Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

Course: Microbial Analysis of Air and Water — **Semester : VI**

Program: B.Sc. Microbiology — **Duration : 3 Hours**

Course Code: HSMB3007P — **Max. Marks: 100**

Instructions: Read all questions carefully.

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	_____ is most effective against bacterial endospores in air systems: A) HEPA filtration B) UV-C exposure C) Dry heat D) Incineration	**1.5**	**CO1**
Q 2	HEPA filters can capture particles: A) ≥1 µm B) ≥0.3 µm C) ≤5 µm D) Only visible particles	**1.5**	**CO1**
Q 3	_____ is *not* a consequence of microbial bioaerosols in pharma industries: A) Product contamination B) Reduced production yield C) Cross-contamination of raw materials D) Increased product shelf life	**1.5**	**CO2**
Q 4	The presumptive coliform test typically involves: A) Nutrient agar and streak plating B) Lactose broth and Durham tubes C) Tryptic soy broth with pH indicator D) Blood agar with bile salts	**1.5**	**CO1**
Q 5	In CFU calculation from air samples, the key assumption is: A) Each organism divides into three B) Each CFU arises from a single viable cell	**1.5**	**CO1**

	C) Only anaerobic organisms grow D) Air temperature must be above 37°C		
Q 6	Presence of gas in the Durham tube during MPN test indicates: A) Anaerobic contamination B) Thermophilic organisms C) Coliform fermentation D) Absence of bacteria	**1.5**	**CO1**
Q 7	The confirmed test in water analysis typically uses: A) EMB agar B) MacConkey broth C) Mueller-Hinton agar D) Nutrient agar	**1.5**	**CO1**
Q 8	A high CFU count in a clean room sample indicates: A) Good air circulation B) Adequate disinfection C) Overgrowth by fast-growing species D) Microbial contamination beyond acceptable limits	**1.5**	**CO1**
Q 9	The inactivation mechanism of UV-C light primarily targets: A) Cell wall B) Cytoplasmic membrane C) DNA/RNA D) Mitochondria	**1.5**	**CO1**
Q 10	The presence of fungal spores in bioaerosols is most dangerous for: A) Dairy industry B) Immunocompromised hospital patients C) Textile workers D) Water purification staff	**1.5**	**CO2**
Q 11	Bioaerosols can include endotoxins and mycotoxins in addition to microorganisms. (True/False)	**1.5**	**CO1**
Q 12	Gram-negative bacteria are more resistant to desiccation than Gram-positive bacteria. (True/False)	**1.5**	**CO1**
Q 13	The MPN test is based on statistical probability of coliform presence. (True/False)	**1.5**	**CO2**
Q 14	UV disinfection is equally effective in all types of microorganisms. (True/False)	**1.5**	**CO1**
Q 15	Bioaerosols can trigger occupational asthma in workers exposed to organic dust. (True/False)	**1.5**	**CO1**
Q 16	Sampling air with passive sedimentation is more accurate than active air sampling. (True/False)	**1.5**	**CO2**

Q 17	Membrane filtration allows for direct enumeration of coliform colonies. (True/False)	**1.5**	**CO2**
Q 18	Boiling water ensures complete removal of all microbial pathogens. (True/False)	**1.5**	**CO1**
Q 19	Bioaerosol sampling is not required in pharmaceutical cleanrooms. (True/False)	**1.5**	**CO1**
Q 20	Water analysis for fecal coliforms is only needed for non-potable water. (True/False)	**1.5**	**CO2**
Section B **(4Qx5M=20 Marks)**			
Q 21	Explain the air sampling results expressed in CFU/m^3, and apply the concept of CFU calculation to describe how plate counts are converted into air concentrations.	**5**	**CO3**
Q 22	Compare chemical disinfection and UV sterilization in terms of mode of action, effectiveness, and application constraints.	**5**	**CO2**
Q 23	Explain one method used to collect air samples for microbial analysis.	**5**	**CO2**
Q 24	Explain the difference between the presumptive and confirmed tests in the MPN method for water analysis.	**5**	**CO1**
Section C **(2Qx15M=30 Marks)**			
Q 25	**Case study:** Villagers using untreated groundwater report gastrointestinal symptoms. Water testing revealed coliforms and high turbidity. **Questions:** a) Identify and explain which microbial tests you would apply to confirm fecal contamination in a water sample. b) Analyze the relationship between turbidity levels and the survival of waterborne pathogens. c) Propose and justify a practical water treatment method suitable for areas affected by contamination and high turbidity.	**5+5+5**	**CO3**
Q 26	**Case study:** Routine swabbing shows increased CFUs near vents in an OT. Surgeries are being postponed. **Questions:** a) Identify the most likely source of microbial contamination in the given scenario.	**5+5+5**	**CO3**

	b) Describe how microbial air quality can be quantitatively assessed using appropriate sampling techniques. c) Propose immediate control methods to manage and reduce microbial contamination in the environment.		
Section D **(2Qx10M=20 Marks)**			
Q 27	Discuss the mechanisms of microbial inactivation by UV radiation, HEPA filtration, desiccation, and incineration.	**10**	**CO2**
Q 28	Describe the sources and types of bioaerosols and analyze their health impacts in hospitals, pharmaceutical units, and food industries.	**10**	**CO1**