CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations April 2022

Programme: M.Sc. Biochemistry **Session: 2021-22**

Semester: First **Max. Time: 3 Hours**

Course Title: Analytical Biochemistry **Max. Marks: 70**

Course Code: SIAS BC 1103 C 3104

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) Describe the principle of compound microscope? How do you calculate linear and angular magnification?

b) On what basis does agarose gel electrophoresis separate molecules? Which factors affect the migration of DNA in gel electrophoresis?

c) Explain the principle of centrifuge. What factors have an influence on centrifugation?

d) What is the principle of high performance liquid chromatography and its application? Could you tell some disadvantages of high performance liquid chromatography?

e) Draw Jablonski diagram to illustrate fluorescence. Make sure that you include the name of the various processes involved. What do you understand by "Stokes shift" in fluorescence?

f) What are the basic principles of NMR spectroscopy? Where is NMR used? What causes chemical shifts in NMR?

g) What kind of information do we get from flow cytometry? What is the principle behind this technique? What are the three main components of a flow cytometer?

Q 2. (2X7=14)

a) What are the basic components of "Fluorescence microscope"? Describe in brief its optical system. What is the principle behind confocal microscopy?

b) What are the two different types of Electron Microscope? How do they differ? How do you prepare samples for them?

c) What are the basic principles of Atomic-force microscope (AFM)? Elaborate the methods used in AFM to acquire images.

Q 3. (2X7=14)

a) How does polyacrylamide gel electrophoresis (PAGE) work? Elaborate step by step. What is the difference between PAGE and SDS-PAGE? What is the role of SDS in SDS-PAGE?

b) What is the difference between gel electrophoresis and pulsed field gel electrophoresis? When and why pulse field gel electrophoresis is preferred?

c) What is density gradient centrifugation? How does it differ from differential centrifugation? Describe in brief the two types of density gradient centrifugation.

Q 4. (2X7=14)

a) What is the principle of affinity chromatography? How does antibody affinity chromatography work? What are the main differences between ion exchange chromatography and gel filtration chromatography?

b) What is gas chromatography and how does it work? Which is better between high performance liquid chromatography and gas chromatography? Give reasons to support your answer.

c) What are the three major types of radiation detectors? What is the advantage of using a scintillation counter rather than a Geiger-Muller counter to detect radiation? How do you handle radioactive sources safely?

Q 5. (2X7=14)

a) Which spectroscopy will you use to understand secondary structure of proteins? What are the basic principles of this spectroscopy? How do you analyse the data to predict the secondary structure?

b) How is Beer-Lambert law used in absorption spectroscopy? How do you determine extinction coefficient?

A protein has one tryptophan and two tyrosine in its sequence. Assume molar extinction coefficients at 280 nm of tryptophan and tyrosine as 3000 and 1500 M^{-1} cm^{-1}, respectively. What would be the molar concentration of that protein if its absorption at 280 nm is 0.60 in a 1 cm cuvette?

c) What is electrospray ionisation mass spectrometry? Does electrospray ionization cause fragmentation? Why is ionisation important in mass spectrometry? Discuss about the mass analysis in this technique.

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End Semester Examinations April 2022

Program: M.Sc. Biochemistry **Session: 2021-22**

Semester: First **Max. Time: 3 Hours**

Course Title: Fundamentals of Biochemistry **Max. Marks: 70**

Course Code: SIAS BC 1 1 01 GEC 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) Describe mutarotation phenomenon.
b) Write a short note on prostaglandins and their functions.
c) Why monosaccharides are called reducing sugars? Explain with examples.
d) What are hexose derivatives?
e) How many categories of amino acids are there? Explain with examples.
f) Write down name and structure of different kinds of nitrogenous bases found in nucleic acids.
g) What are bile salts? Mention their functions.

Q 2. (2X7=14)

a) Describe with examples the different heteropolysaccharides.
b) Write down convention of writing name of disaccharide/oligosachharide in biochemistry.
c) What are glycoconjugates? Give their structural details.

Q3. (2X7=14)

a) Draw the structure of amino acids with aromatic side chains.
b) What are motifs and domains? Describe the forces that control the tertiary structure of proteins.
c) Describe classification of proteins.

Q 4. (2X7=14)

a) Describe the Chargaff's rule, also explain the characteristics of different forms of DNA.
b) What do you mean by denaturation and renaturation of DNA?
c) Describe structural organization of eukaryotic DNA.

Q 5. (2X7=14)

a) Describe different types of sphingolipids with their structures.
b) Describe properties and functions of cholesterol and its derivatives.
c) What are lipids? Write down their classification.

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End Semester Examinations April 2022

Programme: M.Sc Biochemistry **Session: 2021-22**

Semester: First **Max. Time: 3 Hours**

Course Title: Cell and Molecular Biology **Max. Marks: 70**

Course Code: SIAS BC 11 01 C 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) Draw the structure of a plant and an animal cell mentioning their important organelles

b) Although the membrane is tightly packed by phospholipids, it is not static. Justify

c) What are the unique properties of plasma membrane? Draw the structure of phospholipids and lipid bilayer

d) In fluid mosaic mosaic model, how are the phospholipids and proteins arranged in the membranes of the cells? Explain the model with an illustration.

e) State three essential functions of the genetic material.

f) Schematically show the overview of cellular processes from DNA to proteins.

g) A preliminary RNA sequence has the following nucleotides: 5'-AUGAAAGUUCGCAUUACUAACUACAGUGGUAG-3'. What would have been the template and non-template of genomic DNA sequence of this pre-mRNA?

