DSE A2 Model Questions Credits:4

Unit 1:Evolution of Microbial Genomes

Very short answer type/one word answer type questions (1 mark each)

SL. No.	
1.	Which one is bigger, the core genome or the pan genome?
2.	Which bacteria generally have a bigger pangenome, a free living or a symbiont?
3.	What is generally the gene density in prokaryotes?
4.	How many genomes does *Vibrio cholerae* have?
5.	What are the different modes of horizontal gene transfer?
6.	Does E. coli show transformation?
7.	Which foreign genetic entity has persisted the most in bacterial genomes?
8.	What are the two key factors which shape the evolution of the bacterial genome?

Short answer type questions (2 marks each)

SL. No.	
1.	What is a resistosome?
2.	What is NGS?
3.	How can you ascertain a new species in case of prokaryotes?
4.	How are prokaryotes able to maintain a streamlined genome?
5.	State clearly the difference in meanings of the terms, serogroups, serotypes and biotypes.
6.	Name the serogroups which have been responsible for the cholera epidemic.
7.	Why do PAIs generally insert adjacent to tRNA genes?
8.	What is the significance of direct repeats flanking the PAIs?
9.	Why are PAIs genetically unstable?
10.	What are siderophores?

Broad answer type questions (more than 2 marks)

SL. No.	
1.	Briefly explain the mechanism behind pyrosequencing. What advantage does it have over other sequencing technologies?
2.	Why do symbionts generally have a smaller genome as compared to their free living counterparts?
3.	Differentiate between genetic drift and genetic shift.
4.	What are the salient features of a bacterial genome?
5.	How can you find out in a homogenous population of microbes that a new species has appeared?
6.	What are the unique features of a PAI?
7.	State the two key virulence factors of *V. cholerae.* Where are these located?
8.	Write a short note on Vibrio pathogenicity islands.
9.	Explain the 'Cheater hypothesis' for maintenance of virulence factor genes on horizontally transmissible elements.
10.	What do you mean by a susceptible host? Briefly discuss the key factors which govern host susceptibility to disease.

Unit 2: Metagenomics

Very short answer type/one word answer type questions (1 mark each)

SL. No.	
1.	Who coined the term "metagenome".
2.	What are the types of metagenomic approaches?
3.	What is viral metagenomics?
4.	What is metaproteomics?
5.	What is metagenomics binning?
6.	What % of microbes in the atmosphere are uncultivable or difficult to cultivate?
7.	Name a bioinformatic tool for metagenomic data analysis.

Short answer type questions (2 marks each)

SL. No.	
1.	Write few applications of metagenomic study
2.	Write the advantages of meta transcriptomics over metagenomics.
3.	Define metabolomics and community metabolomics?
4.	Why is the 16S rRNA survey not considered a metagenomic study?
5.	Which sequencing technology is used prior for metagenomic study? What technology is used currently?
6.	What information will you get after a metagenomic analysis?
7.	What is the impact of metabolomics study?
8.	What are the challenges of viral metagenomic study?
9.	What are the different scopes of metagenomics?

Broad answer type questions (more than 2 marks)

SL. No.		
1.	Define structural metagenomics and functional metagenomics.	2+2=4
2.	Draw a simple overview of a metabolomic experiment. What different types of liquid chromatography-mass spectrometry is used for different metabolites?	2+2=4
3.	Describe the application of community metabolomics in various fields. What are the major challenges of metabolomic study?	3+2=5
4.	Draw a simple viral metagenomic sequencing workflow and their promising applications.	2+2=4
5.	Write the importance of metaproteomic study. What are the challenges of metaproteomic study?	2+2=4

Unit 3: Molecular basis of host-microbe interactions

Very short answer type/one word answer type questions (1 mark each)

SL. No.	
1.	Name the molecules used for quorum sensing in Gram-negative bacteria.
2.	Give an example of a type three secretion system.

3. What type of forces are involved in surface adhesion during biofilm formation?

4. What is the function of the type three secretion system?

5. What is quorum sensing?

Short answer type questions (2 marks each)

SL. No.

