(2)

[This question paper contains 4 printed pages.]

Your Roll No.....

F

Sr. No. of Question Paper : 1230

Unique Paper Code : 2492011203

Name of the Paper : Basic Concepts of Cell Biology

Name of the Course : **B.Sc. (Hons.) Biochemistry – DSC-5**

Semester : II

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **6** questions.
3. Attempt any **4** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Fill in the Blanks :

   (i) _____ enzyme is defective in autosomal recessive disorder I cell disease.

   (ii) _____ cytoskeletal element is found in flagella of Euglena.

   (iii) _____ microscope is best suited for visualizing a live cell without using any stain.

P.T.O.

(iv) _____ is primary structural component of basal lamina.

(v) In animal cells, lipids like steroidal hormones are synthesized in _____.

(b) State True or False and Justify (**any 5**) :

(i) Lysosomes are formed by process of packaging in the endoplasmic reticulum.

(ii) Glycosylation completes in Endoplasmic reticulum

(iii) Gap Junctions are present in neurons and cardiac cells.

(iv) Vesicles are moved by Cytoplasm.

(v) Proline and Glycine are two amino acid that forms triple-stranded helix of Elastin.

(vi) Deficiency of vitamin C causes weakened connective tissue. (5,10)

2. Differentiate between the following :–

(i) Pinocytosis and Phagocytosis

(ii) Upright and Inverted Microscope

(iii) SER and RER

(iv) Dyes and Fixatives

(v) Tight junctions and Adheren Junctions (5×3=15)

3. (a) Comment on the following statements :

(i) Vincristine is a common chemotherapeutic agent used to treat cancer.

(ii) In a couple, if father suffers from LHON and mother does not, son will not be affected with this disease.

(iii) Polarity of epithelial cells is maintained by tight junctions.

(iv) Liver cells contain abundant amount of Peroxisomes.

(v) Golgi bodies are dynamic in nature.

(b) Define the following :

(i) Magnification

(ii) Pinocytosis

(iii) Plasmodesmata

(iv) MTOC

(v) Cell adhesion molecules (10,5)

P.T.O.

4. (a) Describe the process of Receptor mediated endocytosis with the help of suitable example.

(b) What is the role of GTP in the assembly of microtubules? Explain the term Dynamic instability and what role does it play in cellular activity?

(c) Explain two activities of Lysosomes. Draw the structure of axoneme of cilia and flagella. (5,5,5)

5. (a) How does Endoplasmic reticulum perform the Quality check of the newly synthesized Glycoproteins?

(b) Compare Mitochondrial Genome with Chloroplast Genome.

(c) Describe the mechanism of proteins import inside the nucleus. (5,5,5)

6. Write short notes on the following **(any 3)** :

(i) Lysosomal storage diseases

(ii) Glycosaminoglycans

(iii) Endosymbiotic theory

(iv) Meiosis (5,5,5)

(1)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4657 **E**

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. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

1. (a) Explain the following :

(i) At very high substrate concentrations the enzyme activity becomes constant.

P.T.O.

(ii) A purified enzyme has maximum specific activity.

(iii) Penicillin is an enzyme inhibitor.

(iv) Enzymes can be regulated by irreversible covalent modifications.

(v) Streptokinase is used in enzyme therapy.

(b) Define the following terms :

(i) Turnover Number

(ii) Activation energy

(iii) Initial velocity

(iv) Specific activity

(v) Isozyme (10,5)

2. (a) What are the features of enzymes that make them remarkable biological catalysts?

(b) Pyridoxal phosphate is a versatile coenzyme. Explain with the help of three examples.

(c) Explain why ser-195 in chymotrypsin has a lower pKa than other serine residues. (4,6,5)

3. (a) Explain why ATCase is an important regulatory enzyme. Describe how this enzyme is regulated by allosteric modulation.

(b) Using lineweaver-Burk plots explain the following types of enzyme inhibitions:

(i) Competitive

(ii) Non-competitive

(c) How do you express activity of an enzyme? Explain why enzyme activities are measured under saturating substrate concentration. (6,6,3)

4. (a) Discuss the catalytic mechanism of lysozyme.

(b) How are enzymes classified? Explain giving an example of each class.

(c) What is the ratio of the [S] to K_M when the velocity of an enzyme catalyzed reaction is 80% of its V_{max}? (6,6,3)

P.T.O.

5. (a) Specific activity of an enzyme is an important parameter in following the progress of enzyme purification. Comment.

(b) Name the cofactor and give the structure of the following enzymes :

(i) Transaminase

(ii) Pyruvate carboxylase

(c) Give an example of the following :

(i) A metalloenzyme

(ii) An allosteric enzyme

(iii) An therapeutic enzyme

(iv) An enzyme present in tears (6,5,4)

6. (a) Discuss with the help of examples how enzymes can be regulated by reversible covalent modification.

Differentiate between the following :

(i) Holoenzyme and apoenzyme

(ii) Active site and regulatory site

How will you differentiate between single and double displacement reactions kinetically? (6,5,4)

(a) Explain the importance and the regulaory mechanism of the enzyme aspartate transcarbmoylase.

(b) Derive the Michaelis-Menten equation. Show how it can be transformed to LB plot. Compare the LB plot with Eadie-Hofstee plot.

(c) The drug allopurinol is used in the treatment of gout. Explain. (6,6,3)

Write short notes on the following :

(a) Immobilized enzymes

(b) Protease inhibitors

(c) Zymogens (5,5,5

(500)

[This question paper contains 4 printed pages.]

Your Roll No.....

F

Sr. No. of Question Paper : 1192

Unique Paper Code : 2492011201

Name of the Paper : Enzymes

Name of the Course : **B.Sc. (Hons.) Biochemistry – DSC-3**

Semester : II

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

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

1. (a) Explain the following **(any 4)** :

   (i) The value of Km does not reflect the strength of enzyme substrate binding.

