10	Draw and explain the differences between batch, fed-batch, and continuous culture systems and their industrial applications.	15	CO2	KL3
11	Describe Electron transport chain in bacteria in detail.	15	CO5	KL2

CO- Course Outcomes, **KL**- Knowledge Level, **PO** – Program Outcome

Course Outcomes	CO1	Learn the concept of Stereochemistry, conformation and geometrical isomerism
	CO2	Discuss relative and absolute configuration
	CO3	Describe hydrogenation and hydrohalogenation reactions
	CO4	Demonstrate reactions of aldehydes and ketones with ammonia and its derivative. Understand aldol, cross aldol and cannizzaro reactions.
	CO5	Understand the reaction mechanism of halogenations of alkanes, allylic compounds and alkyl benzenes, elimination reaction

GRAPHICAL REPRESENTATION





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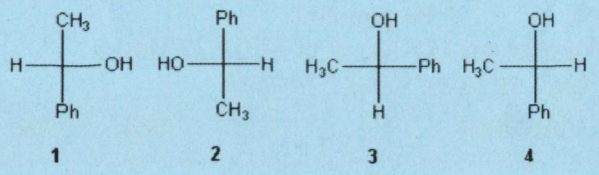
[26-11-2025]
END SEM EXAMINATION
School of Allied Health Science

Program	**Bachelor of Science-Biotechnology**		
Subject Name	**Chemistry I**	**Session**	**Odd, 2025-26**
Semester	**III**	**Year**	**Nov, 2025**
Time: 3 Hour Max. Marks : **60**	• Start writing from 2nd page onwards; **don't Write on the 1st Page Backside** • **Answer all Questions of Section A (Compulsory)** • **Answer Any Four out of Six of Section B** • **Answer Any Two out of Four of Section C** • **Possession of Mobile Phones** or any kind of **Written Material, Arguments with the Invigilator or Discussing with Co-Student** will comes under **Unfair Means**and will **Result** in the **Cancellation of the Papers**.		
Knowledge Level (KL)	**K1** : Remembering	**K3** : Applying	**K5** : Evaluating
	K2 : Understanding	**K4** : Analysing	**K6** : Creating

Section A (Each question Carry 01 Marks from Q1-i to x) – 10 Marks

Q. N 1	QUESTIONS	Marks	COs	KL
i	Which of the following Fischer projections is different from the other three?  1 2 3 4 a. 1 b. 2 c. 3 d. 4	01	CO1	K3
ii	Which of the following compounds can exist as geometrical isomers? a. CH_2Cl-CH_2Br b. CHCl-CHBr c. CH_2Cl-CHCl-CH_2Cl d. CH_2Cl_2	01	CO1	K4
iii	Which among the following compounds will undergo sulphonation readily? a. Benzene b. Nitrobenzene c. Toluene d. Chlorobenzene	01	CO3	K4
iv	Free radicals are paramagnetic due to a. an associated odd electron. b. an ionic pair.	01	CO2	K2

	c. an associated electron pair. d. none of the above.			
v	Which of the following will undergo hemolytic fission? a. Br_2 b. HBr c. H_2O d. HCl	01	CO5	K2
vi	The formation of cyanohydrins from a ketone is an example of a. Electrophilic addition. b. Electrophilic substitution. c. Nucleophilic addition. d. Nucleophilic substitution.	01	CO4	K1
vii	Aqueous solution of the detergents are _____ a. Neutral b. Acidic c. Basic d. Amphoteric	01	CO5	K1
viii	The most stable conformation of *n* butane is a. Partially eclipsed b. Eclipsed c. Gauche d. Staggered anti	01	CO1	K1
ix	Markownikoff's rule can be used to predict the addition of HBr on a. CH_2-CH_2 b. CH_3CH-CH_2 c. CH_3CH-$CHCH_3$ d. CH_3-CH-CHBr	01	CO2	K3
x	Which among the following alcohols undergoes the fastest reaction with HBr by SN^1 mechanism? a. 2-Methylpropan-1-ol b. Propan-1-ol c. 2-Methylpropan-2-ol d. Propan-2-ol	01	CO4	K5

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 5 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
2	Why do electrophilic substitution reactions occur more readily on phenol than on benzene?	05	CO4	K3
3	Discuss the mechanism of Cannizzaro reaction.	05	CO3	K5
4	Discuss the relative stability of staggered and eclipsed conformations of ethane.	05	CO1	K2
5	What is Markownikoff's rule? Explain giving example.	05	CO2	K3
6	What is electromeric effect? How does it differ from inductive effect?	05	CO5	K4
7	What is the role of elements of symmetry in optical activity? Name the elements of symmetry.	05	CO1	K4

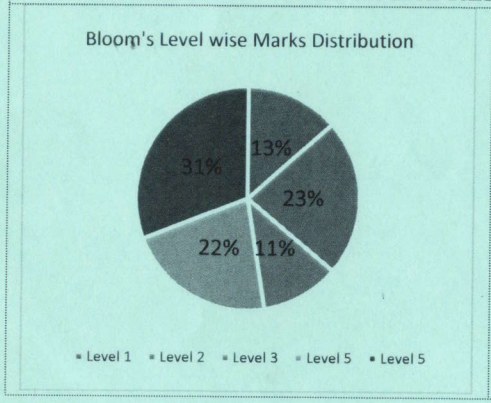
Section C (Answer any TWO out of FOUR) – 30Marks
(Each question Carry 15 Marks)

