ENAE 483/788D LECTURE #06
(MASS ESTIMATING RELATIONS) PROBLEMS – FALL, 2023
.
THIS PROBLEM IS FOR EXTRA CREDIT ONLY

Following the procedures illustrated in the lecture notes, perform a component-level design using MERs of a two-stage launch vehicle with payload mass to LEO of 25,000 kg. Use the following parameters in the analysis:

Parameter	First Stage value	Second Stage value
Propellants	LOX/LCH4	LOX/LH2
O/F ratio (by mass)	3.2	6.1
Specific impulse (sec)	380	450
Stage ΔV (m/sec)	4200	5200
Stage diameter (m)	7.0	5.0
Number of engines	2	2
Chamber pressure (MPa)	13.4	7.66
Nozzle area ratio	14.5	80
T/W ratio (initial)	1.3	0.76

Anything you haven't been given, you should be able to calculate or estimate. Design the vehicle and provide mass breakdowns for each stage which demonstrate that each stage has a 30% mass margin. Also produce a simple sketch of your final design with dimensions.