Name:

Enrolment No:

UPES

End Semester Examination, December 2023

Course: Environmental Microbiology and Microbial Ecology **Semester : V**

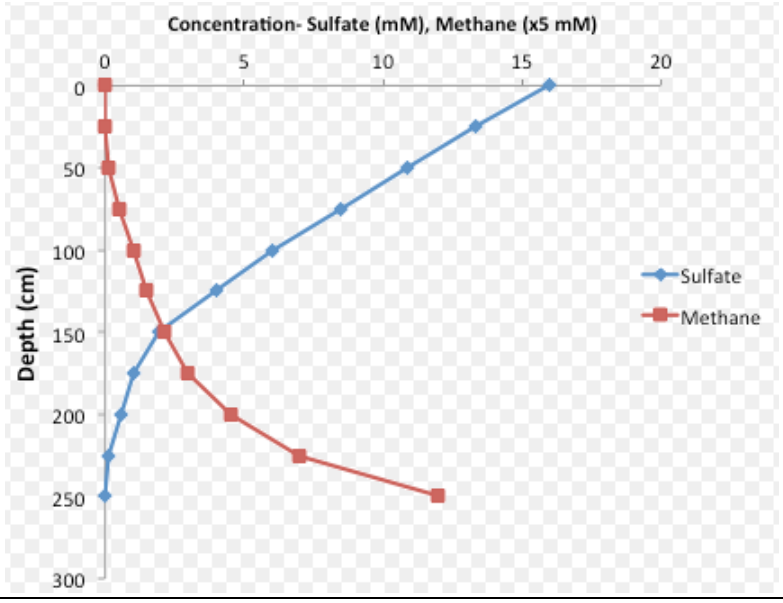
Program: Integrated BSc-MSc Microbiology **Duration: 3 Hours**

Course Code: HSMB 3016 **Max. Marks: 100**

Instructions:

1. Read all questions carefully and answer them all.
2. **Answer all Section A questions to the point in one or two sentences ONLY.**
3. Use scientific calculators for solving numericals.
4. Draw labelled diagrams wherever necessary for sections B, C and D.
5. Do not scribble on question paper.

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	Define Meromictic lakes.	1.5	CO1
Q 2	Name a sampler for collecting water samples discretely from different depths in a water body.	1.5	CO3
Q 3	State the concept of 'Viral shunt' in tropical oligotrophic oceans.	1.5	CO2
Q 4	Comment how pH affect Carbon concentrating mechanisms in cyanobacteria.	1.5	CO2
Q 5	Define Thermokarst lakes.	1.5	CO1
Q 6	Give an example of how microbes may play a role in climate engineering.	1.5	CO3
Q 7	State what are diatoms.	1.5	CO1
Q 8	Define Mixed layer Depth.	1.5	CO1
Q 9	Give an example of C1 carriers during Methanogenesis.	1.5	CO2
Q 10	State importance of water channels for bacteria forming biofilms.	1.5	CO2
Q 11	Comment on microflora you expect from endorheic lakes of Himalayas?	1.5	CO1
Q 12	Comment on electrogenic bacteria. Give an example.	1.5	CO2
Q 13	State a difference between Plankton and Benthos.	1.5	CO2
Q 14	Comment on "aerobic anoxygenic phototrophs".	1.5	CO2
Q 15	Give an example of "square shaped" cells of Haloarchaea.	1.5	CO2
Q 16	Name the signature pigment for identifying cyanobacteria using HPLC?	1.5	CO3
Q 17	Give example of a hyperthermophile that enjoys autoclave temperature?	1.5	CO2
Q 18	Mention how redox potential changes from oxic to anoxic conditions.	1.5	CO1

Q 19	Identify Sulphate-Methane transition zone in below diagram: 	**1.5**	**CO2**
Q 20	Identify a preferred reductant during microbial Fe/Mn reduction: a. Glucose b. Maltose c. Lactose d. Lactate	**1.5**	**CO2**
	Section B **(4Qx5M=20 Marks)**		
Q 1	Describe microbial transformations of sulphur in soils and sediments that controls sulphur cycling in nature?	**5**	**CO2**
Q 2	Explain 'biological carbon pump' with a diagram and comment on its relevance for climate change.	**5**	**CO2**
Q 3	a. Define thermohaline circulation? (2) b. Discuss the plausible effects of melting arctic ice on thermohaline circulation, in turn, on global climate? (3)	**5**	**CO1**
Q 4	Explain the concept of energy flow in ecosystems through 'Microbial loop'.	**5**	**CO2**

Section C (2Qx15M=30 Marks)			
Q 1	 Assume, above is an image of DAPI stained microrganisms observed under 100X from 100 ml of a lake water filtered on 25 mm diameter black nuclepore filters placed on a glass slide. Image size is 50 µm x 50 µm. a. Explain the principle behind DAPI staining and the type of microscopy needed for enumeration of DAPI stained cells. (5) b. Count and calculate cell concentration from above image. (8) c. Suggest a staining method using same microscope by which you can differentiate different phylogentic groups of microrganisms from environmental samples using above microscopy technique (2).	**15**	**CO3**
Q 2	 a. Identify and name the organism. (1) b. Describe characteristic features of the ecosystem where they thrive. (6) c. Explain microbial interactions that sustains this ecosystem. (8)	**15**	**CO2**

Section D (2Qx10M=20 Marks)			
Q 1	In 2016, an outbreak of anthrax wiped out population of thousands of reindeer among nomadic communities and infecting hundreds of humans. This occurred on the Yamal peninsula, Northwest Siberia, Russia.  a. Discuss what may have caused this outbreak? (2) b. Design an experiment to study microbiology of deglaciated landscapes from Himalayan regions to predict how climate change can affect Human Health. (08)	**10**	**CO3**
Q 2	a. Define Quorum sensing? (2) b. Explain the mechanism of Quorum sensing with a diagram and how this microbial interaction serves for survival of Bobtail Squids.(8)	**10**	**CO2**