[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 745 **B**

Unique Paper Code : 32491202

Name of the Paper : Enzymes

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **8** questions.
3. Attempt any **5** questions.
4. Question no. **1** is compulsory.

1. (a) State whether true or false with justification (**Any five**) :

   (i) Disopropyl flurophosphate (DIFP) reacts with serine present at the active site of the enzyme and inactivates it.

P.T.O.

(ii) Histidine is a particularly versatile amino acid in enzyme reactions.

(iii) Allosteric enzymes follow Michealis-Menten kinetics.

(iv) Substrate inhibition is encountered at low substrate concentration.

(v) Enzymes with high K_m have more affinity for the substrate.

(vi) Hexokinase and Glucokinase are isozymes.

(vii) Reversible covalent modification occurs once in the lifetime of an enzyme.

(b) Give one example of each :

(i) Metalloenzyme

(ii) Oxidoreductase

(iii) Diagnostic enzyme

(iv) PLP-dependent enzyme

(v) Lyase (10.5)

2. Differentiate between the following :

   (i) Random and ordered single displacement reactions.

   (ii) Competitive and uncompetitive inhibition.

   (iii) Lock and key and induced fit hypothesis.

   (iv) Acid-base and covalent catalysis.

   (v) Prosthetic group and holoenzyme.

(3,3,3,3,3)

3. (a) What are the important catalytic residues of Lysozyme? Explain its mechanism of action.

   (b) Define specific activity of an enzyme. What is the relation between specific activity and the purity of enzyme?

   (c) With an example explain a continuous enzyme assay. (2.5+5,4,3.5)

4. (a) What are immobilized enzymes? Explain any two methods of immobilization. Give any two uses of these enzymes in biotechnology.

P.T.O.

(b) Explain Eadie-Hofstee and Hanes plot.

(c) Explain why: Isozyme LDH-1 (H4) is designed to oxidize lactate to pyruvate while LDH-5 (M4) is optimized to operate in reverse direction.

(2+4+2,4.5,2.5)

5. (a) How are zymogens activated? Give one example.

(b) Mention any other two ways of enzyme regulation.

(c) Derive Michealis Menten equation for a monosubstrate reaction. Give the significance of K_m.

(4,4,7)

6. (a) How are enzymes classified? Give one example of each class.

(b) Give an example of enzyme and the reaction that requires the following coenzyme :

(i) Biotin

(ii) Coenzyme A

(iii) NAD^+

(c) Mention any four features of an enzyme catalyzed reaction.

(5+3,3,4)

7. (a) Explain why :

(i) Electronic complementarity and geometric complementarity are important for enzyme-substrate binding.

(ii) Chymotrypsin follows a ping pong mechanism.

(iii) Enzymes are large molecules with active sites almost located in clefts and depressions rather than on protrusions.

(iv) Taq polymerase is used in research.

(b) What are mechanism-based inhibitors? Explain by writing any two examples.

(2+3+2+2,6)

8. Write short notes on :

(i) Dependence of enzyme activity on pH and temperature

(ii) Enzymes in therapy

(iii) Penicillin as antibiotic

(iv) Role of HRP and ALP in ELISA (4,3,4,4)

May 2022

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 727 **B**

Unique Paper Code : 32491201

Name of the Paper : Proteins

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **8** questions.
3. Attempt any **five** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Write True or False. Justify (**Any five**) :

   (i) Protein folding is not a random process.

P.T.O.

(ii) Proteins when kept at a pH higher than pI will move towards negative electrode in an electric field.

(iii) Antiparallel beta sheets are more stable than parallel beta sheets.

(iv) Peptide bond is rigid in nature.

(v) Ultrasonication is a method used for isolating subcellular organelles.

(vi) Bromophenol blue is used for staining polyacrylamide gels.

(vii) Proteins are least soluble at their pI value.

(b) Explain the Edman degradation method of protein sequencing. (10,5)

2. (a) Give the principle and application of 2D-gel electrophoresis.

OR

Give the principle and application of gel permeation chromatography.

(b) What are molecular chaperones? Explain their role in protein folding with the help of suitable diagram.

(c) Explain Ramachandran plot. Discuss with the help of suitable diagram. Why are many values of phi and psi angles of polypeptide chain prohibited in Ramachandran plot? (4,5,6)

3. (a) Write all the steps involved in the synthesis of a peptide Lys-Arg through Solid Phase Peptide Synthesis.

