SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM NAGAR, KATTANKULATHUR – 603 203

DEPARTMENT OF CHEMISTRY

QUESTION BANK

II SEMESTER

CH3226 - Chemistry for Biomedical Engineering

Regulations 2023

Academic Year 2024-25

UNIT-I CARBOHYDRATES, LIPIDS, AND PROTEINS

Carbohydrates, lipids, fat, amino acids, proteins: types, structure, physical and chemical properties. Nucleic acid: structural aspects - components of DNA and RNA, nucleosides & nucleotides (introduction, structure & bonding), double helical structure of DNA (Watson-Crick model).

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	What are carbohydrates?	1	Remembering	CO1
2.	What are the major functions of carbohydrates?	2	Understanding	CO1
3.	List out the chemical properties of carbohydrates.	3	Applying	CO1
4.	Define Stereoisomerism.	1	Remembering	CO1
5.	Define Annomerism.	1	Remembering	CO1
6.	What are the four types of proteins?	1	Remembering	CO1
7.	Examine DNA structure.	4	Analyzing	CO1
8.	Define Mutarotation.	1	Remembering	CO1
9.	Mention any two examples of essential amino acids.	2	Understanding	CO1
10.	Summarize the functions of fats.	4	Analyzing	CO1
11.	Defend proteins.	2	Understanding	CO1
12.	Why are lipids essential to our body?	4	Analyzing	CO1
13.	List out the types of nucleic acids.	3	Applying	CO1
14.	Compare Essential and Non-essential amino acids.	4	Analyzing	CO1
15.	Define Lipids.	1	Remembering	CO1
16.	What is amino acid? Give an example.	5	Evaluating	CO1
17.	Illustrate types of lipids.	6	Creating	CO1
18.	List the different types of RNA.	3	Applying	CO1
19.	What is meant by nucleoside?	5	Evaluating	CO1
20.	Execute the term nucleotides.	3	Applying	CO1
21.	Describe fibrous and globular proteins with examples.	2	Understanding	CO1
22.	Demonstrate the types of fats.	4	Analyzing	CO1

S.No	PART-B (16 Marks)	BTL	Competence	CO
1.	i. Mention the types and structure of carbohydrates?	2	Understanding	CO1
	ii. Discuss any four chemical properties of carbohydrates.	1	Remembering	CO1
2.	Briefly describe the Stereochemistry of Carbohydrates.	4	Analyzing	CO1
3.	Describe the physical and chemical properties of amino acids.	1	Remembering	CO1
4.	Give an account of different structural levels of proteins.	3	Applying	CO1
5.	Implement the structure and bonding of nucleoside and nucleotide.	4	Analyzing	CO1
6.	Explain the double helical structure of DNA.	1	Remembering	CO1
7.	Compile the properties of amino acids.	6	Create	CO1
8.	Explain the classification and functions of nucleic acids.	4	Analyzing	CO1
9.	Demonstrate the physical and chemical properties of lipids.	1	Remembering	CO1
10.	i. Clarify the various structure and functions of protein.	4	Analyzing	CO1
	ii. Give detailed notes on structure, properties and uses of fatty acids.	1	Remembering	CO1
11.	What are nucleotides and nucleosides? Illustrate with suitable structures.	3	Applying	CO1
12.	i. Discuss the various levels of protein structure.	2	Understanding	CO1
	ii. Explain classification of carbohydrates and its structure.	3	Applying	CO1
13.	Explain the structure of DNA and RNA.	2	Understanding	CO1
14.	Write in detail about the Watson-Crick model.	3	Applying	CO1
15.	Demonstrate the essential and non-essential functions of amino acids.	3	Applying	CO1

