58957 FYBSc MICROBIOLOGY - I
Choice - Based SEMESTER I

(1)

SEM I SET 1 (3 HOURS) (100 MARKS)

N.B. (1) Attempt **all** questions. (2) Draw labeled diagrams wherever necessary.

Q I. A. Define the following terms: **(5)**

1. Pleomorphism -**Refers to cells or viruses that are variable in shape and lack a single, characteristic form.**
2. Phagocytosis – **it is a process where the protrusions from the cell surface surround and engulf particulates.**
3. **Spontaneous generation**: the origination of life from non-living material
4. Hydrophilic biomolecules Hydrophilic biomolecules
   Ans: Biomolecules which are polar and react favorably with water molecules forming hydrogen bonds with it and dissolve in it are called hydrophilic.
5) **Covalent bond:** a chemical **bond** that involves the sharing of electron pairs between atoms.

Q I B. State whether the following statement is true or false: **(5)**

1. Escherichia coli has peritrichous flagella. **True**
2. Mycoplasma have proteins in their cell wall. **False**
3. Watson and Crick suggested the double helical structure for DNA **True**
4. Smooth endoplasmic reticulum have numerous ribosomes. **False**
5. Lactose is an example of a disaccharide. **True**

Q I C. Give one example for each of the following: **(5)**

1. Endospore bearing bacterium ***Bacillus subtilis*, other *Bacillus* species, *Clostridium* species**
2. Capsulated bacterium **Bacillus anthracis, Streptococcus pneumoniae, Klebsiella pneumoniae,**
3. Gram negative coccobacillus ***E. Coli, S. typhi. Klebsiella pneumoniae***
4. Ciliated eukaryote - ***Paramecium***
5. Aromatic amino acid: phenylalanine, tyrosine, tryptophan

QI D. Select the correct alternatives and rewrite the statement. **(5)**

1. **Pili** aid in conjugation (fimbriae, flagella, pili)
2. Porins are present in the **cell wall** of bacteria (cell wall, cell membrane, nucleus)
3. The eukaryotic ribosome has a sedimentation coefficient of **80S** (30S, 70S, **80S**).
4. *Micrococcus luteus* shows cocci in **tetrads.** (chains, tetrads, clusters)
5. Polysaccharides are made up of monosaccharides held by **glycosidic** bond. (peptide, glycosidic, ester)

QII . Answer briefly any two of the following: **(20)**

1. Discuss the cell wall of Gram negative bacteria with respect to following points- Peptidoglycan structure, periplasmic space, components of LPS, function-**Prescott Harley, 8 th ed, pages 47 - 51**
2. What are plastids? With help of a diagram explain the structure and role of chloroplast in Eukaryotes **(Prescott 8th edition –page 90)**

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3. Discuss the role of water as a solvent in context to its properties.
Ans: Pg 49-53 Lehninger 4th edn

Water Forms Hydrogen Bonds with Polar Solutes– Alcohols, aldehydes, ketones, and compounds containing NOH bonds all form hydrogen bonds with water molecules and tend to be soluble in water.

Water Interacts Electrostatically with Charged Solutes– It readily dissolves most biomolecules, which are generally charged or polar compounds. Compounds that dissolve easily in water are **hydrophilic**

Nonpolar Gases Are Poorly Soluble in Water– gases CO2, O2, and N2 are nonpolar.

Nonpolar Compounds Force Energetically Unfavorable Changes in the Structure of Water— Amphipathic compounds in aqueous solution form micelles

Q III. A. Answer briefly <u>any three</u> of the following: **(18)**

1. Discuss the scope of Microbiology in the field of Industrial Microbiology.- **Elementary microbiology by Modi, pages 25-27 or Pelczar, page 31**
2. Discuss the contribution of Scientists in disproving the germ theory.**Pelczar,pages21-23**
3. Discuss with the help of suitable example the variety of cell sizes, shapes and arrangement exhibited by bacteria. **Prescott , 8TH ed, pages 34,35**
4. Write a note on bacterial glycocalyx, capsule , its components and significance. **Prescott , 8TH ed, pages 53,54**
5. Explain the Fluid Mosaic model of bacterial cell membrane and state its functions. **Prescott , 8TH ed, pages 38,39**
6. Discuss the following in bacterial cell and state their function : PHB granules, polyphosphate granules and sulfur granules. **Prescott , 8TH ed, pages 42,43**

