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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1617

G

Unique Paper Code : 2492011103

Name of the Paper : Biochemical Techniques

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

Semester : 1

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 :

- (i) Proteins are eluted from ion exchange column by increasing salt concentration

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- (ii) During electrophoresis, a tracking dye is loaded along with the sample
- (iii) Globular proteins have higher sedimentation velocity than fibrous proteins
- (iv) Glass cuvettes are not suitable for measuring the absorbance of DNA solutions

(b) Define the following terms :

- (i) Relative Centrifugal Force
- (ii) Quantum yield
- (iii) Exclusion limit (12,3)

2. (a) Explain how SDS-PAGE is used to determine the molecular weight of a protein.
- (b) Diagrammatically explain the working of a spectrophotometer.
- (c) Compare the techniques of TLC and paper chromatography. (6,4,5)
3. (a) Discuss the principle of fluorescence and give any two applications.

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- (b) Compare the features of a table top centrifuge and a high-speed centrifuge.
- (c) Explain why large molecules move faster as compared to smaller molecules in gel permeation chromatography. (5,5,5)
4. (a) Explain the role of the following :
- (i) Spacer arm in affinity chromatography
 - (ii) EtBr in agarose gel electrophoresis
- (b) What are the different ways to elute a protein from an ion exchange column?
- (c) A solution of UTP of concentration 87.9 mg/litre has an absorbance of 0.75 at 260nm. If the light path is 1.0cm and the molecular weight of UTP is 586, calculate the molar absorbance coefficient of UTP. (6,5,4)
5. (a) Differentiate between the following :
- (i) Cation and anion exchanger
 - (ii) Extrinsic fluor and intrinsic fluor

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(b) Discuss the principle of affinity chromatography.
What is the ligand used for purification of the following:

(i) Histidine-tagged protein

(ii) Avidin

(iii) mRNA

(e) Explain the technique of density gradient centrifugation. (6,5,4)

6. Write short notes on the following:

(a) Lambert-Beer Law

(b) Staining methods in electrophoresis

(c) Isoelectric focussing

(5,5,5)

(500)

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Your Roll No.....

Sr. No. of Question Paper : 1541

G

Unique Paper Code : 2492011101

Name of the Paper : Biomolecules (DSC-1)

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

Semester : I

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. Identify the following statements as true or false and justify your answer :

(a) All Amino acids are optically active.

(b) Histidine acts as biological buffer at physiological pH.

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- (c) Proline gives yellow color with Ninhydrin.
- (d) Trehalose is non reducing disaccharide.
- (e) Fatty acids when put in aqueous solution make micelles.
- (f) DNA does not show increase in absorbance on heating.
- (g) Chitin is an example of storage homopolysaccharides.
- (h) At a pH more than the pI, amino acids exist in negatively charged form.
- (i) Vit K has antioxidant activity.
- (j) Glycosaminoglycans have a slippery consistency. (1.5×10=15)

2. Differentiate between the following :

- (a) B-DNA and A-DNA
- (b) Essential and Nonessential Amino acids
- (c) Glycerophospholipid and Sphingophospholipid
- (d) Anomers and Epimers
- (e) Water soluble and Fat-soluble vitamins (3×5=15)

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- 3. (a) Why is tryptophan poorly soluble but arginine is readily soluble in water?
 - (b) The pKa value of carboxylic group in amino acids is lower than that in acetic acid. Explain.
 - (c) Sucrose is non-reducing sugar, but lactose is reducing sugar. Why?
 - (d) Why do animals store glycogen but not glucose for their energy need? Explain in brief.
 - (e) Why TAG is better form of storage in comparison to Glycogen? (3×5=15)
4. (a) Discuss the titration curve of glycine, indicating pKa, pI and buffering zone
- (b) What are glycosaminoglycans? Explain their role with help of examples.
- (c) Draw the structure of following :
- (i) Sulphur containing amino acid
 - (ii) 7 methyl Guanosine
 - (iii) Phosphatidylethanolamine
 - (iv) Beta D galactosamine
 - (v) Lactose (5,6,4)

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5. (a) Salient features of Watson and Crick DNA double helix model.
- (b) Name the vitamin deficiency and write identify symptoms of the following conditions :
- (i) Scurvy
 - (ii) Pellagra
 - (iii) Rickets
 - (iv) Megaloblastic anaemia
- (c) Distinguish between Glycoproteins and Proteoglycans giving suitable examples. (5)
6. (a) Discuss the role of Lipids as signalling molecules.
- (b) List out the various roles of nucleotides.
- (c) Give reactions for the following :
- (i) Action of alkali on RNA
 - (ii) Reaction of monosaccharides with cuprous ions
 - (iii) Action of phospholipase A on lecithin
 - (iv) Action of enzyme sucrase on sucrose in presence of HCL. (3)

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Your Roll No.....

Sr. No. of Question Paper : 2362

G

Unique Paper Code : 2494001001

Name of the Paper : Molecules of Life (GE-1)

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

Semester : 1

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) Define the following: Buffering Capacity, PUFA, Epimer.