UNIT-II VITAMINS AND CO-ENZYMES

Vitamins: structure, importance and stability, water-soluble vitamins, Fat-soluble vitamins. Enzymes & co-enzymes: classification, characteristics and mechanism of action (Lock and key, Induced fit), enzyme specificity, enzyme inhibitors, drugs inhibiting enzyme activity, and medical uses.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	What are vitamins?	1	Remembering	CO2
2.	List out any two examples of Fat-Soluble Vitamins.	3	Applying	CO2
3.	Analyze the Water-soluble vitamins.	4	Analyzing	CO2
4.	Mention any four factors affecting stability of vitamins.	1	Remembering	CO2
5.	Explain any two functions of vitamins.	1	Remembering	CO2
6.	Define fat soluble vitamin.	1	Remembering	CO2
7.	Explain competitive and non-competitive inhibition.	1	Remembering	CO2
8.	Describe enzymes.	5	Evaluating	CO2
9.	What is an active site of an enzyme?	1	Remembering	CO2
10.	Examine the functions of enzymes.	4	Analyze	CO2
11.	Discuss the applications of enzyme inhibition.	6	Creating	CO2
12.	List out the any four functions of co-enzymes.	3	Applying	CO2
13.	Define co-enzymes.	1	Remembering	CO2
14.	Compare enzyme and co-enzyme.	3	Applying	CO2
15.	How enzyme specificity is categorized?	2	Understanding	CO2
16.	How animals and plants can act as inhibitors?	2	Understanding	CO2
17.	Organize the importance of enzymes in medicine.	3	Apply	CO2
18.	What are cofactors? Give examples.	5	Evaluating	CO2
19.	Design the process involved in the Reversible Inhibition.	6	Creating	CO2
20.	Mention any four examples of co-enzymes.	2	Understanding	CO2
21.	Examine Enzyme specificity.	4	Analyzing	CO2
22.	Differentiate Enzyme promoters and inhibitors.	2	Understanding	CO2

S.No	PART-B (16 Marks)	BTL	Competence	CO
1.	Discuss the classification, structure and functions of vitamins.	2	Understanding	CO2
2.	What are fat soluble vitamins? Explain the types and factors affecting the stability of vitamins.	4	Analyzing	CO2
3.	Criticize water soluble vitamins.	5	Evaluating	CO2
4.	Illustrate the lock and key hypothesis of enzyme action.	3	Applying	CO2
5.	Give a detailed note on classification of co-enzymes.	2	Understanding	CO2
6.	Discuss the applications of enzymes in medicinal field.	6	Create	CO2
7.	i. What is an enzyme? What are the characteristics and classifications of enzymes?	1	Remembering	CO2
	ii. Write the structure and chemical features of enzymes.	1	Remembering	CO2
8.	Explain Enzyme Substrate Specificity?	4	Analyzing	CO2
9.	Compare fat soluble and water soluble vitamins.	4	Analyzing	CO2
10.	Draw a suitable schematic representation, types and applications of Enzyme Inhibition.	2	Understanding	CO2
11.	i. What are vitamins? Explain the sources of vitamins.	3	Applying	CO2
	ii. Discuss in brief the structure and functions of fat soluble vitamins.	2	Understanding	CO2
12.	Discuss in brief the factors affecting the vitamin stability.	4	Analyzing	CO2
	Give detailed note on the mechanism of an enzymatic action.	1	Remembering	CO2
13.	Describe in detail on mechanism of enzyme actions.	2	Understanding	CO2
14.	Write brief notes on the applications of enzymes in various Industries.	4	Analyzing	CO2
15.	i. What is enzyme inhibition? Discuss in detail.	1	Remembering	CO2
	ii. Compare reversible and irreversible inhibition with suitable examples.	3	Applying	CO2

UNIT- III ORTHOPAEDIC MATERIALS

Bone composition and properties - temporary fixation devices - joint replacement - biomaterials used in bone and joint replacement: metals and alloys - stainless steel, cobalt-based alloys, titanium-based materials - ceramics: carbon, alumina, zirconia, bioactive calcium phosphates, bioglass and glass ceramics - polymers: PMMA, UHMWPE/HDPE, PTFE - bone cement - composites.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	Define bones.	2	Understanding	CO3
2.	How will you distinguish compact and spongy bones?	2	Understanding	CO3
3.	Explain composition of bones.	4	Analyzing	CO3
4.	List out the functions of bones.	1	Remembering	CO3
5.	Examine properties of bones.	4	Analyzing	CO3
6.	Define arthroplasty.	2	Understanding	CO3
7.	Investigate. What are the different types of fixation devices?	6	Creating	CO3
8.	Analyze the uses of joint replacements.	4	Analyzing	CO3
9.	List out the biomaterials are used in joint replacement.	3	Applying	CO3
10.	Mention Orthopedic Implant Materials.	3	Applying	CO3
11.	Analyze the applications of Bone composites.	4	Analyzing	CO3
12.	Name the commonly used biomaterials in bone and joint replacements	1	Remembering	CO3
13.	State the uses of stainless steel in orthopedic implants.	5	Evaluating	CO3
14.	Give any two applications of cobalt chrome.	2	Understanding	CO3
15.	List out the biomaterials used in Joint replacements.	1	Remembering	CO3
16.	Defend bio-ceramics.	4	Analyzing	CO3
17.	What are polymers?	2	Understanding	CO3
18.	Describe the properties of ceramic materials.	1	Remembering	CO3
19.	Summarize the applications of glass ceramics.	2	Understanding	CO3
20.	What is UHMWPE?	2	Understanding	CO3
21.	Identify some of the applications of PMMA polymer	3	Applying	CO3
22.	Outline the term bone cement composites.	4	Analyzing	CO3