1. Compare between biofilm and planktonic life of microorganism

2. Why do microorganisms form biofilms?

3. Mention the stages in the formation of biofilms.

4. What is the role of conditioning film?

5. Write a note on extracellular polymeric substances (EPS)

6. Define quorum sensing.

7. Mention different types of secretion systems in bacteria.

8. Differentiate between type II and type III secretion systems.

9. What is the function of chaperon protein involved in TTSS?

10. State four similarities between the TTSS and Flagellum.

11. Name one beneficial and one detrimental biofilm.

12. What are the differences between the secretion system in Gram Positive and Gram negative bacteria?

SL. No.

1. Write a note on the clinical importance of biofilm.

2. Comment on the tolerance of biofilms to antimicrobial agents.

3. How does the type three secretion system contribute to pathogenicity?

4. Write a note on the TAT transport system.

5. Name the different proteins involved in type three secretion systems?

6. Define biofilms and indicate why they are a concern to the food industry.

Unit 4: System &Synthetic Biology

Very short answer type/one word answer type questions (1 mark each)

SL. No.

1. Quorum sensing was first explored in the bacteria …… ……..
2. In *pseudomonus* two pairs of luxI/R homologous are present namely ……& ……..
3. QS in bacteria ……. ……. Has been found to influence filamentation
4. In gram negative bacteria autoinducers are generally …….. …….. …… molecule
5. In gram positive bacteria autoinducers are detected by …… ……. Protein
6. Two peptide signal molecules responsible for QS in *Bacillus subtilis* are ……. & ……..
7. …… & …….. are the substrates for AHL synthase
8. The ……. Of Ti plasmid is regulated by QS in *Agrobacterium Tumefecien*
9. Polio virus is a chemical. (T?F)
10. T7 RNA polymerase is used in chemical synthesis of polio viral genome (T?F)

Short answer type questions (2 marks each)

SL. No.

1. Define a) System biology b) Biological system
2. What are the components of system biology?
3. Name four multicellular behaviors of bacteria that are controlled by quorum sensing
4. What is quorum sensing?
5. Explain the LuxI/LuxR regulon mechanism in *V.Fischeri*
6. Why are quorum signals called autoinducers**?**
7. What is the function of luxI enzyme AHL synthase?
8. Name the QS systems & autoinducer molecules present in *Pseudomonas aeruginosa*
9. What is PQS? How does it mimic eukaryotic vesicular trafficking?
10. How does QS in gram positive bacteria differ from that in gram negative one?
11. Explain how competence generation in Bacillus differs from that in streptococcus?
12. Explain how QS controls self recognition in streptococcus when present in mixed culture.
13. Which autoinducer molecules are used to cross talk between different microbes?
14. How is biofilm formation controlled/regulated by quorum sensing?
15. Name the different types of bacterial networking that require cell to cell physical contact.
16. Why should we study bacterial networking?
17. What is OME? Which bacteria use OME &why?
18. In which bacteria initially CDI is observed? Which function is controlled there by using CDI?
19. What are the components of the CDI core system? Describe them
20. How bacteria use CDI for cooperative interactions?
21. What is the major difference in quorum sensing mechanism in Gram-positive and Gram-negative bacteria?
22. Discuss the major stages of biofilm development
23. Mention the chemical nature of the molecules used by bacteria for quorum sensing,
24. What is the strategy for chemical synthesis of polio virus in the laboratory?
25. How does the chemical synthesis differ from natural replication of polio virus in the host

cell?

26. Can we consider polio virus as a 'chemical'? why?

27. Can synthetic biology aid in bioterrorism?

Broad answer type questions (more than 2 marks)

1. Name the autoinducer molecules, types of QS systems & function of Qs found in i) Agrobacterium? ii) *E. Caratovora*?

2. What are the four steps of the general model of quorum sensing?

3. Explain how the AHLs are used to enhance the competitiveness between bacteria in a consortium of mixed bacteria with a suitable example

4. What is biofilm? Why do bacteria in the environment love to reside in biofilm? What are the steps of biofilm formation?

5. Discuss the scopes and achievements of synthetic biology

6. How is the cDNA of the polio viral genome synthesized? Explain with steps/diagrams.

7. Write short note on biological networking

8. Describe the steps involved in chemical synthesis of polio virus with a clear diagram

9. Explain how two layers of recognition occur through OME.