Outline for Orbital Mechanics
Sept 2017

Module 1: Laws of Physics Governing Orbital Mechanics

1. Define Orbit
2. Gravity
3. Velocity
4. Baseball Example
5. Precise Balance
6. Kepler's laws
    a. First law
        i. Define Ellipse
    b. Second Law
    c. Third Law
        i. Define Period
        ii. Define Semi-Major Axis

Module 2: Characteristics of Orbits

1. Reference Points
    a. Nadir
    b. Ground Track
    c. Orbital track
2. Eccentricity
    a. Define
    b. Elliptical
    c. Circular
    d. Effects
        i. Access
        ii. Speed
        iii. Dwell/persistence
        iv. Resolution
3. Altitude
    a. Define Altitude
    b. Apogee & Perigee
    c. Effects of altitude

        i. Period
        ii. Speed
        iii. Mean Motion (Orbits/Day)
        iv. Access Area
4. Inclination
    a. Define Equatorial Plane
    b. Define Orbital Plane
    c. Define Inclination
    d. Types
        i. Equatorial
        ii. Polar
        iii. Prograde/Posigrade
        iv. Retrograde
    e. Effects
        i. Access (latitude)
        ii. Revisit rate
5. Module 4: Launch Considerations
    a. Location
    b. Direction
    c. Other Considerations

Module 3: Common Orbit Types

1. LEO
2. MEO
3. HEO
4. GEO
5. Tundra

For each Orbit type:

1. Specifications
    a. Altitude
        i. Apogee
        ii. Perigee
    b. Eccentricity
    c. Inclination
    d. Access Area (in SQNM)
    e. Dwell
    f. Speed

   g. Period
   h. Mean Motion
2. Ground Track
3. Global Access
4. Pros & Cons
5. Applications
6. Variations (For LEO and GEO only see next topic)

Orbital Variations

1. LEO variations
   a. Walking Orbit
      i. Sun Synchronous
      ii. Walker Constellation
   b. Apsidal Rotation
2. MEO
   a. Walker Constellation
3. GEO variations
   a. Geostationary

Module 4: Classical Orbital Elements

1. Terms
   a. Orbital Nodes (Ascending and Descending)
   b. Right Ascension of the Ascending Node (RAAN)
   c. Argument of Perigee
   d. True Anomaly
2. Classical Orbital Elements
   a. Semi-Major Axis
   b. Eccentricity
   c. Inclination
   d. Right Ascension of Ascending Node
   e. Argument of Perigee
   f. True Anomaly
3. Two Line Element (TLE) Set
   a. Mean Motion
   b. Eccentricity
   c. Inclination
   d. Right Ascension of Ascending Node
   e. Argument of Perigee

Module 5: Closing

1. People analogy
2. Orbit of every satellite is unique