(b) Write reason for the following :

(i) Amino acids can exist as zwitter-ions

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- (ii) Glycogen is a branched polysaccharide.
 - (iii) Phospholipids are amphipathic in nature.
 - (iv) Tryptophan absorbs UV light
- (c) Indicate whether true or false and justify the following :
- (i) Cholesterol is only found in animal cell membrane.
 - (ii) B-DNA is a right-handed helix.
 - (iii) Nucleosides are more soluble in water compared to the corresponding bases.
 - (iv) D-amino acids are present in all proteins. (3,6,6)
2. Differentiate the following (Cite examples/draw structure wherever applicable) :
- (a) Reducing and non-reducing disaccharide
 - (b) Chitin and Cellulose
 - (c) Standard and Non-standard amino acids.
 - (d) Essential and non-essential fatty acids.
 - (e) t-RNA and mRNA (3×5)

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3. Write short notes :
- (a) Watson and Crick model of DNA
 - (b) Purine and pyrimidine base pairing
 - (c) Cholesterol
 - (d) Biologically important Nucleotides
 - (e) Cis and trans fatty acids (3×5)
4. (a) Draw the structures of the following biomolecules :
- (i) L- α -Alanine
 - (ii) Fatty acid: C18:3: $\Delta^{6,9,12}$
 - (iii) Maltose
 - (iv) Phosphatidylcholine
 - (v) Tripalmitoylglycerol
- (b) Elaborate on the role of lipids as hormones and Vitamins
- (c) Highlight the salient features of the Watson Crick model of DNA. (5×3)

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5. (a) Explain the features of the peptide bond and draw the structure of the pentapeptide : Ala-Cys-Ser-Gly-Tyr.
- (b) Write the basis of classification of amino acids based on nature of side chain citing one suitable example for each group.
- (c) Triglycerides are considered as an ideal storage fuel. Comment. (4,6,5)
6. Write short notes on the following :
- (a) Chromatin
 - (b) Storage polysaccharides
 - (c) Buffers
 - (d) Mutarotation
 - (e) Henderson-Hasselbalch equation (3×5)

(500)

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Your Roll No.....

Sr. No. of Question Paper : 1579

G

Unique Paper Code : 2492011102

Name of the Paper : Proteins (DSC-2)

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

Semester : 1

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. Choose the best choice :

(a) What accounts for peptide bond planarity within a polypeptide?

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- (i) The fully double bonded peptide bond.
 - (ii) Electronegativity differences between nitrogen and carbon.
 - (iii) Hydrogen bonding between amino acid side chains and water.
 - (iv) Partial double bond character of the peptide bond.
 - (v) Rotation around ψ and ϕ bonds.
- (b) Which of the following is most correct :
- (i) Charged amino acids are never buried in the interior of a protein.
 - (ii) Charged amino acids are seldom buried in the interior of a protein.
 - (iii) All hydrophobic amino acids are buried when a protein folds.
 - (iv) Tyrosine is only found in the interior of proteins.

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- (v) Glycine is rarely found in proteins because it is too destabilizing.
- (c) Proteins are classified within families or super-families based on similarities in :
- (i) Evolutionary origin.
 - (ii) Physico-chemical properties.
 - (iii) Structure and/or function.
 - (iv) Subcellular location.
 - (v) Subunit structure
- (d) The oxygen bound to hemoglobin or myoglobin is directly attached to the :
- (i) Helix-F in the protein
 - (ii) Proximal Histidine
 - (iii) Fe (II)
 - (iv) Heme N
 - (v) Fe (III)

P.T.O.

B. Give reasons for the following:

- Glycine and proline are found in β sheets.
- Silk fiber has high tensile strength.
- Hydropathy plots are used to determine membrane protein topology.
- Disulphide bonds make proteins thermostable.

C. Give an example and one function of the following:

- Conjugated protein
- Dipeptide
- Basic protein

(4,8,3)

- Give salient features of α helix and β pleated structure.
 - Describe the primary, secondary, tertiary and quaternary structure of collagen. Elaborate on the

role of Vitamin C in collagen biosynthesis.

(b) Ramachandran plot is also referred to as a dihedral plot. Explain. (4,8,3)

(a) Describe in detail, the steps involved in Solid phase peptide synthesis. What are the two major advantages of this method?

(b) An oligopeptide was analyzed. Given the data below, what is its sequence?

(i) Amino acid analysis revealed the composition Asp, Asn, 2Glu, Gly, Lys, 2Met, Phe, 2Pro.

(ii) Carboxypeptidase digestion gave the results as Glycine.

(iii) N-terminal analysis afforded the DNP derivative of glutamic acid

(iv) Treatment of the peptide with cyanogen bromide gave three fragments. Sanger N-terminal analysis of these three fragments

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gave the DNP derivatives of Glu, Pro, and Asp.

(v) Cleavage of the oligopeptide with trypsin gave two fragments. Sanger analysis of these two fragments both gave the DNP derivative of Glu.

(vi) Cleavage of the oligopeptide with chymotrypsin gave two fragments. Sanger analysis of these two fragments gave DNP derivatives of Glu and Lys.

(c) Give the role of the following reagents with the associated reaction in Protein chemistry:

(i) Dansyl chloride

(ii) β -Mercaptoethanol

(8,4,3)

4. (a) What are Hill plots? Myoglobin has a linear plot,

whereas hemoglobin plots are non-linear with variable slope. Explain.

(b) How do the following affect O_2 binding curves of hemoglobin? What is the biological impact of it.

(i) 2, 3 BPG

(ii) CO_2

(iii) pH

(c) In brief, give the Sequential or Induced Fit Model of Cooperative O_2 Binding to Hemoglobin. (6,6,3)

5. (a) Give the biochemical basis and manifestation of the following diseases :

(i) Alzheimer's disease

(ii) Sickle cell anemia.

(b) Protein S will fold into its native conformation only when protein Q is also present in the solution. However, protein Q can fold into its native conformation without protein S. Detail out the P.T.O.

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folding mechanism of protein Q and protein S.
(8,7)

6. Give short notes on the following :

(a) Protein domain

(b) β barrel proteins

(c) Protein sequence databases

(d) Supersecondary structures

(e) Protein denaturation

(3×5)

02/01/24 (M)

(500)

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Your Roll No.....