III B. Do as directed <u>any two</u> of the following: **(2)**

1. State the target site for action of antibiotic penicillin..**cell wall formation**
2. Name one unusual amino acid present in peptidoglycan...**meso- DAP, D-alanine, D-glutamic acid**
3. Explain the term : Teichoic acid- **Polymers of glycerol or ribitol joined by phosphates; they are found in the cell walls of gram-positive bacteria.**
4. Name the Scientist who discovered nitrogen fixation..**Sergei Winogradsky.**

Q IV. A. Answer briefly <u>any three</u> of the following: **(18)**

1. Differentiate between prokaryotic and eukaryotic cell **(Prescott 8th edition –page 96-97).**
2. note on cytoskeletal elements in eukaryotes **(Prescott 8th edition –page 83-84)**
3. equipments and nature of work place would help adopt safety measures in a Microbiology Laboratory.
(IS:12035 - 1986 Indian Standard code of safety in microbiological laboratories document pg 6-7)
4. Discuss the structure and function of Golgi apparatus **(Prescott 8th edition –page 85-86).**
5. Write a short note on mitochondria **(Prescott 8th edition –page 88 -90)** .
6. Cilia and flagella move, tinsel & whiplash flagellum **(Prescott 8th edition –page 95-96)**

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Q IV B. Do as directed <u>any two</u> of the following: **(2)**

1. State one role of lysosomes in eukaryotic cell–
   They are involved in intracellular digestion and contain the enzymes needed to digest all types of macromolecules.
2. Give the significance of lipid raft in plasma membrane of eukaryotic cell.
   Lipid raft appear to participate in a variety of cellular processes like cell movement and signal transduction. They are also involved in the entry of viruses into host cell and assembly of virus.
3. Define containment.
   Containment is prevention or control of the exposure of laboratory workers, other people and the outside environment from microbes and pathogens.
4. What happens to protein structures that are misfolded in a eukaryotic cell?
   These proteins are secreted in cytosol, marked and degraded by 26S proteasome.

Q.V.A. Answer any three of the following **(18)**

1. What are triacylglycerols? Explain their biological role.

Ans: The **triacylglycerols** are the simplest lipids constructed from fatty acids, also referred to as triglycerides, fats, or neutral fats. Triacylglycerols are composed of three fatty acids each in ester linkage with a single glycerol. Those containing the same kind of fatty acid in all three positions are called simple triacylglycerols and are named after the fatty acid they contain. Simple triacylglycerols of 16:0, 18:0, and 18:1, for example, are tristearin, tripalmitin, and triolein, respectively. Most naturally occurring triacylglycerols are mixed; they contain two or more different fatty acids

Biological functions:

- Triacylglycerols Provide Stored Energy and Insulation--Triacylglycerols are also stored as oils in the seeds of many types of plants, providing energy and biosynthetic precursors during Adipocytes and germinating seeds contain **lipases,** enzymes that catalyze the hydrolysis of stored triacylglycerols, releasing fatty acids for export to sites where they are required as fuel.
- Many Foods Contain Triacylglycerols
  Pg 345-348 Lehninger 4th edn

2 . Discuss amino acids with respect to their general structure and stereoisomerism.

Ans: All the common amino acids are α-amino acids.

- They have a carboxyl group and an amino group bonded to the same carbon atom (the α carbon) .
- They differ from each other in their side chains, or **R groups,** which vary in structure, size, and electric charge, and which influence the solubility of the amino acids in water.
- The additional carbons in an R group are commonly designated β, γ, δ, ε, and so forth, proceeding out from the α carbon.
- For all the common amino acids except glycine, the α carbon is bonded to four different groups: a carboxyl group, an amino group, an R group, and a hydrogen atom.
- The α-carbon atom is thus a **chiral center.**. Because of the tetrahedral arrangement of the bonding orbitals around the α-carbon atom, the four different groups can occupy

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two unique spatial arrangements, and thus amino acids have two possible stereoisomers.

- Since they are nonsuperimposable mirror images of each other, the two forms represent a class of stereoisomers called **enantiomers**.
- All molecules with a chiral center are also **optically active**—that is, they rotate plane-polarized light. Special nomenclature has been developed to specify the **absolute configuration** of the four substituents of asymmetric carbon atoms.
- The absolute configurations of simple sugars and amino acids are specified by the **D, L system**, based on the absolute configuration of the three-carbon sugar glyceraldehyde, a convention proposed by Emil Fischer in 1891.
- For all chiral compounds, stereoisomers having a configuration related to that of L-glyceraldehyde are designated L, and stereoisomers related to D-glyceraldehyde are designated D. The functional groups of L-alanine are matched with those of Lglyceraldehyde by aligning those that can be interconverted by simple, one-step chemical reactions. Thus the carboxyl group of L-alanine occupies the same position about the chiral carbon as does the aldehyde group of L-glyceraldehyde, because an aldehyde is readily converted to a carboxyl group via a one-step oxidation. Historically, the similar *l* and *d* designations were used for levorotatory (rotating light to the left) and dextrorotatory (rotating light to the right). Another system of specifying configuration around a chiral center is the **RS system,** which is used in the systematic nomenclature of organic chemistry and describes more precisely the configuration of molecules with more than one chiral center. The amino acid residues in protein molecules are exclusively L stereoisomers. D-Amino acid residues have been found only in a few, generally small peptides, including some peptides of bacterial cell walls and certain peptide antibiotics

