OCT ACADEMY
A U.S. Government Education Contractor
Class Description submittal to OESAC

Title: **Collection System Mathematics Grades 1-2**

☐ New Class   or   ☑ Class Renewal
☑ Classroom   or   ☑ Distance Education

CEU Award requested: **1.4 CEUs**

OVERVIEW:

This is a two (2) – day Grade 1 – 2 Collection Operator math class. The mathematics compiled within the supporting **COL – 98** classroom workbook for collection system operators has been arranged according to process unit. Word problems are presented together with multiple choice answers. Solutions are provided in **Step-By-Step format** with a summary of working formulas, unit process problems with written solutions, and chapter quizzes with solutions.

CLASS DESCRIPTION:

Session attendees learn that they need five (5) **Learning Objectives** basic tools before they begin to solve typical system, or examination math problems at their candidate grade level. These tools are, as follows:

1. A written format for the successful solution of all wastewater math problems: the **Step-by-Step Method**.

2. How to properly use a basic scientific calculator.

3. A knowledge of conversions, units and simple diagramming.

4. A summary and knowledge of **process working formulas** broken down by unit process.

5. An understanding of algebraic concepts.

6. Use of Grade I –II math Pie Wheels; algebraic formulas in graphic form.

From the very beginning, instructors place great emphasis on the need for each operator/student to learn the basic Process Unit Formulas, and then write out their individual solutions in a Step-by-Step manner to focus their solution work. Operators are encouraged to avoid trying to do all the solution work in their head.

OUTLINE:

An Outline of the chapter topics appears below. The manual contains far more material than can be covered during the one (1) day workshop, so it also serves as a self-study manual for further study.

1.   The Step-By-Step Method
2.   Using Your Scientific Calculator
3.   Summary of the Key Formulas
4.   Conversions and Diagramming
5.   General Volume Problems
6.   Population Equivalent.
7.   Mass Pounds Problems.
8.   Chlorine Dosage, demand and residual
9.   Solutions & Solution Percentages - Beginning level
10.   Velocity – Grit Channels
11.   Hydraulics
12.   Pumps
13.   Slope and Grade / Rise over Run

TIME PRESENTATION OUTLINE:

DETAILED SUPPORTING DESCRIPTION:

1.   **The Step-By-Step Method**

        The following is the Step-By-Step Method taught at OCT, Inc. workshops.

        Step 1.   Write Down The Formula That Applies.
        Step 2.   Rewrite the Formula With the Known's Given in the Problem.
        Step 3.   Complete all Conversions.
        Step 4.   Reduce Terms.
        Step 5.   Solve For The Answer (using correct units).

2.   **Use of a scientific calculator. TI – 30 xa**

        Instruction in the use of a standard scientific
        calculator is presented.

3.   **Summary of the Key Formulas:**

      Examples:

1.	**Lbs/Day**	**=**	**(Volume, MGD) x (Conc., mg/L) x (8.34 lbs/gal)**

2.   **Dosage, mg/L   = $\dfrac{(\text{Feed, lbs/day})}{(\text{Volume, MGD}) \times (8.34\ \text{lbs/gal})}$**

3.   **Rectangular Tank   =   (Length, ft) x (Width, ft) x (Height, ft)**
     Volume, cu. ft.

     i)   Volume, Gals   =   Multiply the above by the factor 7.48
         gals/ cu. ft.

4.   **Right Cylinder   =   (0.785) x (D^2,ft) x (Height or Depth,ft)**
     Volume, cu. ft.

     i)   Volume, Gals   =   Multiply the above by the factor 7.48
         gals/ cu. ft.

4.   **Conversions:**

     A conversion is a number that is used to multiply, or divide, into another number in order to change the units of the number. In most instances, conversion numbers cannot be derived. They must be known.

Conversion Factors:
1 acre = 43,560 square feet
1 acre foot = 326,000 gallons
1 cubic foot = 7.48 gallons
1 cubic foot = 62.4 pounds
1 cubic foot per second = 0.646 MGD
1 foot = 0.305 meters
1 foot of water = 0.433 psi
1 gallon = 3.79 liters
1 gallon = 8.34 pounds
1 grain per gallon = 17.1 mg/L
1 horsepower = 0.746 kW or 746 watts or 33,000 ft. lbs./min.
1 mile = 5,280 feet
1 million gallons per day = 694 gallons per minute
1 million gallons per day = 1.55 cubic feet per second (cfs)
1 pound = 0.454 kilograms
1 pound per square inch = 2.31 feet of water
1 ton = 2,000 pounds
1% = 10,000 mg/L
Π or pi = 3.14159

Day 1

Start Time	End Time	Instructional Time	Allotted Break Time	Chapter/Discussion/Quiz
8:00am	8:50am	50 minutes	8:50am–9:00am	Introduction, The Step-By-Step Method, Using Your Scientific Calculator
9:00am	9:50am	50 minutes	9:50am–10:00am	Summary of the Key Formulas
10:00am	10:50am	50 minutes	10:50am-11:00am	Key Formulas – Continued, Conversions
11:00am	12:00pm	60 minutes	12:00pm-12:30pm	Conversions - Continued
12:30pm	1:20pm	50 minutes	1:20pm-1:30pm	Volumes
1:30pm	2:20pm	50 minutes	2:20pm-2:30pm	Population Equivalent
2:30pm	3:20pm	50 minutes	3:20pm-3:30pm	Dosage, demand and residual
3:30pm	4:30pm	60 minutes		Chapter 4 Continued: Equipment Inspection and Maintenance – Grit Removal; Operator Tasks & Common Problems; Lift Pumps Stations
		420 minutes		

6 sessions of 50 minutes of instruction and 2 sessions of 60 minutes of instruction equals 420 minutes. 420 minutes equates to 7 hours of instruction divided by 10 which is 0.7 CEUs

Day 2

Start Time	End Time	Instructional Time	Allotted Break Time	Chapter/Discussion/Quiz
8:00am	8:50am	50 minutes	8:50am–9:00am	Review selected problems from 1st day & The Step-By-Step Method
9:00am	9:50am	50 minutes	9:50am–10:00am	Solutions & Solution Percentages
10:00am	10:50am	50 minutes	10:50am-11:00am	Velocity
11:00am	12:00pm	60 minutes	12:00pm-12:30pm	Velocity Continued & Hydraulics
12:30pm	1:20pm	50 minutes	1:20pm-1:30pm	Hydraulics Continued
1:30pm	2:20pm	50 minutes	2:20pm-2:30pm	Pumps
2:30pm	3:20pm	50 minutes	3:20pm-3:30pm	Slope & Grade
3:30pm	4:30pm	60 minutes		Slope & Grade Continued
		420 minutes		

6 sessions of 50 minutes of instruction and 2 sessions of 60 minutes of instruction equals 420 minutes. 420 minutes equates to 7 hours of instruction divided by 10 which is 0.7 CEUs