Sr. No. of Question Paper : 1560

G

Unique Paper Code : 2492012302

Name of the Paper : Bioenergetics (DSC)

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

Semester : III

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) Explain the following terms :

(i) Iron sulfur Protein

(ii) Biochemical Standard free energy change

(iii) Nernst equation

(iv) Energy charge

P.T.O.

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- (v) Accessory pigments
- (vi) GFP
- (vii) Uncoupler
- (viii) State function

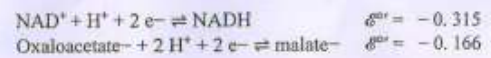
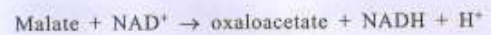
(b) Give the contribution of the following scientists :

- (i) Albert L. Lehninger
- (ii) Paul Boyer
- (iii) Efraim Racker (12,3)

2. (a) Calculate ΔG° for the reaction $A + B \rightleftharpoons C + D$ at 25°C when the equilibrium concentrations are $[A] = 10 \mu\text{M}$, $[B] = 20 \mu\text{M}$, $[C] = 4 \mu\text{M}$, and $[D] = 6 \mu\text{M}$. Is the reaction exergonic or endergonic under standard conditions?
- (b) If ΔH and ΔS for a reaction are both positive, can the reaction be spontaneous. If so then under what conditions?
- (c) Phosphocreatine is an energy source in skeletal muscle during heavy exercise. Explain.
- (d) ATP transfers energy by group transfers. Explain. (3,3,3,6)
3. (a) The reaction catalyzed by malate dehydrogenase is,

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Calculate ΔG° for the reaction. Is the reaction Spontaneous?

- (b) Explain how Ubiquinone is a two-electron carrier and cytochrome c is a one electron carrier.
- (c) Explain the Chemiosmotic theory, proposed by Peter Mitchell. Give two experimental proofs in support of this theory.
- (d) Give the role of Brown adipose Tissue in new born. (4,4,5,2)
4. (a) Give the schematic diagram of electron transport chain in mitochondria for transport of 2 electrons from NADH to oxygen. Show the complexes involved in proton translocation
- (b) What is Malate Aspartate shuttle? Give its functional importance.
- (c) Draw a labeled diagram of F_1F_0 -ATP synthase. Mention the subunits that are static, subunits that rotate and which change conformation.

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- (d) Explain how do the following inhibit ATP synthesis :
- (i) Rotenone
 - (ii) DCCD
- (4,4,5,2)
5. (a) Calculate the free energy change for moving a proton from the thylakoid lumen to the stroma when $\Delta pH = 3.4$, $\Delta \Psi = 0.5$, and $T = 25^\circ C$.
- (b) Give a diagrammatic representation of electron carriers in PSII from Reaction Center to Plastoquinone.
- (c) Compare the cyclic electron transport in Purple and Green Sulfur photosynthetic bacteria.
- (d) Give the role of phycobilisome in red algae.
- (4,4,5,2).
6. (a) Explain how firefly Luciferin / Luciferase system is used for ATP assay.
- (b) How are ROS species generated in mitochondria? Give an account of the ROS scavenging mechanism present in mitochondria.
- (c) Give an account of water splitting complex in thylakoid membrane.
- (5,5,5)

[$R=8.314J/mol.K$, $F=96,480J/V.mol$,]

(300)

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[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4507

G

Unique Paper Code : 32491303

Name of the Paper : Hormone : Biochemistry and
Function

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

Semester : III

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 7 questions.
3. Attempt any 5 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.

1. (a) Explain the following :

- (i) Post-menopausal women have a higher risk of coronary heart disease.

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- (ii) Steroid hormones have longer half lives as compared to peptide hormones.
- (iii) In natives of Africa goiter is prevalent.
- (iv) Growth hormone can be considered as trophic hormone.
- (v) Oxytocin action during parturition is an example of feed forward response.
- (vi) Gases can function as second messenger.

(b) Define the following terms :

- (i) Antagonist
- (ii) Polyuria
- (iii) Spare receptors

(12,3)

2. Differentiate between the following :

- (a) Diabetes mellitus type I and II
- (b) Mineralocorticoids and Glucocorticoids
- (c) Adenohypophysis and neurohypophysis
- (d) PKB and PKC

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(e) Short loop and long loop feedback mechanism to regulate hormone secretion. (3×5)

- 3. (a) Explain how aldosterone synthesis and secretion is regulated by the RAAS system.
- (b) What are the metabolic conversions that are required to produce the active form of VitD. What is the role of Vit D in bone mineralization?
- (c) What are the various hormones obtained from POMC? Discuss their functions? (5,6,4)
- 4. (a) Describe flight or fight response.
- (b) Describe how ANF causes natriuresis and diuresis.
- (c) What do you understand by cooperativity, ligand specificity and scatchard analysis with respect to hormone receptor interactions as observed in binding assays? (5,4,6)
- 5. (a) Give the pathophysiology of following disorders :
 - (i) Cushing syndrome
 - (ii) Hashimotos thyrotoxicosis

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(1)

(iii) Paget's disease

(iv) Dwarfism

(v) Explain how cholera toxin causes diarrhea?

(12,3)

6. (a) Discuss the role of hormones during ovarian and uterine phases of menstrual cycle.

(b) Describe the steps of thyroid hormone synthesis.

(c) Give physiological role of following :

(i) Leptin

(ii) Gastrin

(6,5,4)

7. With the help of the flowchart/diagram, explain the role of the following in the signaling pathway :

(i) Raf kinase in MAP kinase pathway

(ii) PKA in Glycogen breakdown

(iii) GTPase activity in G protein

(iv) PH domain in PDK activation

(v) IP3 in PKC activation

(3×5)

(200)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4393

G

Unique Paper Code : 32491302

Name of the Paper : Membrane Biology and
Bioenergetics

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

Semester : III

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.
6. Simple Calculators are allowed.

