Day 1

1- Introduction

2- BA Interface

3- Material / Width / Speed / Capacity
   a. Material Description
      i. Density
      ii. Surcharge
      iii. Lump Size
   b. Capacity
      i. Width
         1. Max Lump Size
      ii. Speed
         1. How Fast?
      iii. Idler Configuration
      iv. Cross Sectional Area (CEMA vs. DIN)
   c. Output
      i. Percent Loaded
      ii. Edge Distance
      iii. Material Weight per unit length
   d. Belt Speed
   e. Belt Width
   f. Put it all together in BA
4- Flights
   a. Inputting/Manipulating
   b. Importing from AutoCAD etc
5- Belts
   a. Constructions
      i. Carcass- Fabric / Steel
      ii. Covers- Grade / Gauges
   b. Selection
      i. Strength / Rating
         1. Running / Transient
      ii. Maximum Belt Width
      iii. Minimum Belt Width
   c. Output
      i. Belt Weight
      ii. Elastic Modulus
      iii. Minimum Pulley Diameters
6- Idlers
   a. Function
   b. Types
   c. Components
      i. No of Rolls
      ii. Troughing Angle
      iii. Frame Type
      iv. Bearing Type

v. Load Rating / L10 Life
vi. Seal Type

d. Selection
i. Load
ii. Life
iii. Rim Drag (Resistance to Motion)

e. Installation

7- Pulleys

a. Types
b. Components
i. Shaft
ii. Bearings
iii. Lagging
c. Resultant Loads
i. T1 and T2
ii. Wrap Angle
iii. Tension Multipliers
d. What a Manufacturer Needs to Know
i. Diameter
ii. Face Width
iii. Bearing Centers
iv. Lagging
v. Overhung Load
vi. Backstop
e. Components
i. Locking Devices
ii. End Disks
iii. Rims
f. Shaft/Bearing Calculations (if Necessary)
i. Shaft Deflection
ii. Shaft Safety Factor
iii. Bearing L10 Life
g. Fatigue Life

8- Drives

a. How much power do we need?
i. Lift
ii. Friction
1. CEMA Standard
2. CEMA Universal
3. DIN 22101
b. Drive Definition
i. Components
c. Purpose
i. Static (sometimes regenerative)
ii. Dynamic
1. Safe Operation Definition
a. “Systems Engineering”
2. Start
a. Acceleration Torque vs. Running Torque

3. Stop

d. Fundamentals of AC motors
   i. Facts About Power
   ii. Speed Torque Curve
   iii. Starting Torque vs. Breakaway Torque
e. Drive Types
   i. Active vs. passive vs. no control
   ii. In context of BA Time vs. Torque
f. Brakes
   i. Spring set/hydraulic release
   ii. Velocity controlled
g. Backstops
   i. Rating vs Torque
h. Configuration Options
   i. Single drive pulleys
      1. Multiple motors, etc.
   ii. Multiple drive pulleys
      1. Load Sharing
         a. Definition
         b. examples

9- Take-up
   a. Type
      i. Gravity
      ii. Mechanical
      iii. Fixed
   b. How Big?
      i. Design Criteria
         1. Drive Slip
         2. Belt Sag
      ii. Conditions
         1. Running
         2. Starting
         3. Stopping
   c. Travel
      i. Permanent
      ii. Elastic

Day 2

1- Introduction

2- Power Calculations
   a. DIN f / CEMA Basic
   b. CEMA Standard / Historical
      i. Kx and Ky
   c. CEMA Universal
      i. Idler Rim Drag
         1. Bearing
         2. Seal
         3. Temperature / Grease
      ii. Idler Alignment
      iii. Material Flexure (Trampling)
      iv. Rubber Indentation
         1. Rubber Grade
         2. Rubber Gauge
         3. Belt Speed
         4. Idler Roll Diameter
         5. Temperature

3- Belts
   a. 3D Stresses
      i. Longitudinal (Tension Diagram)
      ii. Transverse
         1. Transitions
         2. Vertical Curves
         3. Turnovers
      iii. Vertical
         1. Pulleys
         2. Face Pressure
   b. Safety Factors
      i. Sizing belts by SF

4- Drives
   a. Day 1 review
      i. Facts About Power
      ii. Speed-Torque Curve
   b. Drive Types
      i. No Control
         1. Across-the-line
      ii. Passive Control
         1. AC Reduced Voltage
         2. Fixed Fill Fluid Coupling
      iii. Active Control
         1. Variable Frequency Drive
         2. Wound Rotor
         3. Variable Fill Fluid Coupling
         4. DC Motor
         5. Hydro-viscous Clutch

- c. Brakes
  - i. Active vs Passive Control
  - ii. “Torque Curve”
- d. Backstops
- e. Lagging
  - i. Classical vs Advanced Analysis
- f. Drive Configurations
  - i. Load Sharing
  - ii. Head Tail Drives
  - iii. Intermediate Drives

5- Accurate / Advanced Flight and Pulley Inputs
- a. Setup Flights accurately on carry and return
- b. Setup Pulleys accurately
  - i. Drag and Drop
- c. Advanced Pulley Selection
  - i. Database
    1. Locking Devices- Different types of Hubs/Bushings
    2. Bearings- Different Types of Bearings
  - ii. Safety Factors
  - iii. Bearing L10 Life

6- Take-up
- a. Adding Sheaves
- b. Mechanical Losses

Day 3

1- Introduction

2- Dynamic Analysis
   a. Overview
      i. What is it? Static vs. Dynamic
      ii. How do we do it?
      iii. When do we need it?
   b. Stopping a belt dynamically
      i. Characterize Power
         1. None- Drift
         2. Brakes- Mechanical
         3. Drives- Electrical
         4. Lose of Power
      ii. Characterize Take-up
   c. Starting a belt dynamically
      i. Characterize Drives
      ii. Characterize Take-up
      iii. Aborted Starts

3- Horizontal Curves
   a. When
   b. How
   c. An application in BA

4- Feeders
   a. Types
   b. Calculate Power

5- Non Conventional
   a. Pipe
      i. Calculate Power etc
   b. Cable Belt
   c. RopeCon