   (ii) Competetive inhibition can be overcome by increasing substrate concentration.

P.T.O.

(iii) Enzymes activity becomes constant at high substrate concentrations.

(iv) Use of the enzyme Taq polymerase in research.

(v) Induced fit theory of enzyme action.

(b) Define the following terms :

(i) Specific activity

(ii) Turnover number

(iii) Isoenzyme (12,3)

2. (a) Derive the Michaelis-Menten equation. Explain what do you understand by Km and Vmax of an enzyme catalyzed reaction.

What is the ratio of substrate concentration to Km when :–

(i) Initial velocity of enzyme catalyzed reaction is 50% of V_{max}

(ii) Initial velocity of enzyme catalyzed reaction is 80% of V_{max}

(b) What are the two types of bisubstrate reactions. How do you differentiate between the two types of bisubstrate reactions?

(c) Give a suitable example for each of the following :

(i) Metalloenzyme

(ii) Competetive inhibitor

(iii) Therapeutic enzyme

(iv) Zymogen (6,5,4)

3. (a) What are suicide inhibitors. Explain with the help of an example.

(b) Explain with suitable example how NAD+ and PLP aid in enzyme catalysis.

(c) How are enzymes classified? Explain giving example of each class. (5,5,5)

4. (a) Elaborate the following enzyme applications :

(i) Enzymes in research

(ii) Enzymes in therapy

(iii) Enzymes as diagnostic tools

P.T.O.

(b) What do you understand by e. me activity. What are the factors that affect : activity of an enzyme?

(c) Differentiate between the following :

(i) Prosthetic group and cofactor

(ii) Metalloenzyme and metal activated enzyme (6,5,4)

5. (a) What are the different ways to regulate the activity of enzymes. Explain any one with the help of an example.

(b) Explain the Transition state theory with the help of a diagram. Explain the terms free energy and activation energy.

(c) What do you understand by uncompetitive and non-competitive inhibition. Give one example for each. (6,5,4)

6. Write short notes on the following :

(a) Feedback inhibition

(b) Catalytic mechanism of chymotrysin

(c) Immobilized enzymes (5,5,5)

(300)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1211 **F**

Unique Paper Code : 2492011202

Name of the Paper : Metabolism of Carbohydrates

Name of the Course : **B.Sc. (Hons.) Biochemistry DSC–4**

Semester : II

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **6** questions.
3. Attempt any **4** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Give reasons for the following :

   (i) Fructose is metabolized more rapidly than glucose.

   (ii) Glucose 6-Phosphate Dehydrogenase deficiency results in hemolytic anemia.

P.T.O.

(iii) Gluconeogenesis is an endergonic pathway.

(iv) In the absence of oxygen, pyruvate is converted into lactate in the muscle.

(b) Give the reaction for the following :

(i) Oxidative decarboxylation reaction in TCA cycle.

(ii) Reaction involved in substrate level phosphorylation in Glycolysis.

(iii) Reaction catalyzed by Enolase.

(iv) Reaction of TCA cycle which is also a part of Electron transport chain.

(v) Reaction requiring Biotin as coenzyme.

(2.5×4, 1×5)

2. (a) Differentiate between the following :

(i) Autotrophs and Heterotrophs

(ii) Post absorptive state and early fasting state

(iii) Branching enzyme and debranching enzyme

(iv) Pasteur effect and Crabtree effect

(3,4,4,4)

3. (a) PFK-1 is the key regulatory enzyme of glycolysis. Explain the mode of regulation.

(b) Give the pathway of Galactose entry into glycolysis.

(c) Give the mechanism how Arsenate blocks ATP synthesis in Glycolysis.

(d) Fluoride in tooth pastes prevent dental caries. Explain. (6,4,3,2)

4. (a) Gluconeogenesis involves two compartments: mitochondria and cytosol for the synthesis of glucose from pyruvate. Explain.

(b) Elaborate on the Non-oxidative phase of HMP pathway. How does it feed into glycolysis?

(c) Hexokinase IV (glucokinase) in the liver differs from hexokinase (I) in the muscle in its kinetics and biological role. Explain. (6,6,3)

5. (a) Elaborate how Glycogen phosphorylase is activated by Glucagon.

(b) Give the role of Glycogenin in initiation of Glycogen synthesis.

P.T.O.

(c) Give the steps involved in the addition of new glycosyl units to the non-reducing end of glycogen starting with Glucose-6-phosphate. Also state the type of bond formed. (6,3,6)

6. (a) Krebs cycle is an Amphibolic pathway. Explain.

(b) Describe the Cori cycle. What is its physiological function?

(c) Explain the process of alcohol fermentation. (6,5,4)

7. (a) Give the cause and Biochemical and physiological manifestation of the following diseases.

(i) Galactosemia

(ii) Von Gierke disease

(iii) McArdle Disease

(b) Give the mechanism of inhibition of the following TCA cycle inhibitors :

(i) Fluoroacetate

(ii) Malonate (3×3, 2×3)

[This question paper contains 4 printed pages.]

Your Roll No.....

F

Sr. No. of Question Paper : 1981

Unique Paper Code : 2494001202

Name of the Paper : Protein and Enzymes

Name of the Course : **G.E. : Biochemistry**

Semester : II

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **6** questions.
3. Attempt **any 4** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

1. (a) Justify following statements **(Any 6)** :

   (i) Aspartate Transcarbamoylase is a allosteric enzyme.

   (ii) Enzyme active site contains polar charged molecules.

P.T.O.

(iii) Disulfide bonds are covalent bonds.

(iv) Lactate dehydrogenase is an example of isoenzyme.

(v) Enzymes decrease the activation energy of reactions.

