

AE 330/708
Assignment 1
(Due date: 30/08/2020)

Instruction:

Submit the assignment in a single pdf file before 30/08/2020 (Sunday) 11.59 pm.

1. Following data is reported for rocket a few seconds after it leaves the launch pad. Thrust is 9 kN; propellant consumption rate is 4 kg/s; velocity of the rocket is 400 m/s. Calculate, at the particular instant of time for which data is available: (a) jet velocity, (b) propulsive efficiency of the rocket.
2. Following measurements were made in a sea level test of a solid propellant rocket:
Burning time: 40 sec
Initial mass: 1210 kg
Burn-out mass: 215 kg
Thrust: 62.25 kN
Chamber pressure: 7 MPa
Nozzle exit pressure: 0.07 MPa
Nozzle exit diameter: 0.2703 m
Determine mass flow rate, jet velocity, effective exhaust velocity, specific impulse.
3. Consider a rocket vehicle stage which has propellant mass of 140000 kg and specific impulse of 270 sec. The stage generates the thrust of 4800 kN. If the propellant mass fraction for the stage is 0.7, determine the burning duration of the stage, initial acceleration of the vehicle, impulse-to-weight ratio at the take-off and effective exhaust velocity.
4. A large ballistic rocket vehicle has the following characteristics: propellant mass flow rate: 175 kg/s, nozzle exit velocity: 2164 m/s, nozzle exit pressure: 34.5 kPa (assume no separation), atmospheric pressure: 101.35 kPa (sea level), takeoff weight: 12000 kg, burning time: 50 s, nozzle exit area: 0.258 m^2 . Determine:
 - (a) Sea-level specific impulse.
 - (b) Sea-level effective exhaust velocity.
 - (c) Initial thrust-to-weight ratio.
 - (d) Impulse-to-weight ratio.