Q 2. (2X7=14)

a) What are the constituents of nuclear pore complex? Explain with an illustration.

b) Explain the molecular trafficking that allows proteins to move to and fro through nuclear pore.

c) Provide indirect evidences to show that genetic information is stored in DNA. Explain in detail atleast one experimental proof to show DNA mediates transformation with clear illustration.

Q3. (2X7=14)

a) What is the structure of DNA? Explain with clear structures! What is the form in which the genetic information is stored in it?

b) What are the alternate forms of DNA double helix and show how they are different from each other? Explain the functional state of E.coli chromosome.

c) What are the five types of RNA molecules and mention their essential roles. Compare the prokaryotic and eukaryotic gene expression with illustration.

Q 4. (2X7=14)

a) Explain the chemical composition of eukaryotic chromosomes, Explain in detail three levels of DNA packaging in eukaryotes.

b) Telomeric regions are important for DNA stability. Justify by stating three important functions of telomeres. Explain the replication of telomeric region.

c) A segment of human DNA has the following sequence of nucleotide pairs:

3'-ATATTTACGTGCTACCTTGCTGATAGGACTGCAATATCTACTTTACCATT-5'

5'-TATAAATGCACGATGGAACGACTATCCTGACGTTATAGATGAAATGGTAA-3'

When this is segment of DNA is

(a) Replicated what will be the sequence of nucleotides in the daughter DNA strands

(b)Transcribed by RNA polymerase, identify the promoter sequence and write the sequence of nucleotides in the RNA transcript?

(c) Explain clearly how primosome and replicosome complexes co-operate to replicate two strands of DNA

Q 5. (2X7=14)

a) How transcription is regulated in prokaryotes?

b) Compare the DNA polymerases of prokaryotes and Eukaryotes with clear illustrations. How are RNA polymerases different from DNA polymerases of prokaryotes?

c) Explain how all three steps of transcription process in Prokaryotes with clear illustration.

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End Semester Examinations April 2022

Programme: M.Sc Biochemistry **Session: 2021-22**
Semester: First **Max. Time: 3 Hours**
Course Title: Protein Biochemistry **Max. Marks: 70**
Course Code: SIAS BC 11 04 C 3104

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries 3.5 Marks.

2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries 7 marks.

Q 1. **(4X3.5=14)**

a) What are hydrophobic and hydrophilic amino acids? Give list of amino acids of these classes.

b) What is dipole moment? Write in detail about the dipole moment of water.

c) Explain the energy coupling in biological reactions.

d) What are good and bad helix formers and why?

e) Describe Anfinsen's experiment to demonstrate protein refolding.

f) Explain the varieties of lipid motions which create disorder in the fluid lipid bilayer.

g) What are the major classes of membrane proteins? How do they interact with membrane lipids?

Q 2. **(2X7=14)**

a) Explain Ramachandran plot with torsion angles related to alpha helix and beta sheets.

b) Explain in detail the non-covalent interactions between molecules in the protein.

c) Explain the physicochemical properties of the intracellular environment in detail.

Q3. **(2X7=14)**

a) Explain the secondary structure of proteins.

b) Write in detail the protein folding patterns of the motifs and domains.

c) What are the forces and interactions responsible for the tertiary and quaternary structure of proteins?

Q4. **(2X7=14)**

a) Write in detail the chaperone and chaperonin assisted protein folding.

b) Explain the thermodynamics of protein folding.

c) What is protein melting curve and how can we determine the fraction of unfolded protein using these curves?

Q5. **(2X7=14)**

a) Explain the mechanism of the development of amyloidoses in detail.

b) How does Mass spectrometry work and explain the methods of ionization?

c) Write about different methods of protein engineering with examples.

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End Semester Examinations April 2022

Programme: M.Sc. Biochemistry **Session: 2021-22**

Semester: First **Max. Time: 3 Hours**

Course Title: Biomolecules and Metabolism **Max. Marks: 70**

Course Code: SIAS BC 1102 C 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) Differentiate between B DNA and Z DNA.

b) What are coupled reactions?

c) Differentiate between amylose and amylopectin

d) Explain importance of omega fatty acids in the diet.

e) What are sphingolipids?

f) Comment on structural aspects of a glycoprotein.

g) Differentiate between de novo and salvage pathways of nucleic acids.

Q 2. (2X7=14)

a) Differentiate between gluconeogenesis and glycolysis.

b) Describe energy transducing steps of citric acid cycle.

c) Describe the structure, properties and importance of cellulose and chitin.

Q3. (2X7=14)

a) Explain oxidation of odd number of fatty acids.

b) Discuss synthesis of fatty acids at Fatty acid synthase complex.

c) Briefly classify membrane phospholipids and cite their structural features.

Q 4. (2X7=14)

a) Discuss tertiary structure of proteins and forces responsible for maintaining it.

b) Explain features of alpha helix and beta pleated sheet structures.

c) Give schematic representation of urea cycle steps and mention the enzymes involved at various steps.

Q 5. (2X7=14)

a) Give structure of nucleotides.

b) Briefly explain purine nucleotide biosynthesis pathway.

c) Explain the double-helical structure of DNA.