(vi) Non-covalent bonds involved in the formation of tertiary structure.

(vii) Rotation around peptide bonds is restricted. (2×6=12)

(b) Give the contribution of following scientists :

(i) Bruce Merrifield

(ii) JBS Haldane

(iii) A. Chien (1×3=3)

2. Differentiate between the following :

(a) Active site and Regulatory site

(b) Metalloenzymes and Metal activated enzymes

(c) Fibrous and Globular proteins

(d) Induced fit model and lock & key model

(e) Reversible and Irreversible inhibition (3×5=15)

3. (a) Define the followings with suitable examples :

(i) Holoenzyme

(ii) Dihedral angles

(iii) Multimeric proteins

(iv) Coenzyme

(v) Active site

(vi) Keratin (6×2=12)

(b) Explain the following parameters used in enzyme kinetics with their significance

(i) K_M

(ii) K_{Cat}/K_M (1.5×2=3)

4. (a) Describe various types of secondary structure of protein.

(b) How molecular chaperons assist in folding?

(c) Explain protein denaturation and renaturation with suitable example. (5,5,5)

5. (a) Differentiate between competitive, uncompetitive and mixed inhibitors using Lineweaver Burk plot.

(b) Explain the regulation of enzyme activity by reversible covalent modification using a suitable example.

(c) Explain the application of enzymes in diagnostics. (6,5,4)

6. Write short note on following **(Any 5)** :

(i) Ramachandran plot.

(ii) Creutzfeldt-Jakob disease

(iii) 3D structure of Hemoglobulin

(iv) Zymogens

(v) Biologically important peptides

(vi) Enzyme nomenclature (3×5=15)

May-June-2023

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4537 **E**

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 **eight** questions.
3. Attempt any **five** questions.
4. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

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

(i) Proline is rarely present in an alpha-helix.

P.T.O.

(ii) Fibroin, the silk protein is rich in Ala and Gly residues.

(iii) Persons living at high altitudes have higher levels of BPG in blood.

(iv) Myoglobin is abundant in the muscle of diving mammals such as seals and whales.

(v) French press is used for homogenizing fibrous proteins.

(vi) Dialysis is used for desalting of protein preparations.

(b) Give one example of each of the following proteins/ peptide :

(i) Glycoprotein

(ii) Hormone

(iii) Metallo-protein

(iv) Storage protein

(v) Transport protein

(vi) Antibiotic (12,3)

2. (a) Two peptides are to be separated by ion exchange chromatography. At the pH of the mobile phase to be used on the column, peptide A has a net charge of –3 and peptide B has a net charge of +1. Which peptide would elute first from the cation-exchange resin and anion-exchange resin? Explain why?

(b) Describe Anfinsen's experiment, concerning the denaturation and renaturation in ribonuclease A.

(c) Comment on the following :

(i) Woolen clothes shrink when washed in hot water but silk items do not.

(ii) 2D gel electrophoresis is used for the resolution of complex mixture of proteins.

(iii) Ammonium sulfate is the preferred salt for salt fractionation of proteins.

(iv) Glycine in proteins does not have restricted psi and phi dihedral angles. (3,4,8)

3. (a) Differentiate between the following :

(i) Integral and peripheral membrane proteins

(ii) Salting in and salting out

(iii) Globular and fibrous proteins

(iv) HPLC and FPLC

(v) Concerted and sequential model (15)

4. (a) Describe the solid phase peptide synthesis method given by Merrifield. Also give its advantages.

(b) Explain the principle of affinity chromatography. Discuss its advantages over other column chromatographic methods of protein purification.

(c) Write down the functions of the following reagents in Protein chemistry :

(i) Performic acid

(ii) Phenyl isothiocyanate

(iii) 1-fluoro-2,4-dinitrobenzene

(iv) Urea (6,5,4)

5. (a) Explain how hydropathy plots predict transmembrane domains of proteins.

(b) Explain the molecular basis of the Bohr effect.

(c) Discuss the molecular basis and disease manifestation of the following diseases :

(i) Sickle cell anemia

(ii) Prion disease (3,4,8)

6. (a) Give the various steps involved in the Edman degradation method of determining the sequence of a given protein.

(b) Discuss the various bonds which lead to the stability of a protein.

(c) Carbon monoxide binds to free heme molecules more than 20,000 times better than O_2 but it binds only about 200 times better when the heme is bound in myoglobin. Explain why?

(d) Define the following :

(i) Sedimentation coefficient

(ii) Exclusion limit

(iii) Isopycnic centrifugation (5,4,3,3)

P.T.O.

7. (a) What are protein databases? Name any one and explain its uses.

   (b) Compare and contrast the O_2 binding curves of Myoglobin and Hemoglobin.

   (c) Differentiate between α helix and β pleated structure. (4,6,5)

8. Write short notes on the following :

   (a) Ramachandran map

   (b) Lyophilization

   (c) Fetal hemoglobin

   (d) Molecular chaperones

   (e) Antibody structure (15)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6005 **E**

Unique Paper Code : 32495205

Name of the Paper : Techniques in Biochemistry (GE)

Name of the Course : **B.Sc. (H) 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. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

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

   (i) Dark field microscopy is used to examine living cells.

P.T.O.

(ii) Quartz cuvettes are used to measure absorbance of DNA solutions in UV light.

(iii) SDS-PAGE allows molecular weight determination of unknown proteins.

(iv) Beer's law is not obeyed at high concentrations.

(v) Two monochromators are used in a fluorimeter

(vi) Primary cell culture requires a surface for attachment and survival.

(vii) Sedimentation velocity is directly proportional to the density of the particle.