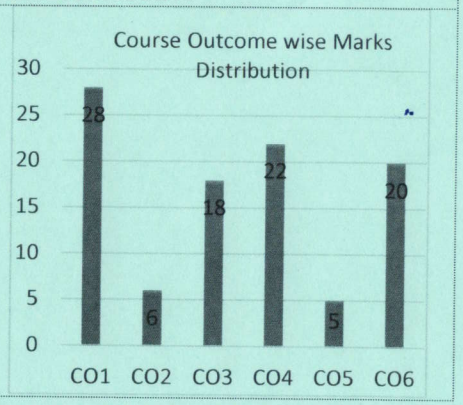
Q. No.	QUESTIONS	Marks	COs	KL
8	Explain the term chirality. Discuss the optical isomerism of chiral organic compounds using the example of tartaric acid.	15	CO1	K3
9	What is aldol condensation? Write the mechanism and products of crossed aldol condensation involving equimolar amounts of acetaldehyde and formaldehyde.	15	CO3	K5
10	Explain SN1 and SN2 mechanism for nucleophilic substitution reactions. Discuss their stereochemical implications.	15	CO4	K4
11	Describe the steps involved in free radical substitution reactions using example of chlorination of alkanes.	15	CO2	K3

CO- Course Outcomes, KL- Knowledge Level, PO – Program Outcome

Course Outcomes	CO1	History, background, principle and applications of microscopy
	CO2	Principles and applications of spectrophotometer and spectroscopes
	CO3	Principle and application of centrifugation in biological research
	CO4	Principle, types and application chromatography
	CO5	Electrophoresis and blotting techniques
	CO6	Introduction to Biosensors and Nanotechnology and their applications

GRAPHICAL REPRESENTATION





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[28-11-2025]
END SEM EXAMINATION
School of Health & Allied Sciences

Program	Bachelor of Science-Biotechnology		
Subject Name	Bioanalytical Tool	Session	Odd, 2025-26
Semester	III	Year	Nov, 2025
Time: 3 Hour Max. Marks : 60	• Start writing from 2nd page onwards; don't Write on the 1st Page Backside • Answer all Questions of Section A (Compulsory) • Answer Any Four out of Six of Section B • Answer Any Two out of Four of Section C • Possession of Mobile Phones or any kind of Written Material, Arguments with the Invigilator or Discussing with Co-Student will comes under Unfair Means and will Result in the Cancellation of the Papers.		
Knowledge Level (KL)	K1 : Remembering	K3 : Applying	K5 : Evaluating
	K2 : Understanding	K4 : Analysing	K6 : Creating

Section A (Each question Carry 01 Mark from Q1-i to x) – 10 Marks

Q. N 1	QUESTIONS	Marks	COs	KL
i	How many lenses are present in compound microscope a) 1 c) 3 b) 2 d) 4	01	CO1	KL1
ii	Highly magnified 3-D image of the specimen is observed with a) Compound Microscope c) TEM b) SEM d) None of the above	01	CO1	KL2
iii	Absorption spectroscopy is based upon a) Lambert law c) Both b) Beer law d) None	01	CO2	KL3
iv	Globar lamp is used in a) UV-Vis spectroscopy c) IR spectroscopy b) Emission spectroscopy d) None of the above	01	CO3	KL4
v	In UV spectroscopy light of…..nm is used a) 200-400 c) 600-700 b) 500-600 d) All of the above	01	CO3	KL3
vi	Which of the following is a technique for the determination of the three-dimensional structure of a protein?	01	CO3	KL3

	a) Gas chromatography b) Mass spectroscopy c) Radiotherapy d) NMR spectroscopy			
vii	_____ is an initiator of acrylamide polymerization. a) Ammonium persulfate c) Tris-HCl b) TEMED d) Acrylamide	01	CO4	KL2
viii	In a chromatographic separation, which of the following is most appropriate for the qualitative analysis of a substance? a) Taking factor c) Retention time b) Capacity factor d) Resolution	01	CO1	KL1
ix	The most common type of gel used for DNA separation is a) Agar c) Agarose b) Polyacrylamide d) All of the above	01	CO4	KL5
x	What property of enzyme doesn't make it an excellent analytical reagent? a) Piezo-electric biosensor c) Specificity b) Location of the enzyme d) Selectivity	01	CO4	KL1

Section B (Answer any FOUR out of SIX) – 20 Marks
(Each question Carry 5 Marks)

Q. No.		Marks	COs	KL
2	Write short notes on a) Isoelectric focusing b) SDS-PAGE	05	CO5	KL1
3	What is biosensor? Write the applications of biosensor	05	CO6	KL3
4	Write the difference between electron microscope and optical microscope.	05	CO1	KL4
5	What is ion exchanger? Write the example of each types of ion exchanger.	05	CO2	KL3
6	What is Immunoelectrophoresis? Write the applications of Immunoelectrophoresis.	05	CO4	KL1
7	Draw the ray diagram of compound microscope.	05	CO1	KL2

Section C (Answer any TWO out of FOUR) – 30 Marks
(Each question Carry 15 Marks)

Q. No.	QUESTIONS	Marks	COs	KL
8	How you would select appropriate analytical methods, ensuring accuracy, precision, detection limits, sensitivity, and calibration	15	CO1	KL2
9	Describe the principles and applications of centrifugation and cell fractionation techniques for isolating subcellular organelles.	15	CO3	KL4
10	Describe the procedure and application of thin layer chromatography.	15	CO4	KL5
11	What is Biosensor? Describe advantage and disadvantages of different types of biosensor	15	CO6	KL5