TEST 1   **1 HOUR**

ANSWER ALL QUESTIONS

PART A

1.   Define the term *heterotrophy bacteria* and *autotrophic bacteria*. What are the bacterial reactions in carbonaceous and nitrification oxygen demand?

(5 marks)

2.   Explain two (2) differences between BOD and COD.

(2 marks)

3.   Based on the Environment Quality (Sewage) Regulation 2009 (Regulation 7), state the permitted discharge values for BOD at 20°C (in mg/L) that been discharged into river (i), (ii), (iii) and (iv) by a sewage treatment plant (STP).
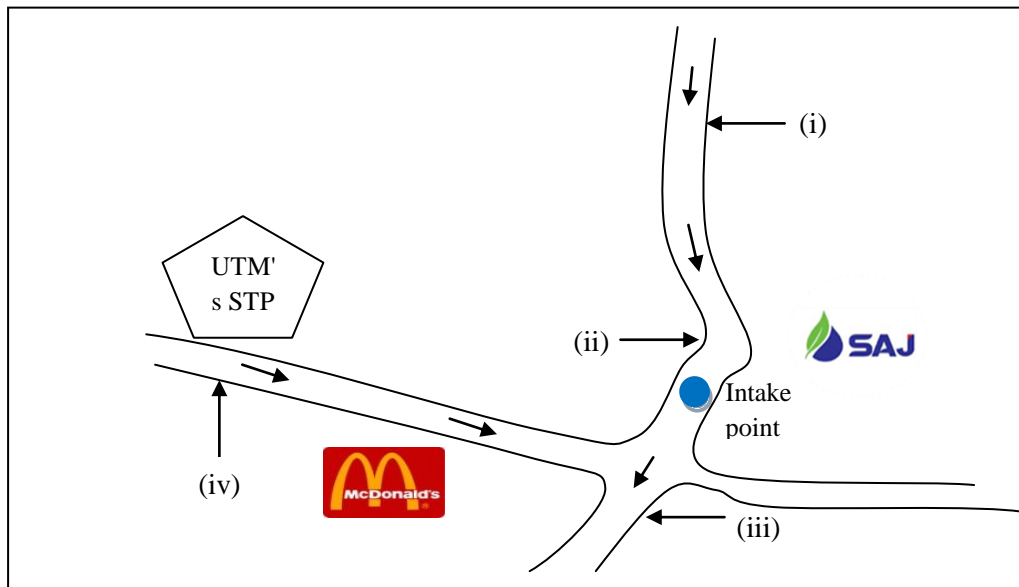
(2 marks)

4.   What are the differences between separate sewer system and combined sewer system. In your point of view, which sewer system is better.

(3 marks)

PART B

1. A COD was carried out on Sample X and Sample Y. Table 1.0 summarizes the information of the test:

Table 1.0: COD Test Results

	Sample X	Sample Y
Volume of sample	20 mL	20 mL
Sample dilution	2 times	20 times
Normality of Fe2+ standard solution	0.25 N	0.25 N
Titration volume of Fe2+ standard solution for sample	14.35 mL	14.70 mL
Titration volume of Fe2+ standard solution for blank	20.35 mL	26.54 mL

   (i)   Calculate the COD values of Sample X and Sample Y
   (ii)   Determine the actual volume of undiluted Sample X and Sample Y
   (iii)   If Sample X is from domestic wastewater, assume the BOD value for Sample X. Assume K_{20} for Sample X is 0.085 per day, find the ultimate BOD and $_{30}BOD_3$ for Sample X

(11 marks)

2. A new residential area is to be developed with a total area of about 50 ha. The following premises are identified to be constructed in this area. Calculate the average daily flow and the peak flow rate of the sewage from the residential area.

Premises	Unit/Area	Others
Residential house	3200 units	900 unit semi-detached houses, 2300 unit terrace houses
Pulai Hijauan Shopping Mall	1 unit (2.5 ha.)	Pulai Hijauan Shopping Mall has 300 shop lots
Pulai Hijauan School	2 units (2 ha.)	(i) Pulai Hijauan primary school has 1000 students (ii) Pulai Hijauan secondary school has 1500 students
Pulai Hijauan Mosque	1 unit	40 % of residential population
Self-service laundry centre	1 unit	10 machines
Wet market	1 unit	13 stalls

(7 marks)

Table 1.0: Population Equivalent Values for Design Premises

Type of Establishment/Premise	Population Equivalent (PE)
Residential	5 per house
Commercial	3 per 100m² area
Educational Institutions	
- Day Schools	0.2 per student
- Residential Schools	1 per student (residential)
Market (Wet Type)	3 per stall
Market (Dry Type)	1 per stall
Mosque	0.5 per person
Laundry	10 per machine

$$L_o = \frac{BOD_t}{(1 - 10^{-Kt})}$$

$$L_o = \frac{BOD_t}{(1 - e^{-kt})}$$

$$BOD_t = \frac{DO_0 - DO_t}{P}$$

$$k_T = k_{20} \ x \ 1.047^{(T-20)}$$

$$PFF = 4.7 \ (p)^{-0.11}$$