(b) Define the following :

(i) Exclusion Limit

(ii) Resolution

(iii) Sedimentation Coefficient (12,3)

2. (a) Discuss the role of the following reagents :

(i) Ammonium persulphate

(ii) TEMED

(iii) Iodine in Gram staining

(iv) Bromophenol blue

(v) Cesium chloride

(vi) DMSO

(b) Give an example of the following :

(i) A strong cation exchanger

(ii) An affinity ligand pair

(iii) A molecule used to determine void volume (12,3)

3. Differentiate between the following :

(a) Selective and enrichment media

(b) Zonal and isopycnic centrifugation

(c) Permanent and temporary slide preparation

(d) intrinsic and extrinsic fluor

(e) protein and nucleic acid blotting (15)

P.T.O.

4. (a) Describe the principles involved in the separation of proteins by ion-exchange chromatography. Indicate the importance of :

(i) pH of the buffer.

(ii) increasing salt concentration.

(b) Explain how size exclusion chromatography could be used to estimate the molecular weight of intact proteins.

(c) What are the advantages of planar chromatography when compared to column chromatography? (6,6,3)

5. (a) Compare and contrast agarose and polyacrylamide gel electrophoresis.

OR

Distinguish between native gel electrophoresis of proteins and SDS-PAGE of proteins.

(b) Write a short note on isoelectric focussing method.

(c) Draw the growth curve of *E. coli* culture and explain different parts of the curve. (5,5,5)

6. (a) With the help of a schematic diagram explain the working of a double beam spectrophotometer.

(b) Define and derive Lambert beer's law. Write down the limitations of Beer's law.

(c) A solution containing 2g/liter of a light-absorbing substance in a 1 cm cuvette transmits 75% of the incident light of a certain wavelength. Calculate

(i) Transmittance of a solution containing 4g/liter

(ii) If the molecular weight of the compound is 250, calculate the molar extinction coefficient. (5,5,5)

7. (a) What are the differences between bright field and phase contrast microscopy techniques?

(b) What are different factors which can affect the resolution of a microscope?

(c) Discuss different sterilization methods used in cell culture lab. (5,5,5)

P.T.O.

8. Write short notes on the following :

(i) Types of Rotors

(ii) Ultracentrifugation

(iii) Applications of Fluorescence in Biochemistry.

(iv) Salting out (4,4,4,3)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4558 **E**

Unique Paper Code : 32493904

Name of the Paper : Bioinformatics (SEC)

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

Semester : IV

Duration : 2 Hours Maximum Marks : 50

Instructions for Candidates

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

1. (a) Expand the following **(any five)**

   (i) PDB

   (ii) DDBJ

P.T.O.

(iii) UPGMA

(iv) OMIM

(v) MEGA

(vi) TrEMBL

(b) Name the following :

(i) A secondary structure prediction tool

(ii) A metabolic pathway database

(iii) An enzyme database

(iv) A small molecule databases

(v) An operating system

(c) Define the following terms :

(i) Entrez

(ii) PubChem

(iii) Gap penality

(iv) Clade

(v) Nodes (5,2.5,5)

2. Differentiate the following :

(i) Primary databases and secondary databases

(ii) Dendogram and Cladogram

(iii) Orthologs and Paralogs

(iv) PAM & BLOSUM

(v) Smith-Waterman Alogrithm and Needlemann-Wunsch Alogrithm (2.5×5=12.5)

3. (a) Why Scoring matrices for amino acids are more complicated than that of nucleotides?

(b) Discuss the applications of KEGG database.

(c) What is Swiss-Prot? Discuss its salient features.

(d) Describe comparative genomics. (3,3,2,4.5)

4. (a) Discuss Ramachandran plot and mention its significance.

(b) Explain Molecular docking.

(c) What are file formats? Name any two commonly used sequence file formats. (4,3,5.5)

P.T.O.

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

(i) Applications of Bioinformatics

(ii) BLAST

(iii) Clustal W

(iv) Lipinsky's rule of five

(b) Discuss in detail the different methods of protein structure prediction by computational approaches. (9,3.5)

[This question paper contains 4 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 6119

Unique Paper Code : 32495402

Name of the Paper : GE – Recombinant DNA Technology

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. **All** questions carry equal marks.
4. Question No. **1** is compulsory.

1. (a) State True or False and Justify :

   (i) Type I Restriction enzymes are commonly used enzymes in genetic engineering.

   (ii) pGEM3Z is used in vitro transcription.

P.T.O.

(iii) While cloning in pBR322, blue-white screening of the recombinants could be done.

(iv) *E. coli* DNA polymerase is not be the best enzyme for PCR.

(v) Factor VIII could be easily expressed in *E. coli*.

(vi) Disarmed vectors do not possess any virulence genes.

(b) Give the role of following enzymes used in Recombinant DNA Technology :

(i) Terminal deoxynucleotide transferase

(ii) SI nuclease

(iii) Klenow fragment (12,3)

2. (a) Plasmid DNA was isolated by the alkaline lysis method and then loaded on an agarose gel. Explain the principle of agarose gel electrophoresis. How many bands of the plasmid DNA will be observed after electrophoresis and why?

(b) What are adapters and linkers? How do they enable the ligation of blunt ended DNA molecules?

(c) What is plaque hybridization? (6,4,5)

3. (a) With the help of a diagram, explain the principle of PCR. Explain the role of different reagents involved in PCR.

(b) Explain different steps of cDNA synthesis for library preparation. How are they different from genomic DNA libraries?

(c) What do you understand by in-vitro packaging of DNA? (6,5,4)

4. Differentiate between the pairs :

(i) Cosmid and Plasmid

(ii) Lambda replacement and insertion vectors

(iii) Cointegrate and binary Ti plasmid.

(iv) Recombinants and transformants

(v) pBR322 and pUC18 (3,3,3,3,3)

5. (a) What are high-capacity vectors? Explain their specific characteristics in term of their cloning capacity, host specificity and usage.