S.No	PART-B (16 Marks)	BTL	Competence	CO
1.	i. Briefly describe the structure and composition of bones.	2	Understanding	CO3
	ii. Outline the temporary fixation devices.	4	Analyzing	CO3
2.	i. Differentiate ceramics and polymers.	3	Applying	CO3
	ii. Discuss the application of polymers in joint replacement.	2	Understanding	CO3
3.	Discuss the biomaterials used in bone and joint replacements.	5	Evaluating	CO3
4.	i. Define arthoplasty. Why arthoplasty is important for human body?	4	Analyzing	CO3
	ii. Explain the characteristics and applications of Orthopedic Implant Materials.	3	Applying	CO3
5.	Illustrate any four Orthopedic Implant Materials used in human body in detail.	4	Analyzing	CO3
6.	Defend ceramics. Explain the classifications and applications of ceramics in orthopedics surgery.	2	Understanding	CO3
7.	Explain in details about the biomaterials used in bone and joint replacements.	2	Understanding	CO3
8.	What do you mean bone cement? Explain applications of bone cement.	5	Evaluating	CO3
9.	i) Discuss i.) stainless steel implants ii. Metal implants	4	Analyzing	CO3
	ii) Explain composite bone cements.	1	Remembering	CO3
10.	Evaluate the applications of Glass-Ceramic Materials for Dental and Orthopedic Implants	6	Creating	CO3
11.	Discuss the various properties and health care applications of bioactive glass ceramics.	6	Creating	CO3
12.	Examine applications of the Bioactive calcium phosphate materials in bone regeneration.	4	Analyzing	CO3
13.	Elaborate the applications carbon and zirconia ceramics in orthopedic implants.	2	Understanding	CO3
14.	Organize the application of following polymers in orthopedic implants. (a) PMMA (b) HDPE (c) PTEF (d) UHMWPE	4	Analyzing	CO3
15.	Explain in detail. a) Cobalt implants 2. Titanium implants	2	Understanding	CO3

UNIT-IV DENTAL MATERIALS

Teeth composition and mechanical properties - impression materials - bases, liners and varnishes for cavities - fillings and restoration materials - materials for oral and maxillofacial surgery - dental cements and dental amalgams - dental adhesives**.**

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	Define dentin.	1	Remembering	CO4
2.	Explain impression compound and its types.	3	Applying	CO4
3.	Enumerate the classification of impression materials	2	Understanding	CO4
4.	Illustrate the various functions of dental impression materials.	4	Analyzing	CO4
5.	Compare chemical and electrical tooth protection.	3	Applying	CO4
6.	State composition of impression material.	1	Remembering	CO4
7.	Generalize the objectives of cavities protection.	6	Creating	CO4
8.	List out any two applications of dental amalgam.	1	Remembering	CO4
9.	Organize the ideal requirement of varnishes for cavities.	3	Applying	CO4
10.	Execute the term varnish liners.	5	Evaluating	CO4
11.	Mention the materials are used in maxillofacial prosthesis.	1	Remembering	CO4
12.	Report the mechanical properties which influencing the teeth.	6	Creating	CO4
13.	Distinguish between direct and indirect fillings.	5	Evaluating	CO4
14.	Write the name of the cement is used for teeth?	6	Creating	CO4
15.	Summarize the dental filling materials.	2	Understanding	CO4
16.	Explain the term restorative materials.	2	Understanding	CO4
17.	What material is used for dental impressions?	1	Remembering	CO4
18.	List out the materials used in dental fillings.	2	Understanding	CO4
19.	What are liners and bases used for in dentistry?	3	Applying	CO4
20.	Examine the term dental fillings.	4	Analyzing	CO4
21.	Explain dental adhesives.	5	Evaluating	CO4
22.	Differentiate dental cement and dental amalgams.	3	Applying	CO4