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1. Explain the following terms :

- (a) Energy charge of the cell
- (b) Hills reaction
- (c) Phycobilisomes
- (d) Critical packing parameter
- (e) Polarized cells
- (f) Antenna pigments
- (g) Cystic fibrosis
- (h) Proton motive force
- (i) CMC
- (j) BAT

(1.5×10)

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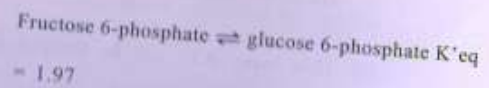
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2. Give an experimental proof of the following :

- (a) Bilayer structure of membranes.
- (b) Membrane fluidity
- (c) Singer and Nicolson mosaic model of membranes.
- (d) Transbilayer movement of membrane molecules

(4,3,4,4)

3. (a) Consider the following interconversion, which occurs in glycolysis



What is $\Delta G'^{\circ}$ for the reaction (K'_{eq} measured at 25°C)?

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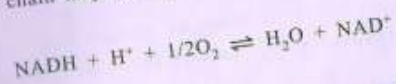
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If the concentration of fructose 6-phosphate is adjusted to 1.5 M and that of glucose 6-phosphate is adjusted to 0.50 M, what is ΔG ?

($R = 8.3143/\text{mol.K}$)

(b) Electron transfer in the mitochondrial respiratory chain may be represented by:



(i) Calculate ΔE° for the net reaction of electron transfer

(ii) Calculate ΔG° for the net reaction of electron transfer

(iii) How many ATP can be theoretically be generated by this reaction if free energy of ATP synthesis under cellular conditions is 52 KJ/mol.

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$$\Delta E^\circ \text{ NAD/NADH} = -0.320\text{V}$$

$$\Delta E^\circ \text{ O}_2/\text{H}_2\text{O} = 0.820\text{V}$$

$$(F = 96.5\text{KJ/V.mol})$$

(c) Give the basis of high energy of hydrolysis of the following molecules:

(i) ATP

(ii) Phosphoenol pyruvate (5,6,4)

4. (a) State the chemiosmotic theory. Give an experimental proof validating the theory.

(b) Give the binding change mechanism of ATP synthesis catalyzed by F_0F_1 ATP synthase.

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- (c) Calculate the proton motive force generated across the inner mitochondrial membrane per pair of electrons transferred through the respiratory chain from NADH to O_2 . Assume $\Delta\psi$ is 0.15V and pH difference is 0.3 units. (6,5,4)

$$[R = 8.314J/mol.K, F = 96,480J/V.mol]$$

5. Differentiate between the following :

- (a) PSI and PSII
(b) Cyclic and non-cyclic photophosphorylation
(c) Flippases and Floppases (6,5,4)

6. Explain the mechanism of the following membrane transporters :

- (a) Phospho transferase system

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- (b) Aquaporins

- (c) $Na^+ K^+$ ATPase

(5,5,5)

7. (a) Mention the site and mechanism of action of the following inhibitors :

- (i) Cyanide

- (ii) DCMU

- (iii) Oligomycin

- (iv) Antimycin A

- (b) What are the different mechanisms to scavenge reactive oxygen species in mitochondria.

- (c) Explain the Malate aspartate shuttle. (8,4,3)

8. Write short notes on the following :

- (a) Lipid rafts

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(b) Porins

(c) RBC membrane

(d) Ionophores

(4,4,4,3)

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[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1598

G

Unique Paper Code : 2492012303

Name of the Paper : Membrane Biology

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

Semester : III

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.

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1. (a) Justify the following statements (ANY FIVE) :

- (i) Phosphatidylcholine is found predominately in outer (extracellular) side of the bilayer.
- (ii) Critical micellar concentration of ionic detergents decreases with the addition of electrolytes.
- (iii) Vanadate inhibits P-type ATPases.
- (iv) Rate of uncoupling by valinomycin is temperature dependent whereas gramicidin is not.
- (v) Transport proteins present on the apical side of membrane cannot diffuse to the basolateral side of the membrane in the intestinal epithelial cells.

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(vi) Halobacterium salinarum can survive under very high salt concentrations.

(b) Give the contributions of the following scientists

(Any Two) :

- (i) Peter Agre
- (ii) Jens Christian Skou
- (iii) A. D. Bangham

(c) Identify the following :

- (i) Technique used to determine transition temperature of membrane
- (ii) Cardiac glycoside that blocks the $\text{Na}^+\text{-K}^+$ pump.

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(iii) A family of proteins which help in transportation of glucose across the RBC membrane. (10,2,3)

2. (a) How is membrane fluidity affected by the following?

(i) Change in temperature

(ii) Lipid composition

(b) What are lipid anchored membrane proteins? Explain different types of lipid anchored membrane proteins.

(c) Explain the structure of acetylcholine receptor. How does the ligand binding open the acetylcholine receptor at neuromuscular junction?

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(d) What do you understand by homeoviscous adaptations? Mention one example. (4,4,5,2)

3. (a) Differentiate between (any two):

(i) COP I and COP II coated vesicles

(ii) Carrier and Channel forming Ionophores

(iii) Primary active and Secondary active transport

(b) Diagrammatically represent the architecture of RBC membrane.

(c) Explain the structure of the CFTR protein. What is the molecular basis of development of the disease Cystic Fibrosis? (6,4,5)

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4. (a) Explain the structure and function of following :

(i) Lipid rafts in membranes

(ii) Potassium ion channels

(b) Explain the structure and mechanism of calcium ATPase present on the plasma membrane.