OR

Give the detail account of various covalent and non-covalent bonds on stabilizing protein three-dimensional structure.

(b) Comment on diverse functions of proteins.

(c) A researcher wants to purify a His-Tagged protein out of a protein mixture. Which of the chromatography techniques will be most suitable for this purpose? Write down the principle of that technique. (5,6,4)

P.T.O.

4. (a) Give the characteristic features of collagen triple helix. Mention any two unusual types of covalent bonds, which are responsible for providing high tensile strength to collagen fibrils.

(b) Discuss the role of the following reagents in determining primary structure of proteins (Any four): Chymotrypsin, FDNB, DTT, CNBr, Carboxypeptidases and Urea.

(c) Determine the sequence of a peptide based on the following information :

(i) Complete hydrolysis revealed that small peptide contains the following amino acids: Ala, Lys, 2 Met, Gly, Leu, Asp.

(ii) Reaction with dansyl chloride gave dansyl-Ala.

(iii) CNBr treatment released :

(a) Tetrapeptide having Ala, Met, Lys and Asp.

(b) Dipeptide having Gly and Met.

(c) Free amino acid was released as Leu.

(iv) Trypsin treatment released :

(a) Tripeptide containing Ala, Lys and Asp.

(b) Tetrapeptide containing Gly, Leu, 2 Met.

(6,4,5)

5. (a) Explain the following with examples **(Any three)** :

(i) Biologically active peptides.

(ii) Conjugated proteins.

(iii) Essential amino acids.

(iv) Motifs

(b) Write short note on the following **(Any Three)** :

(i) Protein visualisation softwares.

(ii) Hydropathy plot.

(iii) Levinthal paradox.

(iv) Amyloidosis (6,9)

6. (a) What are the characteristic features of alpha helix? Discuss various factors affecting stability of alpha helix.

(b) Distinguish between integral and peripheral membrane proteins.

OR

Distinguish between "Salting in" and "Salting out" method.

(c) What are motor proteins? Discuss the role of actin and myosin proteins in muscle contraction. (6,3,6)

7. (a) Explain the role of the following (**Any three**) :

(i) Ammonium persulfate in SDS-PAGE.

(ii) Ampholytes in IEF.

(iii) CM-cellulose in cation exchange chromatography.

(iv) Blue dextran in gel filtration chromatography.

(v) Glycine in SDS-PAGE

(b) Write the principle of centrifugation?

(c) What do you mean by cooperativity? Explain oxygen binding curve of hemoglobin with the help of Hill plot. (6,3,6)

8. (a) Write the principle of HPLC. What are its advantages over conventional column chromatography technique?

(b) Explain the molecular basis of Thalassemia.

OR

Explain the molecular basis of Sickle cell anemia.

(c) Write the principle of ion-exchange chromatography? A protein mixture having three proteins with pI values 2, 4 and 8 respectively is separated using DEAE-cellulose column at pH = 7.0. Deduce the elution profile of proteins and give justification. (6,4,5)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1084 **B**

Unique Paper Code : 32495205

Name of the Paper : Techniques in Biochemistry

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : II

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **8** questions.
3. Attempt any **5** questions in all.
4. Question no. **1** is compulsory.

1. (a) Answer briefly :

(i) Swing out rotors are rotor of choice for density gradient centrifugation.

P.T.O.

(ii) Photomultiplier tubes are more sensitive than photo cells.

(iii) The molecular weight of proteins cannot be determined by Native-gel electrophoresis but can be calculated by SDS-PAGE.

(iv) Greater the frictional coefficient, more slowly the particles sediment.

(v) Front face illumination is a better arrangement than 90° illumination in a spectrofluorometer.

(vi) Agarose is preferred over polyacrylamide for DNA electrophoresis.

(vii) It is not important where the sample is applied in isoelectric focusing.

(viii) The resolving power of a microscope decreases on increasing the wavelength.

(b) State true and false. Justify your answer in each case.

(i) DNA exhibits hyperchromicity on heating.

(ii) No stacking gel is needed for electrophoresis of DNA.

(iii) If a protein is more stable below its isoelectric point, cation exchanger is used for its purification. (12,3)

2. (i) Define chromatography. Explain the principle of thin layer chromatography. How TLC is more advantageous over paper chromatography?