S.No	PART-B (16 Marks)	BTL	Competence	CO
1.	Define teeth. Explain structure, components and mechanical properties of the teeth.	1	Remembering	CO4
2.	Explain the classification of Impression Material.	1	Remembering	CO4
3.	Discuss the ideal requirement of impression materials.	1	Remembering	CO4
4.	Summarize the classification of intermediary bases.	2	Understanding	CO4
5.	Write the classification and functions of dental cements.	5	Evaluating	CO4
6.	Explain the properties and its characteristics of Maxillofacial prosthetic materials.	1	Remembering	CO4
7.	Distinguish base, liner and varnish for cavities.	2	Understanding	CO4
8.	Clarify the methods of dental restoration.	3	Applying	CO4
9.	Illustrate the materials, properties, advantages and disadvantages of calcium hydroxide liners.	3	Applying	CO4
10.	Discuss in detail about dental fillings and restoration materials.	6	Creating	CO4
11.	Describe briefly about the dental amalgams and dental adhesives.	2	Understand	CO4
12.	Demonstrate the different types, methods and process of tooth filling.	3	Applying	CO4
13.	Organize the classification, properties, advantages and disadvantages of impression materials.	6	Creating	CO4
14.	Execute the advantages and disadvantages of filling and restoration materials.	4	Analyzing	CO4
15.	Describe the various materials used in oral and maxillofacial surgery.	4	Analyzing	CO4

UNIT- V SPECTROSCOPY AND BIOSENSORS

Introduction, absorption of radiation, types of spectra, UV-Visible, IR and fluorescence spectrophotometer: Instrumentation and applications. Biosensors: Classification (biochemical sensors), antibody, antigen, peptide, ECG sensor, gyroscope, glucometer, pulse oximeter, biometrics, biochips - applications.

S.No	PART-A (2 Marks)	BTL	Competence	CO
1.	Mention the important characteristics of electromagnetic radiation.	3	Applying	CO5
2.	Define absorption spectra.	1	Remembering	CO5
3.	Distinguish between absorption and emission spectra.	2	Understanding	CO5
4.	Mention the different types of electronic transitions in UV-Visible spectroscopy.	5	Evaluating	CO5
5.	Differentiate chromophore and auxochrome.	4	Analyzing	CO5
6.	List out the limitations of Beer – Lambert's Law.	1	Remembering	CO5
7.	Compare bathochromic and hypsochromic shifts.	5	Evaluating	CO5
8.	State the principle of IR spectroscopy.	6	Creating	CO5
9.	Mention any four applications of fluorescence spectrometer.	3	Applying	CO5
10.	What is Beer-Lambert's Law?	3	Applying	CO5
11.	Discuss fluorescence spectrophotometer.	6	Creating	CO5
12.	Implement the purpose of biosensors to improve the quality of life.	2	Understanding	CO5
13.	Construct the steps involved in biosensor.	6	Creating	CO5
14.	Define biochemical sensor.	1	Remembering	CO5
15.	Mention the basic characteristics of biosensors.	2	Understanding	CO5
16.	Define biometrics.	1	Remembering	CO5
17.	Compare the terms glucometer and pulse oximeter.	4	Analyzing	CO5
18.	Outline the applications o0f biochips.	2	Understanding	CO5
19.	Demonstrate the applications of gyroscope.	5	Evaluating	CO5
20.	Organize some of the advantages and disadvantages of biochips.	3	Applying	CO5
21.	Identify the advantages of ECG sensor.	2	Understanding	CO5
22.	Distinguish between antigen and peptide.	4	Analyzing	CO5

S. No	Part-B	BTL	Competence	CO
1.	Derive the expression for Beer – Lambert's Law.	1	Remembering	CO5
2.	Examine the principle, block diagram and instrumentation of IR spectroscopy.	3	Applying	CO5
3.	Illustrate the instrumentation of UV-Visible spectroscopy in a block diagram.	3	Applying	CO5
4.	Briefly explain the instrumentation and applications of fluorescence spectrometer.	5	Evaluating	CO5
5.	Discuss about the construction, elements, and characteristics of biochemical sensors.	2	Understanding	CO5
6.	What is meant biosensors? Explain the parts, elements and applications of biosensors.	4	Analyzing	CO5
7.	Discuss in detail about the antibody sensors.	2	Understanding	CO5
8.	Explain briefly about the ECG sensor.	5	Evaluating	CO5
9.	Examine the principle, block diagram and instrumentation of Fluorescence spectrometer.	3	Applying	CO5
10.	Write in detail about the glucometer and gyroscope.	1	Remembering	CO5
11.	Give a detailed note on peptide based sensors.	4	Analyzing	CO5
12.	Define biochemical sensor. Explain the applications of Biochemical sensor.	1	Remembering	CO5
13.	Discuss the various types of biosensors.	4	Analyzing	CO5
14.	Describe in detail about the applications of biosensors.	2	Understanding	CO5
15.	Explain in detail about working principle, components and applications of biochips.	6	Creating	CO5