(c) Explain the TNBS labeling experiment to demonstrate the flip-flop movement of membrane lipids.

(d) State the function of the following :

(i) SNARE Proteins

(ii) Flippase

(5,4,4,2)

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5. (a) Calculate the free energy change for transporting 1 mole of glucose into the cell from blood at 37°C. Given that the concentration of glucose outside the cell is 10 folds higher than intracellular concentration. ($R=8.314 \text{ J/mol.K}$)

(b) Justify the following statements :

(i) Rate of glucose transport can be compared with enzyme catalysed reactions.

(ii) Defected aquaporins may lead to diabetes insipidus.

(c) What is the mechanism of acid secretion in gastric lumen? How does cimetidine inhibit the process of gastric acid secretion?

(d) Cholesterol plays a dual role in maintaining fluidity. Justify the statement. (3,4,5,3)

P.T.O

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8

4

6. Write short notes on the following :

(a) FRAP

(b) Patch clamp Technique

(c) Receptor Mediated Endocytosis of LDL

(d) Group translocation in bacteria (4,3,4,4)

(300)

(2)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1522

G

Unique Paper Code : 2492012301

Name of the Paper : Metabolism of Lipids

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

Semester : III

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.

P.T.O.

1. (a) Answer the following :

- (i) Odd chain fatty acid oxidation is gluconeogenic in nature.
- (ii) Cholesterol is made from acetyl-CoA in four major stages.
- (iii) C^{14} labeled CO_2 is not incorporated into fatty acids synthesis.
- (iv) Bile helps in digestion and absorption of lipids.
- (v) Statins are used in the treatment of hypercholesterolemia.
- (vi) Two additional enzymes are required in polyunsaturated fatty acid breakdown.

(b) Write the reactions catalyzed by the following enzymes :

- (i) Methyl malonyl-CoA mutase
- (ii) Acetyl-CoA carboxylase (12,3)

2. Differentiate between :

- (a) Fatty acid oxidation in mitochondria and peroxisome
- (b) Chylomicron and HDL
- (c) Alpha and omega oxidation (5×3)

3. Explain the following :

- (a) Reciprocal regulation of fatty acid oxidation and synthesis
- (b) Oxidation of odd chain fatty acids leads to net synthesis of oxaloacetate.
- (c) Carnitine plays an important role in fatty acid oxidation. (5×3)

4. (a) Give the total number of ATP produced in the complete oxidation of palmitic acid with reactions involved.

- (b) Describe synthesis of triacylglycerol from glycerol.
- (c) How is HMG-CoA reductase regulated?

(7,4, 4)

P.T.O.

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4

5. Give the following conversions :

(a) Acetyl-CoA to Mevalonate

(b) Glycerol-3-phosphate to phosphatidic acid

(c) Palmitoyl-CoA to Ceramide (5×3)

6. Write short notes on :

(a) Ketone bodies

(b) Fatty Acid Synthase Complex

(c) Atherosclerosis (5×3)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4421

G

Unique Paper Code : 32497906

Name of the Paper : Advanced Cell Biology (DSE)

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

Semester : V

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.

P.T.O.

4421

2

1. (a) Explain the following statements (Any FIVE):
- (i) Inactivation of "BRCA1" protein may lead to tumor formation.
 - (ii) Taxol and colchicine are toxic for dividing cells despite their opposite effects on microtubule assembly.
 - (iii) Ran GTP concentration is lower in cytosol than in nucleus.
 - (iv) Pre-sequences of mitochondrial proteins are positively charged whereas the transit peptides of chloroplast proteins are not.
 - (v) Cancer patients undergoing chemotherapy often need bone marrow transplantation.
 - (vi) Mutated cyclin A can cause DNA reduplication during S-phase.

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3

- (b) Name the following :

- (i) Technique used for the separation of subcellular organelles
- (ii) Protein that helps in nucleation of G-actin
- (iii) Protein that initiates the UFP response in yeast

- (c) Discuss the contribution of following scientists :

- (i) Günter Blobel
- (ii) Yoshio Masui and Clement Markert

(10,3,2)

2. (a) Write the mechanism of action of the following drugs :

- (i) Cytochalasin
- (ii) Herceptin

P.T.O.

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(iii) Phalloidin

(iv) Tamoxifen

(b) Explain the process of N-linked glycosylation of a secretory glycoprotein. How does N-linked glycosylation help in quality control function of ER?

(c) Comment on the following :

(i) Concept of Oncogene addiction helps in selection of molecular targets for cancer therapy.

(ii) Concentration of GTP controls growth and shrinkage of Microtubules. (4,6,5)

3. (a) Explain, with help of diagram, the molecular mechanism that leads to cancer when Rb protein and p53 protein are mutated.

4421

5

(b) Elaborate on the four major mechanisms of regulation of CDK activity during the cell cycle.

(c) Compare the structure and function of Myosin, kinesin and dynein motor proteins. (5,4,6)

4. (a) What are stem cells? What are the advantages of embryonic stem cells as compared to adult stem cells for therapeutic applications?

(b) Illustrate the structural features of SRP. Explain the co-translational translocation of secretory proteins into the lumen of ER.

(c) What is the mode of action of imatinib? How do tumors develop resistance to this drug? (5,6,4)

5. (a) How does APC/c promote the separation of sister chromatids at anaphase. Explain with the help of a diagram.

P.T.O.