(ii) Give the role of the following in SDS-PAGE **(any three)** :

(a) TEMED

(b) Ammonium persulphate

(c) SDS

(d) β-mercaptoethanol (9,6)

3. Define the following **(any six)** :

(a) Exclusion limit of a gel

(b) Binding capacity of an ion exchanger

(c) Elution volume

(d) Fold purification for a protein

(e) Nomogram

(f) Void volume

(g) Numerical aperture

(h) Generation time of *E.coli* in a culture media. (15)

4. Differentiate between the following :

(i) Bathochromic and hypsochromic shift.

(ii) Isopycnic and rate zonal centrifugation.

(iii) Isocratic and gradient elution in chromatography.

(iv) Staining by coomassie brilliant blue and ethidium bromide.

(v) Extrinsic and intrinsic fluorophore. (15)

5. (i) How would you isolate a pure culture from a natural source like soil? Discuss in brief the different methods of obtaining a pure culture.

(ii) Briefly explain the terms CFU, biosafety cabinets and microtomy. (8,7)

(i) Explain the working of a double beam spectrophotometer with the help of a diagram.

(ii) Derive Beer-Lambert's law and discuss its limitations.

(iii) If a colored solution has an absorbance of 1.0 and is diluted 1:1, will the absorbance be 0.5? justify your answer. (6,5,4)

(i) Explain the principle of gel filtration chromatography and give two applications of this technique.

(ii) What are the significant instrumental changes in fluorescence microscopy compared to light microscopy? Support your answer with a ray diagram. (7,8)

P.T.O.

8. (i) Discuss different sterilization methods used in microbiology.

(ii) Elaborate on the various steps by which permanent slides are prepared.

(iii) Answer the following in one or two words :

(a) A technique to determine the molecular weight of a protein.

(b) A molecule used to determine the void volume.

(c) A technique to separate amino acids from proteins.

(d) A group specific ligand. (6,5,4)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1366 **A**

Unique Paper Code : 32491402

Name of the Paper : Gene Organization, Replication and Repair

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question No. **1** is compulsory.

1. (a) State True or False and justify your answer :

   (i) The melting temperature (Tm) of DNA increases with the increase in its GC content.

   (ii) H1 histone is half as abundant as the other histones.

P.T.O.

(iii) Tautomerization is believed to contribute to mutation.

(iv) There is inverse correlation between organism complexity and gene density.

(b) Fill in the blanks :

(i) Linking number is the sum of two geometric components called _____ and _____ .

(ii) Decondensed/relaxed form of genome is known as _____ .

(iii) _____ enzyme replicates the ends of the eukaryotic chromosome.

(iv) _____ sequences are the hotspots for recombination in *E coli*.

(c) Give contributions of the following **(any five)** :

(i) Frederick Meischer

(ii) E. Chargaff

(iii) Charles Yanofsky

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(iv) Barbara McClintok

(v) Arthur Kornberg

(vi) Elizabeth Blackburn (6,4,5)

2. (a) What is gene density? Why is it higher in prokaryotes in comparison to eukaryotes?

(b) What are transposons? What are the various classes of transposable elements? Explain the cut and paste mechanism of DNA transposition.

(c) What is a replisome? State the function of the following proteins during replication :

(i) Primase

(ii) Tau protein (4,6,5)

3. (a) Describe the salient features of the Watson and Crick model of DNA.

(b) Describe the structural organization of chromatin according to the nucleosome model.

P.T.O.

(c) Describe the key steps of homologous recombination. (5,5,5)

4. (a) Write the steps involved in mismatch repair in *E.coli*.

(b) What are base analoges and intercalating agents? Explain with the help of examples how they cause mutations.

(c) How do Etoposide and Novobiocin affect DNA replication? Write down their clinical applications. (5,5,5)

5. Differentiate between the following :

(a) Euchromatin and Heterochromatin

(b) DNA Polymerase I and DNA Polymerase III

(c) NER and BER

(d) Frameshift mutation and point mutation

(e) A and B-forms of DNA (3×5)

6. Write short notes on the following :

(a) Different modes of replication

(b) Ames Test

(c) Virus like Retrotransposon (5×3)

(a) What are topoisomerases? Differentiate between the two types of topoisomerases.

(b) What do you understand by the SOS response? Elaborate.

(c) What is site specific recombination.? Distinguish between serine and tyrosine recombinases. (5,5,5)

(a) How does the action and mutagenic effect of 5-bromouracil differ from that of nitrous acid?

