PTAC: Applied Mathematics
COURSE OUTLINE & OBJECTIVES
ESC Approved – February 5, 2005

MATHEMATICAL OPERATIONS, SIGNIFICANT FIGURES & ROUNDING

Learning Objectives:
1. Define terms associated with mathematical operations, significant figures and rounding.
2. Identify exponents, radicals, and scientific notation.
3. Use exponents, radicals, rounding and scientific notations correctly.
4. Use order of operations correctly.
5. Use calculators correctly.

A. Rounding and Significant Figures

B. Measurements and Significant Figures

C. Exponents

D. Scientific Notation

E. Radicals

F. Order of Operations

FRACTIONS, PERCENTAGES & RATIOS

Learning Objectives:

1. Define terms associated with fractions, ratios and percentages.
2. Identify fractions, percentages and ratios in mathematical problems.
3. Use fractions and ratios to perform unit conversions (metric and British systems).
4. Use factor unit method correctly.
5. Determine percentages of given numbers

A. Fractions

B. Ratios

C. Unit Conversions/Factor Unit Method

D. Percentages

Examples:

- Barrels per hour to gallons per minute.
- % to whole numbers.
- Calculate sales tax.

PROBLEM SOLVING

Learning Objectives:

1. Define terms associated with problem solving.
2. Identify steps for problem solving.
3. Given a problem scenario, write and solve equations using single and multiple variables.
4. Perform unit conversions using formulas (i.e., pressure/temperature).

A. Formula Unit Conversions

B. Equations

C. Multi-Variables

D. Industry Specific Word Problems

Examples:

- Temperature conversions.
- Pressure and temperature relationships (Fahrenheit to Celsius).
- Difference in volume and weight.

GRAPHING AND TABLES

Learning Objectives:

1. Define terms associated with graphing and tables.
2. Read and interpret a scale correctly.
3. Read and interpret a graph correctly.
4. Read and interpret a table correctly.
5. Read and interpret a chart correctly.
6. Read and interpret computer/calculator-based graphs.
7. Given data, construct a hand-drawn and computer-generated graph.

A. Reading/Interpretation

B. Computer/Calculator-Based Graphing

C. Reading and Interpreting Tables and Charts

D. Interpolation

Examples:

- Volume versus pressure
- Ejector performance curves
- Changing scale
- Distance/Flow versus time
- Charts versus time
- Tank strappings
- Run charts/trip charts
- X bar R charts

BASIC TRIGONOMETRY

Learning Objectives:

1. Define terms associated with trigonometry.
2. Solve problems involving triangles.
3. Solve a vector addition problem using sines and cosines.

A. Temperature and Heat

B. Thermal Expansion and Transfer of Thermal Energy

Examples:

- Mass of 200 lb on 12 degree incline: determine the force and how strong the ramp needs to be.
- Long handled wrench versus short handled wrench (leveraging; cheater bar).

INTRODUCTION TO PTAC FORMULAS

Learning Objectives:

1. Define terms associated with PTAC formulas.
2. Calculate area and volume.
3. Calculate mass, weight, density and specific gravity.
4. Calculate force, work, energy and power problems.
5. Calculate pressure, temperature and volume.
6. Perform fluid mechanics calculations.
7. Perform electrical calculations.
8. Perform blending calculations.
9. Perform statistical process control calculations.
10. Apply mathematical laws and formulas to solve industry problems.
11. Apply mathematical laws and formulas to interpret values.

A. Area and Volume

- Surface areas
- Spheres & cylinders
    - Piping applications

Examples:

- Use review page with geometric volume and area formulas.
- How much volume is in a pipeline?
- Vessel volume versus vessel configuration.
- Industrial spills: square feet versus volume.
- Perform unit conversions.
- 8-inch pipeline into 20-foot tank.

B. Mass, Weight, Density, Specific Gravity

- Units
- Mass flow rates to volumetric rates
- Density changes due to temperature
- Mass density and weight density

Examples:

- Calculate flow rate of a liquid at specific weight, density and temperature.
- Using a standard, calculate shipping volume with temperature change.
- Perform unit conversions.
- Laboratory tests
- Blanket systems: converting scf of nitrogen to blanket a tank.
- Barrels pumped into barge on hot day versus cold day.
- Measure gas flow in scf.

C. Force, Work, Energy, Power

- Formulas
- Friction loss
- Torque

Examples:

- Horsepower usage on a pump for full flow versus restricted flow.
- Friction loss: going around a curve in a pipeline.
- BTU calculation.
- Cheater bar/applying right amount of torque; tightening vessel heads by torque.

D. Pressure, Temperature, Volume

- Gas laws – Ideal Gas Law, Charles, Boyles, and General Gas Laws
- Pressure, Temperature and Volume Conversions
- Differential pressure
- Vapor pressure
- Absolute versus gauge

Examples:

- Heat exchangers/distillation, etc., as examples of gas laws.
- Pressure differential across dual range gauge: vacuum to positive pressure.
- Volumetric expansion with temperature increase.
- Pressure decreases with volumetric expansion.
- Vapor pressure – filling tank from different streams/products.
- Force exerted by a tower filled with water (pounds of force per square inch).

E. Fluid Mechanics

- Definitions (viscosity)
- Bernoulli
- Reynolds number (charts)

Examples:

- ❑ Change velocity of motive (steam, air, etc.) to create low pressure area (vacuum).
- ❑ Use viscosity numbers to set up flow rate on a system; how many gpm's will it pump at a given viscosity?

F. Electrical

- Ohms law (amps, volts, ohms)
- Resistance/Temperature
- Electric power calculation

Examples:

- ❑ Solve problems for amp usage using volts and ohms.

G. Blending Calculations

- Spheres & cylinders

Examples:

- ❑ Given specifications for a product, determine composition (volume of additives).
- ❑ Perform blending calculations to meet specific spec ranges.
- ❑ Conversions of percentage to ppm and back again.
- ❑ Blend waste gases with natural gas for BTU (set up a ratio).

H. Statistics/Statistical Process Control (SPC)

- Basic terms and definitions (mean, median, mode, standard deviation, range, sigma, outliers)
- Basic calculations

Examples:

- ❑ Given a set of data, calculate mean, median, and mode.
- ❑ Interpret a statistical output.
- ❑ Calculate upper/lower control limits (standard deviation).
- ❑ Trending.