- (b) Explain the structure of the sarcomere of a skeletal muscle myofibril. Describe the sliding filament theory of muscle contraction.
- (c) Predict the effects of the following mutations on the ability of the cell to undergo apoptosis:
- Mutation in Bad such that it cannot phosphorylate protein kinase B.
 - Mutation in Bax such that it cannot form dimers.
 - Mutation in adaptor proteins such that it cannot form dimers.
 - Overexpression of Bcl-2. (5,6,4)
6. (a) Illustrate the steps involved in the progression of a genetically altered cell into a tumor cell.

- (b) What is the molecular basis of the following diseases?

- I-cell disease
- Zellweger disease
- Gaucher's Disease

- (c) How do ATR and ATM proteins regulate the DNA damage checkpoint of the cell cycle? (5,6,4)

7. (a) Differentiate between the following (ANY TWO):

- COP I and COP II coated vesicles
- Actin Bundles and Actin Networks
- Apoptosis and necrosis

- (b) With the help of a diagram, explain the role of "BiP" in post-translational translocation of secretory protein into ER lumen.

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8

3

(c) Explain the role of CDK2/cyclin-A complex in ensuring that the DNA is replicated only once per cell cycle in the S-phase. (6,4,5)

8. Write short note on the following :

(a) Role of Caspases in Apoptosis

(b) SCNT in therapeutic cloning

(c) Applications of ultracentrifuge

(d) Structural and function of MTOC (4,4,3,4)

(200)

[This question paper contains 12 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4321 **G**

Unique Paper Code : 32491501

Name of the Paper : Concepts in Genetics

Name of the Course : B.Sc. (Hons.) Biochemistry
(CBCS-LOCF)

Semester : V

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.
6. The use of simple calculator is allowed.

P.T.O.

1. (a) Give a term that best describes the following :

- (i) Phenotype of heterozygote is intermediate between the phenotypes of the two homozygotes.
- (ii) An autosomal trait expressed in one gender only.
- (iii) A cross between an F1 individual and one of the parental homozygous recessive genotype.
- (iv) Mode of inheritance observed in LHON disease.
- (v) Non-coding RNA involved in dosage compensation in mammals.
- (vi) The region of homology between X and Y chromosome.

(b) Comment on the following :

- (i) In the experiments conducted by Carl Correns on *Mirabilis jalapa*, the variegated branch produces progeny with three different phenotypes.
 - (ii) Incomplete penetrance can lead to confusing transmission patterns in pedigree analysis.
 - (iii) Rare male calico cats are the feline equivalent of Klinefelter's syndrome.
- (c) Discuss the application of the following in genetics :
- (i) Molecular clock
 - (ii) LOD score
 - (iii) Karyotyping

(6,6,3)

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4

2. Differentiate between the following (any five):

- (a) Allopatric and sympatric speciation
- (b) Specialized transduction and generalized transduction
- (c) Maternal effect and maternal inheritance
- (d) Genetic map and physical map
- (e) Translocation and inversion of chromosome segments
- (f) Broad sense and narrow sense heritability

(3×5)

3. (a) Aryan is colour blind. Both his parents have normal vision. His maternal grandfather is colour-blind, while both his paternal grandparents have normal colour vision. Aryan has three elder sisters Gita, Reeta, and Meeta (in the given order). All three sisters have normal colour vision. Aryan's oldest

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sister, Geeta is married to a man with normal colour vision; they have two children, a 10-year-old colour-blind boy and a 6-year-old girl with normal colour vision.

(i) Using standard symbols and labels, draw a pedigree of Aryan's family.

(ii) What is the most likely mode of inheritance for colour blindness in Aryan's family? Justify your answer.

(iii) If Geeta and her husband have another child, what is the probability that the child will be a colour-blind boy?

(b) In four Hfr strains of bacteria, all derived from an original F^+ culture grown over several months, a group of hypothetical genes was studied and shown to be transferred in the order shown in the following table.

P.T.O.

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6

Hfr Strain

Order of Gene Transfer

1

E R I U M B

2

U M B A C T

3

C T E R I U

4

R E T C A B

(i) Assuming that *B* is the first gene along the chromosome, determine the sequence of all genes shown.

(ii) One strain creates an apparent dilemma. Which one is it? Explain why the dilemma is only apparent, not real.

(c) Explain how in a heterozygous individual, a single crossover within a pericentric inversion leads to abnormal gametes. Briefly explain how duplication may lead to the evolution of new genes.

(6,4,5)

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(a) The following genotypes were crossed:

$$Aa Bb Cc dd Ee \times Aa bb Cc Dd Ee$$

What will be the proportion of the following genotypes among the progeny of this cross?

(i) $Aa Bb Cc Dd Ee$ (ii) $Aa bb Cc dd ee$ (iii) $aa bb cc dd ee$ (iv) $AA BB CC DD EE$

What do you understand by trinucleotide expansion? How is it responsible for genetic anticipation? Explain with the help of a suitable example.

axy endosperm (*ax*), shrunken endosperm (*sh*), and yellow seedling (*y*) are encoded by three recessive genes in corn that are linked on

P.T.O.

chromosome 5. A corn plant homozygous for three recessive alleles is crossed with a plant homozygous for all the dominant alleles. The resulting F_1 are then crossed with a point tester homozygous for the recessive alleles in a testcross. The progeny of the testcross are:

<i>Wx</i>	<i>sh</i>	<i>V</i>	87
<i>Wx</i>	<i>Sh</i>	<i>v</i>	94
<i>Wx</i>	<i>Sh</i>	<i>V</i>	3,479
<i>wx</i>	<i>sh</i>	<i>v</i>	3,478
<i>Wx</i>	<i>sh</i>	<i>V</i>	1,515
<i>wx</i>	<i>Sh</i>	<i>v</i>	1,531
<i>wx</i>	<i>Sh</i>	<i>V</i>	292
<i>Wx</i>	<i>sh</i>	<i>v</i>	280
Total			10,756

- (i) Determine the order of these genes on the chromosome.
- (ii) Calculate the map distances between the genes.
- (iii) Determine the coefficient of coincidence and the interference among these genes.
- (iv) What does the interference tell us about the effect of one crossover on another?