(b) Explain the molecular mechanism underlying the symptoms of Xeroderma pigmentosum.

(c) A drug inhibits the activity of the enzymatic inorganic pyrophosphatase. What effect would the drug have on DNA synthesis?

(d) Predict whether the loss of the following *E. coli* genes would lead to lethality. Justify your answer :

(i) dnaB

(ii) Pol I

(iii) recA (4,4,2.5,4.5)

May 2022

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1139 A

Unique Paper Code : 32491401

Name of the Paper : Human Physiology

Name of the Course : **B.Sc. (H) Biochemistry**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all including Q. No. **1** which is compulsory.

1. (a) Explain the following statements : **(Any four)**

(i) Neurons cannot divide but can regenerate

(ii) Inappropriate clot formation does not occur in blood vessels of healthy individuals

(iii) Action potentials are all-or-none events

(iv) Mullerian Inhibiting Substance influences the development of gonads

P.T.O.

(v) Surfactants increase the lung compliance

(vi) Stomach wall is not digested by its secretions

(b) Explain : **(Any two)**

(i) Stroke volume

(ii) Synapse

(iii) Sperm capacitation (10,5)

2. (a) Describe the structure and functions of the placenta.

(b) Describe the sequence of events leading to the formation of sperms from spermatogonia.

(c) What are the functions of Sertoli cells? (5,5,5)

3. (a) With the help of a flow diagram show how arterial baroreceptor reflex compensates for blood loss during hemorrhage?

(b) What is the role of thrombin and tissue thromboplastin in blood clotting?

(c) Explain how an action potential is generated in SA node and why the SA node does not show a steady state resting potential? (5,5,5)

4. (a) Explain the sequence of events in the left atrium, left ventricle, and aorta during the cardiac cycle.

(b) What do the P wave, QRS complex and T wave represent in ECG? Explain.

(c) What causes the heart murmurs in diastole? In systole? (7,4,4)

5. (a) Discusscountercurrent multiplier system in control of urine volume.

(b) What do you understand by renal clearance? How is it determined?

(c) Explain how the kidneys reabsorb bicarbonate, and how the kidneys contribute to the regulation of acid-base balance. (6,4,5)

6. (a) Give the characteristic features and significance of submucosal and myenteric plexus.

(b) Explain how the secretion of HCl in stomach is controlled? Why is the stomach wall normally not digested by the acid present in the lumen?

P. T. O.

(c) Describe the effect of secretin and CCK on the bile ducts and gall bladder. (4,6,5)

7. (a) The chemical composition of the CNS extracellular fluid is different from that of blood. Explain how this difference is achieved? What is the significance of this difference?

(b) Differentiate between excitatory and inhibitory postsynaptic potentials.

(c) Explain the role of ionic channels in initiating action potential in nerve fiber and muscle fiber. Discuss the various factors which could alter this action potential. (4,4,7)

8. (a) Discuss the regulation of respiration through chemoreceptors.

(b) The Haldane effect approximately doubles the amount of carbon dioxide released from the blood in the lungs

(c) What is Bohr effect? How it effects the transport of oxygen in blood? (6,4,5)

(2)

[This question paper contains 6 printed pages.]

Your Roll No.....

A

Sr. No. of Question Paper : 1384

Unique Paper Code : 32491403

Name of the Paper : Metabolism of Amino Acids and Nucleotides

Name of the Course : **B.Sc. (H) Biochemistry (CBCS)**

Semester : IV

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer only **five** questions.
3. Question No. **1** is compulsory.

1. (a) Explain the following **(any 6)** :

(i) dUTP is not a normal component of DNA, despite that ribonucleotide reductase has the capacity to convert UDP to dUDP

(ii) Glutathione functions as redox buffer

P.T.O.

