Name: **Enrolment No:**	

UPES
End Semester Examination, December 2024

Course: Water Supply, Refugee Health & Sanitation in Emergency **Semester: :7**
Program: B.Tech Fire and Safety Engineering **Time : 03 hrs.**
Course Code: HSFS 4026 **Max. Marks : 100**

SECTION A
(5Qx4M=20Marks)

S. No.	Question	Marks	CO
Q1	Mention the agencies responsible for early warning for the following natural hazards a) Avalanches b) Tsunami c) Storms d) Landslides	**4**	**CO1**
Q2	Draw a typical rapid sand filter depicting its parts and mentioning the depth and size of its various layers.	**4**	**CO1**
Q3	a) Which among these are unit operations (Osmosis, Flocculation, Filtration) b) _____ comes under secondary treatment in waste-water treatment plants c) The law which relates disinfection rate with temperature is___ d) Example of a person who is considered under the vulnerable group count is _____	**4**	**CO1**
Q4	A slow sand filter is a preferred choice in emergencies. Justify this statement.	**4**	**CO2**
Q5	Water from a well is highly turbid and the turbidity is not reducing even after the water is made to remain undisturbed in a bucket for 24 hours. How do you suggest it can be treated?	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q6	Derive the linearised expression for the combined effect of concentration and contact time on disinfection action.	**10**	**CO3**
Q7	The primary source of water for a small village has been severely damaged due to a recent cyclone, an emergency water supply has been set up using water from a nearly stream. The stream water is mostly	**10**	**CO2**

<table>
<tr><td></td><td>contaminated with organic matter. Considering that chlorination is used as a method of disinfection, describe the shape that the added chlorine versus the residual curve would take to achieve breakpoint chlorination with explanations for the same.</td><td></td><td></td></tr>
<tr><td>Q8</td><td>Who are migrants, refugees and internally displaced persons? Write notes about the laws in place to safeguard their rights.</td><td>10</td><td>CO1</td></tr>
<tr><td>Q9</td><td>How many liters of HTH has to be mixed in water to obtain 30 liters of 5% stock solution? How many grams of chlorine is present in this mixture?
OR
Estimate the volume of chlorine disinfectant solution required per day if a dosage of 1.2 mg/L is to be applied to disinfect the water. The flow rate of water is 400 m^3/hr. The available chlorine in the disinfectant is 60%. The strength of the solution is 3%.</td><td>10</td><td>CO4</td></tr>
<tr><td colspan="4">SECTION-C
(2Qx20M=40 Marks)</td></tr>
<tr><td>Q10</td><td>It is desired to design a bromide chloride contact tank to be used to disinfect a secondary-treated sewage discharge. To determine the dosage required an experiment was conducted, at 15 °C, producing the following results:
<table><tr><th>Dosage of BrCl (mg/L)</th><th>Time to 99% inactivation (min)</th></tr><tr><td>5</td><td>85</td></tr><tr><td>20</td><td>30</td></tr><tr><td>50</td><td>15</td></tr><tr><td>75</td><td>10</td></tr></table>Determine the concentration required to achieve 99% removal if a contact time of 30 minutes is employed in the tank. What contact time would be required to achieve the same degree of
removal at 25 °C? The activation energy is 52 KJ/mol.</td><td>20</td><td>CO3</td></tr>
<tr><td>Q11</td><td>As the emergency manager for water and sanitation in a flood-affected urban area, you are tasked with setting up clean water supplies for an evacuation center with a population of 200 people, including infants, pregnant women, and immunocompromised individuals. The center is located in a low-lying area with high humidity and daily temperatures ranging from 20-26°C. Considering the potential for water contamination due to floodwater, develop a comprehensive plan to ensure safe drinking water for the evacuees. Your strategy should include:
1. Selection and protection of a suitable water source</td><td>20</td><td>CO4</td></tr>
</table>

	2. Minimum required treatment processes to address flood-related contaminants 3. Disinfection methods appropriate for the environmental conditions 4. Safe disposal solutions for sewage and waste to prevent further contamination risks State any assumptions you make and use diagrams to illustrate your plan where applicable. **OR** Create an incident response plan for restoring safe drinking water and sanitation services after a major earthquake in a densely populated area of India. The earthquake has disrupted water pipelines, contaminated water storage facilities, and compromised sanitation systems, posing a risk of disease outbreaks. Develop a flow chart illustrating the roles and responsibilities of all involved agencies, such as disaster management teams, public health officials, water supply engineers, and sanitation experts. Define hypothetical zones for prioritizing response efforts and outline actions to ensure safe water distribution, temporary sanitation facilities, and hygiene promotion to protect public health.		