3. Differentiate between DNA and RNA.

Ans:

RNA	DNA
Genetic material in RNA viruses	Genetic material in most organisms
Of three types mRNA, tRNA and rRNA	No specific types
Pyrimidines are cytosine and Uracil	Pyrimidines are thymine and cytosine
Sugar is ribose	Sugar is deoxyribose
Building blocks-Ribonucleotides	Building blocks -Deoxyribonucleotides
Single stranded	Normally double stranded
Acts as a template in translation	Acts as a template in replication of DNA and transcription
Used to transfer the genetic code from the nucleus to the ribosomes to make proteins. RNA is used to transmit genetic information in some organisms	The storage and transmission of biological information are the only known functions of DNA.

4. Define carbohydrates. List different classes, aldoses and ketoses and give one example of each type.

Ans: carbohydrates are polyhydroxy aldehydes or ketones or compounds that give such compounds on hydrolysis. There are three major size classes of carbohydrates: monosaccharides, oligosaccharides, and polysaccharides.

- The Two Families of Monosaccharides are Aldoses and Ketoses. Monosaccharides with three, four, five, six, and seven carbon atoms in their backbones are called, respectively, trioses, tetroses, pentoses, hexoses, and heptoses.

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- Triose- aldotriose—glyceraldehyde, ketotriose—Dihyroxyacetone
- Tetrose-Erythrose and erythrulose
- The aldopentoses D-ribose and 2-deoxy-D-ribose are components of nucleotides and nucleic acids. Ketopentose – ribulose, xylulose
- The hexoses, aldohexose D-glucose and the ketohexose D-fructose.

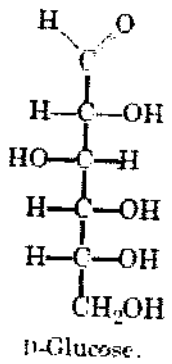
5. Justify the statement: 'Biomolecules are compounds with a variety of functional groups'
   Ans: Biomolecules can be regarded as derivatives of hydrocarbons, with hydrogen atoms replaced by a variety of functional groups to yield different families of organic compounds. Typical of these are alcohols, which have one or more hydroxyl groups; amines, with amino groups; aldehydes and ketones, with carbonyl groups; and carboxylic acids, with carboxyl groups.
   Pg 13-14 Lehninger 4th edn

6. What are peptides? How is a peptide bond formed? Diff between peptide and proteins
   Ans **Pg 85 Lehninger 4th edn**

- Peptides Are Chains of Amino Acids
- Two amino acid molecules can be covalently joined through a substituted amide linkage, termed a peptide bond, to yield a dipeptide. Such a linkage is formed by removal of the elements of water (dehydration) from the α-carboxyl group of one amino acid and the α-amino group of another. Peptide bond formation is an example of a condensation reaction,
- Three amino acids can be joined by two peptide bonds to form a tripeptide; similarly, amino acids can be linked to form tetrapeptides, pentapeptides, and so forth. When a few amino acids are joined in this fashion, the structure is called an **oligopeptide.** When many amino acids are joined, the product is called a **polypeptide.**
- Some proteins consist of a single polypeptide chain, but others, called **multisubunit** proteins, have two or more polypeptides associated noncovalently (Table 3–2). The individual olypeptide chains in a multisubunit protein may be identical or different. If at least two are identical the protein is said to be **oligomeric,** and the identical units (consisting of one or more polypeptide chains) are referred to as **protomers.** Hemoglobin, for example, has four polypeptide subunits: two identical α chains and two identical β chains, all four held together by noncovalent interactions.
- Size, functions, conformation-differences

V.B. Attempt any two **(02)**

1. Write the structure of D-Glucose



D-Glucose.

2. An amino acid when dissolved in water behaves as a zwitterion).

3. Saturated FA: acetic acid, propionic, butyric, palmitic,

4. ~10 per turn