(iii) N-acetyl glutamate is a positive allosteric regulator of Urea cycle

(iv) Purine biosynthesis is impaired in vitamin B12 deficiency

(v) Isoleucine is both glucogenic and ketogenic

(vi) Glutamate plays a pivotal role in the metabolism of amino acids

(vii) Serine is synthesized by glycolytic intermediates

(viii) SGPT has an important diagnostic value

(b) Give scientific contributions of the following scientists **(Any 3)** :

(i) John Buchanan

(ii) Hans Krebs and Henseleit

(iii) David Shemin

(iv) P. Reichard

(v) Joanne Stubbe (12,3)

2. Differentiate between the following **(any 5)** :

(a) Transamination & oxidative deamination

(b) Carbamoyl phosphate synthetase I & II

(c) Positive and Negative Nitrogen balance

(d) Kwashiorkor and Marasmus

(e) Glucogenic and Ketogenic Amino Acids

(f) Denovo and Salvage pathway for Nucleotide Biosynthesis (3×5)

3. Give the reactions for the following conversions **(any 5)** :

(a) Tryptophan to NAD^+

(b) Succinyl CoA to Protoporphyrin

(c) Homocysteine to Methionine

(d) Ornithine to spermine

(e) Phenylalanine to Homogentisate

(f) Serine to Glycine (3×5)

P.T.O.

4. Describe the process and the biochemical reaction where these drugs are effective **(any 5)** :

   (a) Hydroxyurea

   (b) Trimethoprim

   (c) Allopurinol

   (d) 6-mercaptopurine

   (e) Methotrexate

   (f) Azaserine (3×5)

5. (a) Inhibition of ornithine transcarbamoylase leads to orotic aciduria. Explain the metabolic basis for this.

   (b) Birds are uricotelic in nature.

   (c) Write the degradation pathway of Proline.

   (d) Write various reactions that utilize PRPP (at least three).

   (e) How does the deficiency of HGPRT affect the rate of pyrimidine nucleotide synthesis?

   (2,2,3,3,5)

6. Discuss the following :

   (i) Urea Cycle

   (ii) Nitrogen Cycle and Nitrogen fixation

   (iii) Regulation of Ribonucleotide Reductase

   (5×3)

7. Describe the defective process, enzyme and symptoms of the following disorders **(any 5)** :

   (a) Gout

   (b) Maple syrup urine Disease

   (c) Intermittent acute porphyria

   (d) Hartnup disease

   (e) SCID

   (f) Alkaptonuria (3×5)

8. Write short notes on the following **(any 5)** :

   (a) Glucose alanine cycle

   (b) Krebs bicycle

(c) Glycine cleavage system

(d) Purine nucleotide cycle

(e) Gamma Glutamyl Cycle

(f) Leg Hemoglobin (3×5)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1163 **A**

Unique Paper Code : 32497601

Name of the Paper : Advanced Methodologies

Name of the Course : **B.Sc. (H) Biochemistry (CBCS)**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer only **five** questions.
3. Question No. **1** is compulsory.

1. (a) Give justification for the following **(Any six)** :

   (i) Nucleic acids may be transfected in the form of a plasmid or as oligonucleotides.

   (ii) Formalin fixed paraffin embedded (FFPE) samples give the best results when cell morphology is to be preserved.

P.T.O.

(iii) A scanning electron microscope can examine the cell surface.

(iv) Nucleic acids could be fixed to a nylon membrane.

(v) Fluorescence microscope has two monochromators.

(vi) Tritium is an ideal isotope for use in high resolution autoradiography applications.

(vii) FRET is used to identify interacting proteins.

(viii) Bait and prey are used in yeast 2 hybrid systems.

(b) Define the following **(Any three)** :

(i) Fluorophore

(ii) High throughput analysis

(iii) Immunoprecipitation

(iv) Transfection (12.3)

2. Differentiate between the following **(Any five)** :

(i) Southern blotting and Western blotting

(ii) Confocal microscopy and fluorescence microscopy

(iii) Finite and Continuous Cell Line

(iv) 2D gel electrophoresis and 2D-DIGE

(v) Analytical protein microarray and Functional protein microarray

(vi) Direct and indirect non-radioactive labeling of nucleic acid (3×5)

(a) Write down the role of the following **(Any six)** :

(i) Trichloroacetic acid in Isoelectric focusing

(ii) BSA in western blotting

(iii) Tryptic digestion of protein in mass-spectrometry.

(iv) Sheath Fluid in FACS

(v) Formaldehyde in electron microscopy

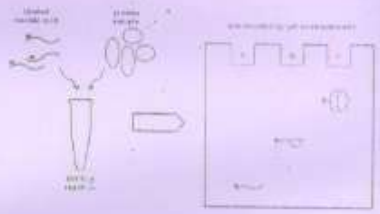
(vi) Dichroic mirror in fluorescence microscopy

(vii) TEMED in western blotting

P.T.O.

