AE 240/240M/713 Assignment Problem Statement Weightage: 20% (12% + 8%)

Submission Deadline: Friday 23rd April Midnight

Please refer to the problem allocation table uploaded on moodle which contains the space mission allotted to you for this assignment. You are encouraged to search for relevant parameters for the mission allocated to you and make reasonable assumptions wherever required. However, the assumptions must be supported through technical justifications. **In case of difficulties contact the course instructor only.**

For your particular mission, do the following:

1. Gather information regarding the space mission objectives, orbital / trajectory parameters, launch vehicle and launch site used for the mission and any other significant data of the mission. Describe the overall mission and its status, including successes and failures for completed / ongoing missions.
2. Next, determine the nature of the orbit / trajectory of the spacecraft, in terms of the applicable orbital parameters (i.e. semi-major axis, eccentricity, time of perigee passage, mean anomaly at injection, right ascension of the ascending node, inclination, argument of the perigee, departure velocity, arrival orbit / trajectory, capture/flyby, landing/reentry etc.). Also, give orbital time period, apoapsis & periapsis.
3. Determine how the nature of the orbit/trajectory is connected with the objectives of the mission. Also, obtain the initial conditions and / or orbital manoeuvres that would be required at the time of injection / after injection, to achieve the above orbit / trajectory.
4. Next, design a nominal trajectory of the launch vehicle, based on the launch vehicle configuration parameters, to achieve the required terminal conditions. (As this is not the real trajectory, which is also not known to you, you may suitably make use of lift-off, gravity turn and upper atmosphere manoeuvres, to achieve the nominal terminal parameters.). Kindly be as accurate as possible with regard to the timing of separation of various stages, as per the launch vehicle data sheet. Also, find the key events in the trajectory taken by both launch vehicle (e.g. stage separation) and the spacecraft from its injection by launch vehicle to the end of mission (orbit raising, escape, capture etc.), including disposal if applicable and report them.
5. Determine nominal burn profiles for launch vehicle and manoeuvre components for spacecraft, starting from the injection point conditions (assumed to be known from the corresponding ascent mission with which the spacecraft is launched), their sequence and the velocity impulses required at each stage in attaining the final mission orbit/trajectory, as per the actual mission performed by the spacecraft. Use nominal injection conditions for the applicable mission, in case there are multiple terminal conditions possible for a launch vehicle.

Note: As far as possible, all the tasks listed above should be carried out. However, in case some aspects are not feasible or the performance is deficient in relation to the actual mission, a detailed justification for the same must be provided.