UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Water Supply, Refugee Health and Sanitation in Emergency Semester   : III
Program: M. Tech. HSE-DM   Duration   : 03 hrs. Course
Code: HSFS 8010   Max. Marks: 100

SECTION A
(Scan and upload)   (5Qx 4M = 20 Marks)

		Marks	COs
Q 1	A slow sand filter is a preferred choice in emergencies. Justify this statement.	4	CO2
Q 2	Write short notes on key health indicators.	4	CO1
Q 3	Mention the agencies responsible for early warning for the following natural hazards a) Floods b) Tsunami c) Cyclones d) Landslides	4	CO1
Q 4	Who are the partners in a humanitarian response, mention one example of each?	4	CO1
Q 5	With the help of a diagram, explain how pH affects the process of disinfection by chlorine.	4	CO1

SECTION B
(Scan and upload)   (4Qx10M = 40 Marks)

		Marks	COs
Q 6	Explain the factors which affect disinfection.	10	CO1
Q 7	Design a hygiene promotion strategy to be implemented for a small village affected by cholera.	10	CO3
Q 8	A population who has experienced a disaster (natural or manmade) is affected in multiple ways. Justify this statement. Elaborate on the various challenges faced by the support staff in helping the affected population return to normalcy.	10	CO2
Q 9	Differentiate between migrants, internally displaced persons and refugees. Write short notes on the guidelines for internally displaced persons. OR Differentiate between IHL and HRL. Write short notes on the world's worst humanitarian crisis.	10	CO2

	SECTION-C		
	(Scan and upload)	**(2Qx 20M= 40 Marks)**	
Q 10	You are in charge of water supply and sanitation for a small emergency settlement for a population of 100 people constituting all age groups as well as disabled persons. Assuming the settlement is near a lush green forest with daily average temperatures ranging from 27-33 degree C, how would you ensure that the people of the camp receive safe drinking water? Design your strategy as per the following 1) Location of water source 2) Minimum treatment requirements 3) Disinfection strategies 4) Sewage and excreta disposal You are free to make assumptions and make diagrams wherever necessary.	**20**	**CO3**
Q 11	a) Derive the linearised expression for the combined effect of concentration and contact time on disinfection action. **(10 M)** b) Estimate the volume of chlorine disinfectant solution required per day if a dosage of 1mg/l is to be applied to disinfect the water. The flow rate of water is 300 m^3/hr. The available chlorine in the disinfectant is 65%. The strength of the solution is 2%. **(10 M)** **OR** a) A calcium hypochlorite contact tank is to be designed to disinfect a secondary-treated sewage discharge. To determine the dosage required an experiment was conducted, at 15 °C, producing the following results: **(12M)**	**20**	**CO4**

Dosage of $Ca(OCl)_2$ (mg/L)	Time to 98% inactivation (min)
7	87
22	32
52	17
77	12

Determine the concentration required to achieve 98% removal if a contact time of 25 minutes is employed in the tank? At what temperature would the same degree of removal be achieved if the contact time of 16 min was maintained? The activation energy is 32.5 KJ/mol.

b) Explain with the help of a diagram how free and combined residual chlorine is formed as the concentration of chlorine is increased in a water sample containing reducing compounds and ammonia as impurities. **(8 M)**