(b) Discuss Sanger's dideoxy method of DNA sequencing. Draw the gel profile of the DNA fragment whose sequence by the Sanger's dideoxy method has been found to be 5'- ATG CAG TTA AGT TCC TCC GAG-3'.

P.T.O.

(c) Explain the parameters that should be kept in mind while designing primers for PCR. (6,5,4)

6. (a) Explain the methods of transformation. Which method gives higher transformation efficiency?

(b) Name the three fusion tags in expression vectors and how they help in purification of recombinant proteins?

(c) What is gene therapy? Explain with a suitable example. (5,5,5)

7. (a) What are the components of an expression cassette?

(b) Discuss different challenges and their troubleshooting while producing recombinant proteins in *E.coli*.

(c) Describe the key features of restriction modification systems in Prokaryotes. (4,5,6)

8. Write short notes on :

(i) Glyphosate resistant crops

(ii) Alpha complementation

(iii) Identification of recombinant phages

(iv) Recombinant insulin

(v) M13 based phage vectors (3,3,3,3,3)

(500)

(03)

[This question paper contains 6 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 4675

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. There are **8** questions.
3. Attempt any **5** questions.
4. All questions carry equal marks.
5. Question No. **1** is compulsory.

1. (a) Justify the following statements :

(i) Cot curve analysis reflects the complexity of the genome.

P.T.O.

(ii) DNA intercalators like ethidium bromide decrease the stability of DNA.

(iii) Bacterial transposable elements transpose by cut and paste mechanisms.

(iv) Ames's test is useful for the identification of carcinogens.

(v) DNA synthesis is coupled to the hydrolysis of pyrophosphate.

(b) Define the following terms :

(i) Retrotransposons

(ii) Microsatellite

(iii) Processivity of DNA Polymerase

(iv) Linking Number

(v) Chi sites (10,5)

2. Differentiate between the following :

(i) Topoisomerase I and Topoisomerase II

(ii) Serine recombinase and Tyrosine recombinase

(iii) Transitions and Transversions

(iv) Euchromatin and heterochromatin

(v) Centromere and Telomere (3×5)

3. (a) Discuss the structural organization of chromatin in terms of nucleosome model.

(b) Sequencing of human genome revealed that 3% of the genome codes for the genes and proteins, so what about the rest 97%?

(c) What are thymine dimers? How are they formed and why do they need to be removed?

(5,5,5)

4. (a) Replication of linear chromosome requires the action of telomerase while the circular chromosome do not require telomerase. Explain why?

(b) Defect in DNA repair system can lead to diseases. Comment on the statement.

(c) Explain in detail the process of homologous recombination in *E. coli* highlighting the role of different proteins/enzymes.

(d) Elucidate the mechanism of mismatch repair system in prokaryotes. (3,4,5,3)

5. (a) What is the biological effect of positive and negative supercoiling?

(b) Diagrammatically explain the structure of replication fork and its components.

(c) Give the mechanism of action of following chemical compounds and their use in medicine **(any four)**.

(i) Novabiocin

(ii) Cisplatin

(iii) Azidothymidine

(iv) 6 mercaptopurine

(v) Acyclovir (3,4,8)

6. (a) Give the scientific contribution of following scientist :

(i) Barbara McClintock

(ii) Meselson and Stahl

(iii) Elizabeth blackburn

(iv) Arthur Kornberg

(b) Explain what is "polymerase switching" during eukaryotic replication

(c) What is Tm? What are the factors that affect the Tm of a DNA sample? (6,4,5)

7. (a) What is the effect of following compounds on the structure of DNA?

(i) 5-bromouracil

(ii) Nitrous acid

(b) What are transposable elements? Mention the different classes of transposable elements?

(c) DNA polymerase that would synthesize the DNA in 3'-5' direction would have a selective disadvantage even if they had a 5'-3' proofreading activity. Explain why? (4,6,5)

Write short notes on the following :

(i) Rolling circle mode of replication

P.T.O.

(ii) DNA glycosylases

(iii) Telomerase

(iv) Different forms of DNA (3,3,3,6)

6. (

[This question paper contains 6 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 4519

Unique Paper Code : 32491401

Name of the Paper : Human Physiology

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. There are **8** questions.
3. Attempt any **5** questions.
4. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

1. (a) Define the following :

(i) EPSP

P.T.O.

(ii) Vital Capacity

(iii) Receptor desensitization

(iv) Cortical reaction

(v) Regurgitation

(b) Comment on the following statements :

(i) The chloride content of the venous red blood cells is greater than that of arterial cells.

(ii) Cardiac muscles are resistant to tetany.

(iii) The ovum has a longer lifespan as compared to the sperm.

(iv) Juxtaglomerular cells act as intra-renal baroreceptors.

(v) Gastric mucosa is resistant to autodigestion. (5,10)

2. Differentiate between :

(a) Temporal and Spatial Summation

(b) Conducting Zone and Respiratory Zone

(c) Intrinsic and Extrinsic regulation of Cardiac output

(d) Gastric and Intestinal phase of gastrointestinal regulation

(e) Parturition and Placentation (3×5)

3. Answer in brief :

(a) What is Lung compliance? Describe various factors which determine lung compliance.

(b) What is Micturition? Describe its neural control mechanism

(c) What is sperm capacitation? Explain its importance in fertilization?

(d) What is fibrinolysis? How is this process regulated? (5,4,3,3)

4. Explain with the help of diagram/flow chart :

(a) Different layers of GI tract

(b) The counter-current multiplier system

P.T.O.

(c) Excitation Contraction coupling in cardiac muscles.

