Theoretical Problem 1: ISS Orbital Decay Dynamics - Answer sheet

Part A: Modified barometric formula [2.0 points]

A.1 (0.5 pt)

A.2 (0.3 pt)

A.3 (0.6 pt)

A.4 (0.4 pt)

A.5 (0.2 pt)

Part B: Orbital deceleration and station descent rate [3.0 points]

B.1 (0.5 pt)

B.2 (0.5 pt)

B.3 (1.0 pt)

B.4 (0.5 pt)

B.5 (0.5 pt)

Part C: Atmospheric drag [1.0 points]

C.1 (0.5 pt)

C.2 (0.5 pt)

Part D: Drag by atomic oxygen ions [1.0 points]

D.1 (0.3 pt)

D.2 (0.7 pt)

Part E: Drag by the Earth's magnetic field [2.0 points]

E.1 (0.6 pt)

E.2 (0.6 pt)

E.3 (0.8 pt)

Part F: Numerical results and conclusion [1.0 points]

F.1 Calculate and fill Table 1 in the Answer Sheet. 0.4pt

$h[km]$	$T_h^{air}[day]$	$w_{air}[m/day]$	$w_{ion}[m/day]$	$w_{ind}[m/day]$	$\sum[m/day]$	$w_{ISS}[m/day]$
350						
375						
400						
410						

Various deorbit velocities on the height h above the Earth surface, compared to the ISS-NASA data.

F.2 Calculate and fill Table 2 in the Answer Sheet. 0.4pt

$h(km)$	$H_h^{air}[m]$	$H_h^{ion}[m]$	$H_h^{ind}[m]$
350			
375			
400			
410			

The descent rates for a revolution of the ISS around the Earth.

F.3 For the International Space Station, orbiting at an altitude above $380km$, the most significant factors ensuring orbital decay are ranked as follows: 0.2pt

1.
2.
3.

Theoretical Problem 2: A ball on a turntable [10.0 points]

Part A: Ball on turntable with constant angular velocity [1.5 points]

A.1 (0.1 pt)

A.2 (0.2 pt)

A.3 (0.2 pt)

A.4 (0.5 pt)

A.5 (0.5 pt)

Part B: Ball on freely rotating turntable [4.0 points]

B.1 (0.2 pt)

B.2 (0.6 pt)

B.3 (0.6 pt)

B.4 (0.1 pt)

B.5 (2.5 pt)

Part C: Ball on turntable in magnetic field [4.5 points]

C.1 (0.5 pt)

C.2 (0.5 pt)

C.3 (1.0 pt)

C.4 (0.9 pt)

C.5 (1.6 pt)

Theoretical Problem 3: Cavitation - Answer Sheet [10.0 points]

Part A: Preliminary analysis [1.5 points]

A.1 (0.5 pt)

A.2 (1.0 pt)

Part B: Main dynamics [6.0 points]

B.1 (1.5 pt)

B.2 (1.0 pt)

B.3 (1.0 pt)

B.4 (0.5 pt)

B.5 (1.0 pt)

B.6 (1.0 pt)

Part C: Dissolution of nuclei through diffusion [2.5 points]

C.1 (2.0 pt)

C.2 (0.5 pt)