(b) What are the advantages of 2D gel over SDS-PAGE for analysis of proteins? (12,3)

4. (a) Identify the technique used in the given schematic diagram, briefly explain its principle and write advantages and disadvantages of this technique.



(b) A student runs SDS-PAGE of crude cell extract. Now, the student wants to analyze and identify a specific protein for which he/she possesses the antibody. What kind of methodology should he/she use? Mention different steps involved and their significance.

(c) Explain various types of immobilization methods used for immobilizing proteins on solid support for microarray technology. Give different applications of protein microarray technology. (5×3)

With the help of schematic diagrams explain the methodology, advantages and limitations of the following techniques **(Any three)**:

(a) Confocal microscopy

(b) Yeast 2 hybridization

(c) Mass spectrometry

(d) Luciferase assay (5×3)

(a) Which technique would you use to identify whether a DNA fragment contains sequence for a potential protein binding site? Explain the methodology of this technique.

(b) Compare and contrast the use of pull down assay and co-immunoprecipitation in studying protein-protein interaction? Describe different types of pull-down assays according to the fusion tags used in proteins.

(c) Why is electron microscopy performed under high voltage and vacuum? Explain with a schematic diagram the working principle of Transmission Electron Microscopy. (4,6,5)

P.T.O.

7. (a) With the help of a schematic diagram explain the working principle of scanning electron microscopy. What are the advantages of SEM over TEM?

(b) Why is protein microarray preferred over DNA microarray to study gene expression pattern? Differentiate between the two techniques.

(c) What is the purpose of chromatin sonication while performing ChIP assay? Draw a schematic diagram and explain how ChIP differs from ChIP on chip. (5×3)

8. Write short notes on the following (Any five) :

(a) ELISA

(b) Northern Blotting

(c) Isoelectric focussing

(d) MALDI-TOF

(e) Supershift Assays

(f) Fusion tags

(200

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1104 A

Unique Paper Code : 32491601

Name of the Paper : Genetic Engineering and Biotechnology

Name of the Course : **B.Sc. (H) Biochemistry**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question 1 is compulsory.
4. **All** questions carry equal marks.

1. (a) Explain the following :

   (i) Type II restriction endonucleases are more popularly used as molecular scissors as compared to Type I and Type III restriction endonucleases.

P.T.O.

(ii) M13 phage is useful for DNA sequencing work.

(iii) Three bands are seen upon running plasmid DNA on agarose gel electrophoresis.

(iv) Ti plasmid is 'disarmed' before its used to make transgenic plants.

(v) YACs and BACs are preferred over plasmids as vectors during genomic library production.

(vi) Hybrid promoters are used in the expression vectors.

(b) Explain the use of the following enzymes in gene cloning **(any two)** :

(i) Alkaline phosphatase

(ii) Terminal Transferase

(iii) Reverse transcriptase (12,3)

2. (a) Differentiate between the following **(any three)** :

(i) Colony and Plaque

(ii) PCR and Real Time PCR

(iii) Lambda insertion and lambda replacement vectors

(iv) Cosmids and plasmids

(b) A purified piece of DNA is cut with PstI and BamHI separately and then with both enzymes together. The following table depicts the result of agarose gel electrophoresis. Construct a restriction map of the DNA

zyme	DNA fragment sizes (bp)		
	300	500	850
mHI	100	600	950
& BamHI	100	250	300, 400, 600

(9,6)

(a) Give the steps in making of a cDNA library.

(b) A young researcher was trying to amplify a gene responsible for cystic fibrosis in his lab using PCR. However, upon running the PCR reaction on an agarose gel, no bands were seen indicating no amplification had taken place. Explain the possible reason behind the failure of DNA amplification.

P.T.O.

(c) Write the characteristic features of Ti plasmid. Illustrate your answer with help of a diagram. (5,5,5)

4. (a) As a protein engineer, you are trying to express a mammalian protein in bacterial cells. What are the potential challenges that you may face in trying to express the protein?

(b) Describe the features of three main types of yeast vectors?

OR

What are phagemids? What are their advantages?

(c) Differentiate between southern blotting and northern blotting. (5,5,5)

5. (a) Give the characteristics of a good expression vector. Draw a suitable diagram to support your answer. Also give an example of an expression vector.