(d) EEG pattern of a person from awake state to different stages of sleep. (4,4,3,4)

5. Give the physiological basis and symptoms of following :

(a) Myocardial Infarction

(b) Asthma

(c) Jaundice

(d) Hemophilia

(e) Nutritional Anemia

(f) Peptic ulcer (2.5×6)

6. (a) Explain the following

(i) Movement of Diaphragm during respiration

(ii) Importance of gastric motility during digestion

(iii) The 2 types of Dialysis

(b) Two individuals have a systolic pressure of 130mmHg and 110 mmHg. Their corresponding Diastolic pressures are 90 mmHg and 85 mmHg. Calculate and compare their MAP. (12,3)

7. Provide reasons for the following :

(a) Blood does not clot in circulation.

(b) Acetylcholine shows different responses in cardiac versus skeletal muscles.

(c) A person cannot voluntarily hold his/her breath for more than few minutes.

(d) Measurement of inulin clearance is the gold standard for assessing GFR.

(e) Blood-Testis barrier creates an immunological barrier.

(f) Action potential is all or none phenomena. (2.5×6)

8. Write short notes on the following :

(a) Enterohepatic circulation

(b) Regulation of blood pH

P.T.O.

(c) Blood Brain Barrier

(d) Atherosclerosis

(e) Serum Protein Electrophoresis (5×3)

15/5/23

03

[This question paper contains 8 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 4799

Unique Paper Code : 32491403

Name of the Paper : Metabolism of Amino Acids and Nucleotides

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. There are **eight** questions.
3. Attempt any **five** questions.
4. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

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

(i) Glutamine metabolism in the kidney tend to counteract metabolic acidosis.

P.T.O.

(ii) Damage to CNS is seen in patients with Lesch-Nyhan syndrome

(iii) Serine is synthesized from glycolytic intermediates

(iv) Children suffering from PKU have light colored skin and hair.

(v) Lysine is purely ketogenic acid.

(vi) Folate deficiency increases the levels of N- formiminoglutamate in urine.

(b) Write the metabolic reactions inhibited by the following inhibitors :

(i) Methotrexate

(ii) 6-Mercaptopurine

(iii) Hydroxyurea

(c) Write the scientific contributions of the following **(any two)** :

(i) John Buchanan

(ii) P. Reicherd

(iii) Archibald Garrod (10,3,2)

2. (a) What are the different pathways for the breakdown and synthesis of glycine? Explain the reaction catalyzed by each protein of glycine cleavage system.

(b) Explain the role of glutamate synthase in the assimilation of fixed nitrogen in plant. Write the reactions catalyzed at three active sites of glutamate synthase.

(c) Explain why :

(i) S-adenosylmethionine (SAM) has a higher methyl group transfer potential than N^5-methyl tetrahydrofolate.

(ii) Isoleucine and valine metabolism is affected by Vitamin B12 deficiency.

(7,4,4)

3. (a) Write the steps involved in the degradation of heme.

(b) Explain the gamma-glutamyl cycle with all the metabolic reactions involved and state its physiological significance.

(c) Explain the regulation of biosynthesis of deoxyribonucleotide. Explain why dATP at low concentration is an activator of ribonucleotide reductase whereas at higher concentration it inhibits its activity. (5,4,6)

4. (a) Differentiate between the following :

(i) Carbamoyl phosphate synthetase I and II

(ii) Transamination and Oxidative deamination

(iii) Positive and negative nitrogen balance.

(b) Explain the mechanism of amino acid transamination reaction with the help of one example.

(c) L-asparaginase is an effective chemotherapeutic agent. Justify. (9,4,2)

5. (a) Explain the biochemical basis and symptoms of the following metabolic disorders :

(i) Acute erythropoietic porphyria

(ii) Lesch-nyhan syndrome

(iii) Homocystinuria

(iv) Hartnup's disease

(b) Explain the urea cycle and state its physiological significance.

(c) The activity of alanine transaminase is usually measured by including an excess of purified LDH and NADH in the reaction system. The rate of alanine disappearance is equal to the rate of NADH disappearance measured by spectroscopic methods. Explain how this assay works. (8,5,2)

6. (a) Explain the detailed structure of nitrogenase complex and discuss the mechanism of nitrogen fixation in *Rhizobium*. What is the contribution of anammox bacteria in Nitrogen cycle?

(b) Write the reactions for the synthesis of the following :

(i) FAD

(ii) Spermidine

(iii) Histamine

(c) The purine ring is assembled de novo from several simple precursors. Draw the purine ring and name the various precursors which are origin of C and N atoms. (7,6,2)

7. (a) Write down the steps to accomplish the following metabolic conversions :

(i) Tyrosine to epinephrine

(ii) Phenylalanine to homogentisate

(iii) Arginine to Glutamate

(iv) IMP to GMP

(b) Consider the regulation of *E. coli* glutamine synthetase and explain the metabolic rationale for each of the following effects :

(i) Inhibition of glutamine synthetase by carbamoyl phosphate

(ii) Activation of uridylylation of PII by ATP.

(c) Write down the common reactions and enzymes associated with the breakdown of branched chain amino acids. What is the biochemical basis of maple syrup urine disease? (8,4,3)

8. (a) Write short notes on the following **(Any Two)** :

(i) Glucose- alanine cycle

(ii) Purine nucleotide cycle

(iii) Activated methyl cycle

(b) Compare and contrast *de novo* and salvage pathway of nucleotide biosynthesis.

(c) Why do patients with Alkaptonuria excrete black colored urine? (8,5,2)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4699 **E**

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) State true or false. Justify your answer **(Any six)** :

(i) Flow cytometry can be used for examining a cellular process occurring over time.

P.T.O.

(ii) Tritium is an ideal isotope for high resolution autoradiography applications.

(iii) Biological samples give the best results when they are Formalin fixed paraffin embedded (FFPE).

