SPACE SYSTEMS – EXAM SUMMARY

1. Mission Architecture

- Definition of mission objectives.
- Requirements flow-down and constraints.
- Trade-off analysis for payload, orbit, and spacecraft configuration.

2. Space Environment

- Radiation environment: trapped belts, solar events, galactic cosmic rays.
- Thermal environment: direct sunlight, albedo, IR emission from Earth.
- Micro-meteoroids and debris environment considerations.
- Its effect on spacecraft hardware and materials.

3. Orbital Mechanics (Basics)

- Orbital elements and orbit types.
- Perturbations: J2, drag, solar radiation pressure.
- Ground track and revisit time relevance for mission design.

4. Spacecraft Subsystems Overview

Power Subsystem:

- Solar arrays sizing, degradation, eclipses.
- Battery depth of discharge and lifetime constraints.

Thermal Subsystem:

- Passive and active thermal control.
- Radiators, thermal coatings, heaters.

Communication (TT&C;):

- Frequency bands, link architecture, antenna types.

- Link budget fundamentals: EIRP, G/T, Eb/N0, margins.

Attitude Determination and Control System (ADCS):

- Sensors: sun sensors, star trackers, gyros, magnetometers.

- Actuators: reaction wheels, magnetorquers, thrusters.

- Control laws for pointing and stabilization.

Structure and Mechanisms:

- Load paths, stiffness requirements.

- Launch loads and vibration environment.

Propulsion Subsystem:

- Chemical vs. electric propulsion.

- Δv budget and propellant sizing.

5. Spacecraft Design Process

- Requirements $\rightarrow$ architecture $\rightarrow$ subsystem sizing $\rightarrow$ verification.

- Interface control and system engineering flow.

- Mass, power, and cost budgets.

6. Spacecraft Operations

- Commissioning, nominal operations, contingencies.

- End-of-life disposal and passivation.