(b) Explain the principle of Sanger's method of DNA sequencing. What are the problems associated with it and how can they be overcome? Draw the slab

gel profile of the DNA fragment whose sequence by Sanger's dideoxy method has been found to be 5' TAC TGG TAT GTC CAG TCA GGC 3' (5,10)

(a) Between pBR322 and pUC8 plasmid, which is a preferred vector for the purpose of gene cloning? Justify your answer.

OR

What are shuttle vectors and how are they useful in gene cloning?

(b) What is the use of linkers in gene cloning? What is the disadvantage and how can it be overcome?

(c) Describe the principle and significance of T7 promoter based expression systems. (5,5,5)

(a) Describe any one technique used for detection of the translation product of a cloned gene.

(b) What is the principle behind production of *Bt* crops? What are the problems associated with them?

(c) Describe the technique of nested PCR using appropriate diagram. (5,6,4)

8. (a) Explain the use of any one of the following for protein purification :

(i) Poly-histidine tag

(ii) GST tag

(b) Explain the oligonucleotide mediated method of site-directed mutagenesis.

(c) Write a short note on recombinant pharmaceuticals. (5,5,5)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1349 **A**

Unique Paper Code : 32491602

Name of the Paper : Immunology

Name of the Course : **B.Sc. (Hons.) Biochemistry**

Semester : VI, CBCS

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all. **All** questions carry equal marks.
3. Q. No. **1** is compulsory.

1. (a) Indicate whether True or False. Defend your choice. **(Any five)**

   (i) Neutrophils are the first line of defense in viral infections.

   (ii) ABO blood transfusions are clinical manifestations of Type III hypersensitivity.

P.T.O.

(iii) IgM antibody is a high affinity antibody.

(iv) An antigen can act as a tolerogen as well as immunogen.

(v) B cell receptor gene arrangement does not take place in T cells.

(vi) γδ T cells are MHC restricted.

(vii) Eosinophilia is seen in allergic reactions.

(viii) All antibodies secreted by a single plasma cell have the same idiotype and isotype.

(2×5=10)

(b) Give one word for the following :

(i) Macrophages found in liver

(ii) Antibody binding site on Antigen

(iii) Effector cells secreting antibodies

(iv) First antibody secreted against the antigen during the immune response.

(v) Site of proliferation of B cells in secondary follicles

(vi) Non phagocyte granulocyte releasing pharmacologically active substances

(vii) Cell exhibiting constitutive expression of B7 molecule.

(viii) Name the scientist who discovered the anaphylactic response.

(ix) Lymphoid organ responsible for filtering antigen.

(x) Fraction of serum that contains antibodies.

(0.5×10=5)

2. Diagrammatically explain the following : **(Any five)**

(a) Mast cell degranulation

(b) Antibody Dependent Cell Cytotoxicity

(c) Ig A

(d) Th and B cell conjugate interaction

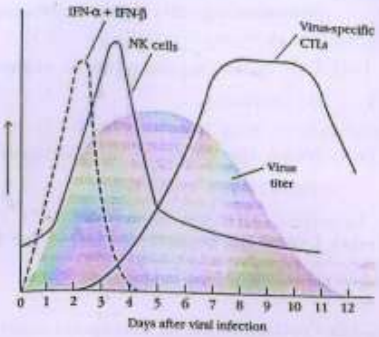
(e) Neutrophil extravasation

(f) Activated Macrophage

(g) Structure of lymph node (5×3=15)

P.T.O.

3.

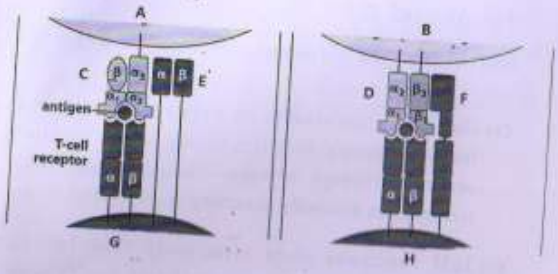


(a) With the help of graph, explain how viral infections are handled by the immune system.

(b) What is positive and negative selection in thymic education? Explain.

(c) Discuss the properties of antigens that contribute to immunogenicity. (3×5=15)

4. The figure below represents the interaction of an immune cell with a target cell. Identify cells A, B, G and H. Identify with justification molecules C, D, E and F. Differentiate between Molecule C and D. Explain process of an endogenous and exogenous antigen processing and presentation. (2,4,3,6)



5. Explain the following : **(Any three)**

(i) Clinical manifestations of graft rejection

(ii) Hybridoma Technology

(iii) B cell maturation in bone marrow

(iv) Merits and demerits of DNA Vaccines

(v) Gell and Coomb's classification (3×5=15)

6. Differentiate between : **(Any 5)**

(i) Active and Passive Immunization.