(iv) FRET is not a distance dependent physical process.

(v) The secondary antibody is species-specific in nature.

(vi) A transmission electron microscope can examine the cell surface.

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

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

(i) Primer

(ii) Blotting

(iii) Isoelectric pH

(iv) Metabolic labeling (12,3)

Differentiate between the following (**Any three**) :

(a) Affinity pull down and tandem affinity purification assay

(b) Confocal microscopy and fluorescence microscopy

(c) Southern and western blotting

(d) ChIP and ChIP on chip (5×3)

(a) Explain the use/ role of the following (**Any six**) :

(i) Monochromator in fluorescence microscopy

(ii) BSA/fat free milk in ELISA

(iii) Trichloroacetic acid in Isoelectric focusing

(iv) DNaseI in DNA footprinting

(v) Heavy metal stain in electron microscopy

(vi) Affinity tags in pull down assay

(vii) Pre-hybridization buffer in southern blotting

(b) Briefly describe the process by which foreign genetic material is inserted in cultured cells. (12,3)

4. (a) Write down the principle and two application of the following techniques :-

(i) DNA microarrays

(ii) ELISA

(b) What is bait and prey? Explain a method which uses them and the principle and the method followed while using them.

(c) Describe the direct and indirect non-radioactive labeling of nucleic acids. (6,5,4)

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

(a) Co-immunoprecipitation

(b) RNA seq

(c) Iso-electric focusing

(d) Pulse, chase analysis (5×3)

(a) How can EMSA be used in protein-DNA binding studies? Write two applications of the technique.

(b) Describe the method by which Primer extension assay is performed. Discuss its advantages and limitations.

(c) Compare and contrast FACS and TUNEL assay. (5×3)

(a) Explain how 2D gel electrophoresis works as an appropriate tool to study proteins. What are the advantages of 2D gel over SDS-PAGE for analysis of proteins?

(b) How is MS/MS different from LC/MS.

(c) Describe protein microarrays. What are its advantages over other methods to study protein protein interaction? (7,4,4)

P.T.O.

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

(a) Luciferase assay

(b) Protein fragment complementation assay

(c) Computed Tomography (CT) Scan

(d) MALDI-TOF (5×3)

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4502 **E**

Unique Paper Code : 32491601

Name of the Paper : Genetic Engineering and Biotechnology

Name of the Course : **B.Sc. (Hons.) 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. There are **eight** questions.
3. Attempt any **five** questions.
4. **All** questions carry equal marks.
5. Question no. **1** is compulsory.

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

(i) Cosmids do not form plaques.

P.T.O.

(ii) DNA is treated with alkaline phosphatase before cloning.

(iii) Ligation of DNA with sticky ends is difficult compared to blunt ended DNA.

(iv) Electroporation does not require the preparation of competent cells.

(v) Recombinant Factor VIII expression can be easily done in prokaryotic host.

(b) Enlist the uses of the following enzymes in genetic engineering :

(i) T4 polynucleotide kinase

(ii) Klenow fragment

(iii) Reverse transcriptase

(iv) Terminal deoxynucleotidyl transferase

(v) Sequenase (10,5)

2. (a) Discuss chemical and physical methods of DNA introduction into cells.

(b) What do you mean by α-complementation? How can it be used for differentiation between transformants from recombinants?

(c) Why is *Agrobacteruim tumefaciens* known as the nature's smallest genetic engineer? Give the salient features Ti plasmid? How is the vector disarmed? (5,4,6)

3. (a) With the help of an example, explain fusion proteins. Enlist the advantages of preparing recombinant fusion proteins.

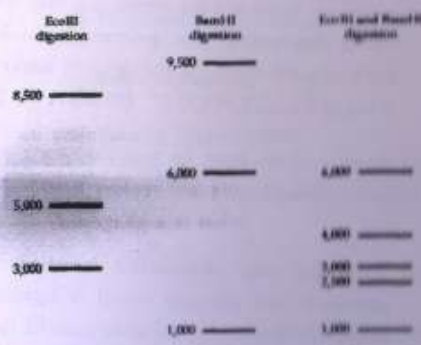
(b) A student carried out PCR amplification, but did not observe any amplification of required gene sequence. What are the errors that may occurred while designing the primers, which may have caused this? If the primer sequence is 5'AGACTCAGAACCC 3', Calculate its T_m.

(c) Write a short note on vectors based on M13 bacteriophages. What is a phagemid? (6,5,4)

4. (a) What do you understand by linkers and adapters? How are they useful in ligating blunt ended DNA?

(b) What is the principle of Sanger's method of DNA sequencing? What are the advantages of automating the technique?

(c) A purified, linear piece of DNA is cut with EcoRI and BamHI separately (single digestions) and then with both enzymes together (double digestion). The horizontal lines under the digestion conditions represent schematically the locations of the DNA fragments (bands) in the lanes of the gel after electrophoresis and staining of the DNA with ethidium bromide. The numbers denote the lengths of the digestion products (fragments) in base pairs. Draw a restriction map of the linear DNA.



(4,6,5)

ferentiate between the following :

cDNA and Genomic libraries

λ-insertion and λ-replacement vectors

) Binary and cointegrate Ti plasmid-based vectors

) Type I and II restriction enzymes

) Southern and Northern hybridisation (3×5)

) What the different types of yeast cloning vectors? Discuss the advantages and disadvantages of any three.

) Why do bacteria have Restriction modification systems? How do bacteria protect themselves from these restriction endonucleases present in the cell?

) Discuss site-directed mutagenesis and its applications. Describe any one method of site-directed mutagenesis. (6,3,6)

What are the major difficulties encountered in expressing animal genes in bacteria? How are these overcome?

P.T.O.

(b) What do you mean by Next generation sequencing? Discuss its applications.