(4,4,7)

With the help of suitable examples, explain the phenomenon and molecular basis which gives rise to the phenotypic ratio of 13:3:1 and 15:1.

State the Hardy Weinberg law. Calculate allelic, genotypic and phenotypic frequencies in a population of 30,000 individuals in which 65 individuals are diagnosed positive for autosomal recessive disorder.

(c) Explain how Benzer used the complementation test to determine the structure of *rII* locus of bacteriophage.

5. (a) What do you mean by complementation test? dominant mutation *Plum* in the fruit fly causes brownish-purple eyes. Is it possible to determine by complementation test whether *Plum* is an allele of the *brown* or *purple* genes? Justify your answer.

(b) Explain the underlying mechanism during development, which leads to the differentiation of *Drosophila* embryo into anterior-posterior and dorsal-ventral axes.

(c) What will be the result of the following conjugation between cells with different *F*-factors :

(i) $F^+ \times F^-$

(ii) $F' \times F$

(iii) $Hfr \times F^-$

(4,8,3)

6. Species A has $2n = 14$ and species B has $2n = 20$. Give all possible chromosome numbers that may be found in the following individuals.

(i) An autotriploid of species A

(ii) An autotetraploid of species B

(iii) An allotriploid formed from species A and species B

(b) Phenylketonuria, a metabolic disease in humans, is caused by a recessive allele, *k*. If two heterozygous carriers of the allele marry and plan a family of five children :

(i) What is the chance that four children will be unaffected and one affected with phenylketonuria?

(ii) What is the chance that the first child will be an unaffected girl?

(c) Explain the molecular mechanism of dosage compensation in humans and compare it with that of the fruit fly.

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A normal female has an inactivated X chromosome as Barr body. However, if she does not have both X chromosomes, she exhibits a genetic disorder. Explain. (3,4,8)

7. Write short notes on the following (any five) :

- (a) Neutral theory of evolution
- (b) Quantitative Trait Loci and their identification
- (c) Robertsonian Translocation
- (d) Mechanisms of genetic transfer in bacteria
- (e) Genetic markers
- (f) Homeotic genes of Arabidopsis
- (g) Somatic hybridization (3×5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4375

G

Unique Paper Code : 32491502

Name of the Paper : Gene Expression and Regulation
(Core)

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

Semester : V

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 :
 - (i) In prokaryotes the ribosome is able to differentiate between internal and initiator methionine.
 - (ii) The eukaryotic mRNAs are more stable than prokaryotic mRNAs.

P.T.O.

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2

- (iii) Peptide bond formation takes place without ATP hydrolysis.
- (iv) Sigma factor is not associated with the elongating RNA polymerase.
- (v) Genetic code is universal and degenerate.

(b) Define the following terms :

- (i) Promoter
- (ii) Abortive initiation
- (iii) Enhancer
- (iv) Polyribosome
- (v) Operon

(10,5)

2. (a) Describe the activity of lac operon in each of the following cases :
- (i) Both lactose and glucose are present
 - (ii) Glucose is present, lactose is absent
 - (iii) Both lactose and glucose are absent
 - (iv) Lactose is present, glucose is absent
- (b) Describe how the enzyme poly A polymerase is different from RNA polymerase.
- (c) Explain the role of transcription factors TFIIID and TFIIH in transcription. (8,3,4)

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3. (a) Give the mode of action of the following :

- (i) Cordycepin
- (ii) Actinomycin D
- (iii) Rifampicin
- (iv) Puromycin
- (v) Cycloheximide

(b) Discuss the mechanism of alternate splicing with the help of a suitable example. (10,5)

4. (a) Describe the salient features of a prokaryotic promoter. Compare with the promoter elements of a eukaryotic promoter.

(b) Describe how the initiation of translation takes place in eukaryotes.

(c) Write the sequence of the coding strand and non-coding strand of DNA for the following mRNA molecule :

5'AAGCUUUAACCCAUUGG3' (6,6,3)

5. Differentiate between the following :

- (a) Group I and Group II self-splicing introns
- (b) Class I and Class II aminoacyl-tRNA synthetases

P.T.O.

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②

- (c) Activator and repressor (5,5,5)
6. (a) Discuss the process of polyadenylation and capping of mRNAs in eukaryotes.
- (b) Explain the elongation phase of translation with the help of a diagram.
- (c) Explain the regulation of expression of gal genes in yeast. (6,5,4)
7. (a) What are the salient features of genetic code.
- (b) Describe the technique used to identify sequences on DNA that binds RNA polymerase.
- (c) Explain the autoregulation of ribosomal protein synthesis. (5,5,5)
8. Write short notes on the following (any 3) :
- (a) DNA binding domains
- (b) Assembly of spliceosome
- (c) Attenuation
- (d) Riboswitches (5,5,5)

(200)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4536

G

Unique Paper Code : 32497909

Name of the Paper : Microbiology (DSE)

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

Semester : V

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 7 questions.
3. Attempt any 5 questions.
4. All questions carry equal marks.
5. Question no. 1 is compulsory.

1. (a) Define the following terms :

- (i) Endospores
- (ii) Generation time
- (iii) Obligate anaerobes
- (iv) Dimorphism

P.T.O.

