KATHMANDU UNIVERSITY
End-Semester Examination
March/April, 2017

Marks Scored:

Level : B. Tech.
Year : IV

Course : ENVE 432
Semester: I

Exam Roll No. :

Time : 30 mins.

F.M. : 20

Registration No. :

Date : MAR 30 2017

SECTION "A"
[20 Q × 0.5=10 marks]

Circle the best answer (s). Make logical assumptions for any missing data or information.

(1) In a typical wastewater treatment plant, removal of suspended solids by settling is referred to:
(a) preliminary treatment (b) secondary treatment
(c) primary treatment (d) tertiary treatment

(2) The treatment process which transforms (or oxidizes) dissolved and particulate bio-degradable constituents into acceptable end products is termed as:
(a) physical treatment (b) biological treatment
(c) chemical treatment (d) physico-chemical treatment

(3) In an anoxic process nitrate nitrogen is converted biologically to nitrogen gas in the absence of oxygen. This process is also known as:
(a) nitrification (b) denitrification
(c) ammonification (d) mineralization

(4) The solids that get evaporated after total solids (TS) are ignited at 500±50°C is termed as:
(a) Total volatile solids (TVS) (b) Total fixed solids (TFS)
(c) Total suspended solids (TSS) (d) Total dissolved solids (TDS)

(5) The autotrophic nitrifies have lower growth rate than the ..... responsible for the removal of carbonaceous BOD.
(a) bio-P micro-organisms (b) heterotrophic bacteria
(c) autotrophic bacteria (d) denitrifying bacteria

(6) Enhanced phosphorus removal process requires which of the following sequence?
(a) aerobic stage - anaerobic stage (b) anaerobic stage - aerobic stage
(c) anaerobic stage - anoxic stage (d) anoxic stage - anaerobic stage

(7) If the wasting of the sludge is done from the aeration tank in operating an activated sludge system, the concentration of the biomass in the waste line is generally represented as:
(a) $X_e$ (b) $X_R$ (c) X (d) $X_o$

(8) Charge neutralization and bridging are thought to be two important mechanisms in:
(a) filtration (b) coagulation (c) sedimentation (d) floatation

(9) Type III (Discrete settling or free settling) settling phenomena refers to:
(a) process where particles flocculate or coalesce
(b) process where particles settle as individual entities
(c) process where the mass of particles settle as a unit
(d) process where the particles form a structure and settling is done with compression

(10) The following statements: to provide safe water, to provide aesthetically pleasing water and to ensure that the technology applied does not create further problems refer to:
(a) water treatment technologies (b) water treatment goals
(c) water treatment challenges (d) water treatment processes

(11) Natual Organic Matter (NOM) is considered as a key parameter in water treatment because ( tick all possible answers)
(a) NOM chelates with aluminium and iron salts used for flocculation and controls the coagulant dose
(b) NOM reacts with the chlorine and other disinfectants and controls the level of dosing required to achieve desired residual
(c) NOM is the precursor material for the generation of DBPs.
(d) NOM decreases the bacteria re-growth potential in the finished water.

(12) Acetic acids, propionic acid and butyric acids are required for triggering the biochemical pathways involved in phosphorus release and uptake mechanisms. These carbon compounds are called as :
(a) Long-chain Volatile Fatty Acids (LCVFAs)
(b) Short-chain Volatile Fatty Acids (SCVFAs)
(c) Natural Organic Matter (NOM)
(d) Disinfection by-products (DBPs)

(13) A wastewater sludge has a solids concentration of 100,000 mg/L. This concentration in percentage will be equal to (assuming the density of solids to be 1000 kg/m$^3$):
(a) 1 % (b) 10 % (c) 0.1 % (d) 0.01 %

(14) The ratio of $BOD_5$ to COD in a municipal wastewater is generally:
(a) In between 0.1 to 0.5 (b) in between 0.5 to 0.9
(c) greater than 1 (d) lower than 0.1

(15) The groundwater production well fields in Kathmandu Valley established by the water supply authority (previously Nepal Water Supply Corporation, NWSC) are located in which of the following aquifer?
(a) Southern (b) Central
(c) Northern (d) Northern and Central

(16) Which policy has been used by the authorities in using the water sources to meet the drinking water supply demand in Kathmnadu Valley?
(a) Surface water from nearby sources
(b) Groundwater from the well fields
(c) Reuse and recycle of wastewater
(d) Conjunctive use of surface and ground sources

(17) The origin of unusual concentration of ammonia, dissolved organic carbon, iron and manganese in the groundwater in Kathmandu Valley is probably due to (tick all possible answers):
(a) microbial disintegration of sediment organic matter
(b) simultaneous reduction of some chemical species
(c) aerobic decomposition of dissolved organic matter
(d) action of the autotrophic bacteria in the deep aquifer

(18) Inter-grannular pore surface flocculation occurs at:
(a) Slow sand filter
(b) Rapid sand filter
(c) Sedimentation tank
(d) Coagulation unit

(19) A Jar Test is carried out to find the :
(a) Turbidity of the raw drinking water
(b) Dose of the coagulants
(c) Dose of the disinfectants
(d) Concentrations of the microogranisms

(20) Natural Organic Matter (NOM) in raw water can be estimated by measuring
(a) Conductivity
(b) Dissolved Organic Carbon (DOC)
(c) Turbidity
(d) DBPs

## SECTION "B"

(10 Q.×0.5=5 marks)

Fill in the blank (s). Make logical assumptions for any missing data or information.

1. The concentration of disssolved solids in a river water is 825 mg/L and this value can also be reported as 825 ppm. The underlying assumption in the foregoing statement is .....

2. The aggregation of colloidal particles can be considered involving two separate and distinct steps. (i) Particle transport to effect interparticle collision and (ii) Particle destabilization to permit attachment when contact occurs. Transport step is known as ..... whereas..... is the overall process involving destabilization and transport.

3. In a continuous culture without recycle, the micro-organism balance in a reactor yields the following equation.

$\frac{1}{T} = \mu - k_d$ where, T is hydraulic retention time, $\mu$ is growth rate constant and $k_d$ is endogenous decay co-efficient.

The significance of the above equation is .....

4. Two major differences between a slow sand filter and rapid sand filter are:

   (i) .....

   (ii) .....

5. Bonnybrook WWTP currently treats a flow of 420,000 $m^3$/day generated from a catchment area population of 800,000. The per capita wastewater generation based on these figures and in Liter per day is .....

6. Retrofitting of secondary wastewater treatment process in Bonybrook WWTP refers to: .....

7. The particles settling with velocities ..... than terminal velocity (or the overflow rate) will not be removed during the sedimentation process.

8. The ratio of mass of substrate (BOD) entering the aeration tank per unit time and mass of microorganisms in the aeration tank is called .....

9. In the provision of safe drinking water, the main issues of concern include :

   (a) .....

   (b) .....

   (c) .....

10. Groundwater pollution in Kathmandu Valley is probably due to:

    (a) .....

    (b) .....

## SECTION "C"

(10 Q.×0.5=5 marks)

Define in a single sentence. Make logical assumptions for any missing data or information.

11. Tertiary (or advance) treatment

12. BNR Process

13. Charge neutralization

14. Anoxic process

15. NOM

16. Substrate utilization rate

17. THM Formation Potential

18. Sediment organic carbon

19. Overflow rate

20. Sequence of reduction in deep aquifer