(ii) B1 and B2 cells

(iii) Idiotype and allotype

(iv) B cell and T cell epitope

(v) Naïve and effector B cell

P.T.O.

(vi) Th1 and Th2

(vii) Central and peripheral tolerance. (5×3=15)

7. (a) One of the remarkable features of the vertebrate immune system is its ability to respond to a limitless array of foreign antigens. Explain how such tremendous antibody diversity is generated.

(b) IgM functions more effectively than IgG in complement reactions, true or false? Justify your answer.

(c) Expand and briefly explain the following terms :

(i) PRR

(ii) AID

(iii) MAC (6,3,6)

8. Write short notes : **(Any 5)**

(i) Effector functions of Antibodies

(ii) SLE

(iii) Sequestered Antigens

(iv) Superantigens

(v) Primary and Secondary response

(vi) Phagocytosis

(vii) Innate immunity (5×3=15)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1248 A

Unique Paper Code : 32497904

Name of the Paper : Molecular Basis of Infectious Diseases

Name of the Course : **B.Sc. (H) Biochemistry (LOCF)**

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all including Question 1 which is compulsory.
3. **All** questions carry equal marks.

1. (a) Briefly describe the following terms **(any 6)** :

(i) Hospital acquired infections

(ii) LD50

P.T.O.

(iii) Emerging and Re-emerging infections

(iv) Convalescent Stage

(v) IGRA

(vi) Giardiasis

(vii) Pathogenicity Island

(b) Explain why rodents are considered reservoir hosts and not vectors for plague while dogs are considered co-hosts in rabies infections. (12,3)

2. (a) Differentiate between the following **(any 4)** :

(i) Sleeping sickness and Chagas disease

(ii) Toxin and Toxoid

(iii) Plus strand and Minus strand RNA virus

(iv) Active and Latent TB infection

(v) Antigenic Shift and Antigenic Drift

(b) Discuss different types of Leishmaniasis. Compare amastigote, promastigote and trypomastigote forms. (10,5)

(a) Draw the structure of the Influenza virus and explain why a trivalent vaccine is produced every season?

(b) Explain the following :

(i) Immune changes during Hepatitis B and its significance for diagnosis

(ii) Anti-retroviral therapy (5,5,5)

(a) Write is the mechanism of action of the following drugs **(any 5)** :

(i) Rifampicin

(ii) Amphotericin B

(iii) Isoniazid

(iv) Nystatin

(v) Acyclovir

(vi) Ampicillin

(b) With the help of a diagram, explain the mechanism of action of Diphtheria Toxin. How is it different from the Tetanus toxin? (10,5)

P.T.O.

5. (a) Describe the uniqueness of mycobacterial cell wall. How is it different from the cell wall of Gram positive bacteria? Describe the principle of Acid Fast Staining.

(b) Draw and explain the following (any 2):

(i) Life cycle of *Plasmodium falciparum*

(ii) Life cycle of HIV

(iii) Transmission of Dengue

(iv) Life cycle of *Mycobacterium tuberculosis*

(8,7)

6. (a) Explain the diagnostic tests for the following (any 5):

(i) Typhoid

(ii) Malaria

(iii) Tuberculosis

(iv) AIDS

(v) Polio

(vi) Rabies.

(b) Give the different types of vaccines with examples. Name two successful vaccines. (10,5)

(a) Explain the following (any 3):

(i) Patients suffering from Rabies exhibit hydrophobia

(ii) Hepatitis G infection requires the presence of Hepatitis B virus

(iii) Stages of Pertussis

(iv) How is HIV infection different from AIDS?

(b) Why are fungal infections difficult to treat as compared to viral and bacterial infections? Name two fungal diseases that cause opportunistic infections.

(c) What is antimicrobial resistance? What are the different ways in which bacteria develop resistance to antibiotics? (7,5,3,5,4)

Write short notes on the following (any 3):

(i) Chicken Pox

P.T.O.

(ii) Tubercle

(iii) Anthrax

(iv) life cycle of *Entamoeba histolytica* (15)