4536

2

(v) BOD

(b) Justify the following statements :

- (i) The bacterial cell wall has D amino acids.
- (ii) Gelatin is not preferred as a solidifying agent in culture media.
- (iii) A typical growth curve represents a closed-system culture.
- (iv) Viruses have variable genetic material.
- (v) Algae are economically important

(5,10)

2. (a) Give the contribution of the following scientists :

- (i) Elie Metchnikoff
- (ii) Edward Jenner
- (iii) Sergei Winogradsky
- (iv) Emil von Behring
- (v) Paul Ehrlich

(b) What is meant by pure culture? Does it exist in natural environment? Explain.

(c) What is the germ theory of diseases? How was it experimentally proved? (5,4,6)

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3

3. (a) Draw the following :

- (i) An enveloped Virus
- (ii) A typical algal cell
- (iii) Various bacterial morphologies

(b) Explain the principle of gram staining technique and its significance in bacterial classification. (9,6)

4. Write short notes on :

- (a) Acellular microbes
- (b) Methods of isolation of pure culture
- (c) Chemical agents of microbial control (5×3)

5. (a) Which type of medium can be used in the following situation? (Justify with example)

- (i) To revive a dormant strain of bacteria cryopreserved for a long time.
- (ii) To select an antibiotic-resistant strain of *E. coli*.
- (iii) To differentiate between pathogenic and non-pathogenic *Staphylococcus* species.
- (iv) To grow microbial flora present in tap water

P.T.O.

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4

- (b) Describe the typical phases of microbial growth curve with the help of a diagram.
- (c) Explain the principle of Disk Diffusion method for determining the level of antimicrobial activity
(6,5,4)
6. (a) Explain with the help of a well-labelled diagram the principle and working of a fermenter. Give its applications.
- (b) Give the appropriate method of sterilization (chemical/physical) of the following and justify the reason for your choice.
- (i) Inoculation loop
 - (ii) Hospital floors
 - (iii) Antibiotic solutions
 - (iv) LB agar
- (7,8)
7. (a) Explain the term Bioremediation with appropriate examples.
- (b) Define the terms pathogenic and non-pathogenic microbes. Give examples of each.
- (c) Discuss the economic importance of protozoa.
- (d) What is antibiotic resistance and how does it develop in bacterial populations? (4,4,4,3)

(200)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 4422

G

Unique Paper Code : 32497909

Name of the Paper : Microbiology (DSE)

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

Semester : V

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 7 questions.
3. Attempt **any 5** questions.
4. **All** questions carry equal marks.
5. Question no. 1 is compulsory.

P.T.O.

1. (a) Provide the terms or phrase that makes the statement correct.

- (i) _____ are the organisms that live on or within a host organism and are metabolically dependent on them.
- (ii) _____ is a mouthwash on the market today and is the testament to one of the pioneers of antiseptic technique.
- (iii) The last man who finally disapproved the spontaneous generation was _____.
- (iv) One of the first compounds used as an antiseptic for wound dressings was _____.
- (v) The first material used as microbiological solid medium for the growth of microbes was _____.

(vi) _____ are the protein hydrolysates prepared by partial proteolytic digestion of meat, casein and other protein sources.

(vii) The microbes which do not require oxygen for its growth but grow better in its presence are called _____.

(viii) _____ is the lowest concentration of a drug/antibiotic that prevents growth of a particular microbes.

(ix) _____ is an example of best-known disinfectant screening test.

(b) Justify the following statements :

- (i) Blood agar is both enriched and differential medium

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4

- (ii) Mycoplasma is not attacked by penicillin
- (iii) Iodophore is an effective disinfectant as compared to iodine (9,6)
2. (a) Briefly describe the following nutrition types with an example :
- (i) Mixotrophs
 - (ii) Photolithoautotrophs
 - (iii) Chemoheterotrophs
 - (iv) Chemolithoautotrophs
 - (v) Photoorganoheterotrophs
- (b) Discuss the contributions of following to the germ theory of diseases and their treatment and prevention :
- (i) M.J. Berkeley

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5

- (ii) Joseph Lister
 - (iii) Robert Koch
- (c) Discuss the role of serial dilution method in obtaining pure microbial culture. In an attempt to determine the microbial load in soil sample, you have plated 100 μ l of 10^6 diluted sample on an agar plate and incubated overnight at 37°C . Next day you observed 200 colonies on agar plate. Calculate the cfu/ml of the soil sample. (5 \times 3)
3. Explain with the help of suitable diagram :
- (a) Cell wall structure of gram positive and gram-negative bacteria
 - (b) Asexual spores of fungi
 - (c) An algal cell (6,6,3)

P.T.O.

4. (a) Draw a typical bacterial growth curve. Why does growth cease during stationary phase and what factors contribute to this phase?
- (b) Mention the effect of following factors on the growth of microorganism :
- (i) Temperature
 - (ii) pH
 - (iii) Oxygen concentration
- (6,9)
5. (a) Explain the mechanism of action of penicillin. Discuss with the help of a diagram any one method used to determine the susceptibility of antimicrobial agent.
- (b) What are prions? Give examples of any two diseases caused by them.

- (c) Mention the type of pathogenic microbe responsible for following diseases :

- (i) Cholera
- (ii) Malaria
- (iii) Dengue
- (iv) UTIs

- (d) Briefly explain how are viruses similar to acellular organisms? How do they differ? (7,2,2,4)

6. Differentiate between following :

- (a) Helical and icosahedral symmetry
- (b) Complex and Defined culture medium
- (c) Mechanism of action of vancomycin and tetracycline
- (d) Physical and Chemical methods of sterilization (3,3,4,5)

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8

7. (a) Microbiology revolutionized the food and beverage industry. Justify with examples.
- (b) Give the schematic diagram of a fermenter and explain its functioning.
- (c) What is BOD? How it is measured?

(7,5,3)

(200)