(c) Explain the industrial production of Insulin using recombinant DNA technology. (6,3,6)

8. Write short note on following **(Any 3)** :

(i) Primer designing for PCR

(ii) Gene therapy

(iii) Bt cotton

(iv) High-capacity vectors (5,5,5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4782 **E**

Unique Paper Code : 32491602

Name of the Paper : Immunology

Name of the Course : **B.Sc. (Hons.) 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. There are **8** questions.
3. Attempt any **5** questions.
4. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

1. (a) Fill in the blanks with appropriate answers :

   (i) _____ are the first cells to reach the inflammatory site.

   (ii) _____ mediators are released in the development of type I hypersensitive reactions.

P.T.O.

(iii) Colostrum is rich in _____.

(iv) _____ complement component acts as an opsonin.

(v) _____ most potent professional antigen-presenting cells

(b) Comment on the following statements :

(i) Levels of IgG antibody rise sharply in secondary response.

(ii) Passive immunization is fast but lasts for a short duration.

(iii) Human skin is resistant to colonization by *E.coli* despite constant exposure to it.

(iv) Unlike CTLs, NK cells can kill IgG-coated target cells.

(v) Activation of complement cascade results in the development of inflammatory reactions. (5,10)

2. Differentiate between :

(i) MHC I and MHC II

(ii) T cell and B cell epitope

(iii) Active immunization and Passive immunization

(iv) Primary and Secondary lymphoid organs (4,4,4,3)

3. (a) Describe the Alternate Pathway for complement activation till MAC formation.

(b) Innate immunity collaborates with adaptive immunity to protect the host. Discuss this collaboration, naming key points of interaction between the two systems.

(c) Explain with the help of a diagram, the mechanism of class switching of B cells. (5,5,5)

4. (a) Explain different phases of development of Delayed type hypersensitivity response.

(b) Briefly describe B cell development and differentiation in the bone marrow.

(c) Elaborate briefly on major events in the inflammatory response. (5,5,5)

5. (a) Describe the cytosolic pathway for processing and presentation of antigen to T lymphocytes.

(b) Discuss briefly all the characteristics of an antigen to be immunogenic.

P.T.O.

(c) Draw a well-labelled cross-section of a portion of the thymus. Depict the location of different types of cells in different regions of the thymus.

(6,5,4)

6. (a) Name the autoantigens, major effectors and explain the immunological mechanism of the following diseases along with the symptoms.

(i) Systemic lupus erythematosus

(ii) Hashimoto's thyroiditis

(b) Explain the cytotoxic activity of CD8+ T cell.

(c) Describe how the adjuvants enhance the immune response.

(6,5,4)

7. (a) Describe the immunological basis of allograft acceptance and rejection. Why autografts are generally accepted?

(b) Draw a neat well labelled diagram of the T cell receptor along with its co-receptor.

(c) Explain the technology used to produce monoclonal antibodies.

(5,5,5)

8. Write short notes on :

(i) Superantigens

(ii) Erythroblastosis fetalis

(iii) DNA vaccines

(iv) TLR

(4,4,4,3)

(500)

[This question paper contains 4 printed pages.]

Your Roll No.....

E

Sr. No. of Question Paper : 4820

Unique Paper Code : 32497904

Name of the Paper : Molecular Basis of Infectious Diseases

Name of the Course : **B.Sc. (Hons.) 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. There are **8** questions.
3. Attempt any **5** questions.
4. **All** questions carry equal marks.
5. Question No. **1** is compulsory.

1. (a) Give reasoning for following :

(i) Diphtheria is diagnosed clinically

(ii) ID50 dose of cholera is very high

P.T.O.

(iii) Zoonotic diseases are majorly rising as new emerging diseases

(iv) Candidiasis is common in AIDS patients

(v) Rabies can be prevented by vaccination

(b) Define the following terms :

(i) Recrudescence

(ii) Dimorphic fungi

(iii) Pathogenicity island

(iv) Nosocomial infection

(v) Tetanospasmin (10.5)

2. (a) Answer the following questions :

(i) There are various immunological tests for tuberculosis. Describe any two.

(ii) Describe the Widal test.

(iii) Which antigenic proteins are first detected during HIV infection? What is their significance in diagnosis?

(iv) How are parasitic diseases historically diagnosed? Describe Montenegro test.

(v) What are Koch's postulates? (15)

3. (a) Describe the drugs used in the DOTS therapy? What is MDR-TB and XDR-TB?

(b) What is HAART? How can AIDS be cured completely?

(c) Draw the structure of influenza virus. What is the function of hemagglutinin and neuraminidase? (15)

4. Draw the life cycles of following pathogenic organisms :

(a) Plasmodium

(b) *Entamoeba histolytica*

(c) HIV (15)

5. Differentiate between the following :

(a) Antigenic shift and antigenic drift

(b) African sleeping sickness and chagas disease

(c) Endotoxin and exotoxin

(d) Hepatitis A and hepatitis B

(e) Oral and injectable polio vaccine (15)

6. (a) How was the BCG vaccine developed? Why is it ineffective in adulthood?

(b) Which diseases are prevented by DPT vaccine? What is the composition of DTaP?

(c) Why is there no vaccine for HIV till now?

(d) Which mechanism prevents vaccine development for dengue?

(e) What is the difference between active and passive immunization? (15)

7. (a) Which are the 3 major toxins involved in pathogenesis of anthrax? Describe their mechanism of action.

(b) What are the three types of leishmaniasis? How are amastigotes different from promastigotes?

(c) What is the cycle of infectious disease? Also describe the course of infectious diseases. (15)

8. Write short notes on :

(a) Re-emerging diseases

(b) Biosafety levels

(c) Source, reservoir and transmission of pathogen

(d) Sporotrichosis (15)

(e) Giardiasis (500)