FACULTY OF CIVIL ENGINEERING, UTM
SKAA 2922 WASTEWATER ENGINEERING
SEM 2015/2016-1

TEST 1 **1 HOUR**

ANSWER ALL QUESTIONS

PART A

1. A group of people in your village propose to discharge untreated domestic wastewater into a nearby river. As a wastewater engineer, describe how you would act upon this proposal.

(3 marks)

2. Discuss two (2) differences between BOD and COD. Why COD value is greater than BOD value for the same wastewater sample?

(5 marks)

3. Under the Environment Quality (Sewage) Regulation 2009 (Regulation 7), state the permitted discharge values for BOD at 20°C (in mg/L), discharge into nearby river by a sewage treatment plant (STP) built in 2015, if:
   (i) the STP is located upstream of the water treatment plant, and
   (ii) the STP is located downstream of the water treatment plant
   (iii) if the STP was built in 2001, would it comply with the same standard as (i) and (ii)? (Yes/No)
   (iv) assume a typical BOD concentration (in mg/L) of untreated sewage entering STP

(2 marks)

PART B

1. Solids analysis was performed on a municipal wastewater. 100 mL well-mixed sample is filtered through a standard glass fiber filter.

   (i) The filter is placed in a crucible, and the residue retained on the filter is dried in an oven for one hour at 103-105^{o}C. The weight of dried residue is 0.068 g
   (ii) The filtrate is placed in a dish and evaporated in an oven at 103-105^{o}C for one hour. The weight of dried residue is 0.028 g
   (iii) The dried residue from (i) is ignited to constant weight at 550^{o}C. The weight of remaining solids is 0.042 g

   Determine the total suspended solids, total dissolved solids, total solids, volatile suspended solids and fixed suspended solids in mg/L.

(5 marks)

2. A BOD_5 test was conducted on a raw sewage in duplicate at 20°C. The dissolved oxygen (DO) readings were as follows:

Bottle No.	DO initial, mg/L	DO_5, mg/L	Sample volume, mL
1	7.6	1.9	9
2	7.2	0.7	50

(i) Comment the BOD results of Bottle 1 and 2

(ii) Find the ultimate BOD if the BOD rate constant at 20°C is 0.12 day^{-1}

(iii) Calculate BOD_3 at 30°C of the sample

(iv) Estimate the COD of the sample

(8 marks)

3. A small size development is to be conducted in an area of about 40 ha. The following premises are identified to be constructed in that area. Calculate the average flow and peak flow of sewage generated.

Premise	**Unit/Area**	**Others**
Residential House	2300 units	800 unit semi-detached houses, 1000 unit terrace houses and 500 unit flats.
Palma Perdana School	2 units (2 ha.)	(i) Palma Perdana primary school has 1200 students (ii) Palma Perdana secondary school has 1000 students
Palma Perdana Mosque	1 unit	40 % of residential population
Commercial centre	1 unit (1.5 ha.)	A Palma Megamall megastore has 200 shop lots
Wet market	1 unit	10 stalls
Dry market	1 unit	4 stalls
Private Hospital	1 unit	Palma Perdana Hospital has 200 beds and 100 staffs

(7 marks)

$$L_o = \frac{BOD_t}{(1-10^{-Kt})} \qquad L_o = \frac{BOD_t}{(1-e^{-kt})} \qquad BOD_t = \frac{DO_0 - DO_t}{P} \qquad k_T = k_{20}\ x\ 1.047^{(T-20)} \qquad \text{PFF} = 4.7\ (p)^{-0.11}$$

Table 1.0 Population Equivalent Design Value for Premises

Type of Premise	Population Equivalent (PE)
Residential	5 per house
Commercial	3 per 100m^2 area
Educational Institutions - Day Schools - Residential Schools	 0.2 per student 1 per student (residential)
Hospitals	4 per bed
Market (Wet Type)	3 per stall
Market (Dry Type)	1 per stall
Mosque	0.5 per person