



AUBURN UNIVERSITY

SAMUEL GINN  
COLLEGE OF ENGINEERING

AEROSPACE

**AERO 4970/7970**

**Rocket Propulsion I  
Liquid Propellant Rocket Engine Fundamentals**

**SET V**

1. The engine performance data for a turbopump rocket system are as follows:

|   |                               |
|---|-------------------------------|
| Engine system specific impulse                  | 272 s                         |
| Engine system mixture ratio                     | 2.52                          |
| Engine system thrust                            | 40,000 N                      |
| Oxidizer vapor flow to pressurize oxidizer tank | 0.003% of total oxidizer      |
| flow Propellant flow through turbine            | 2.1% of total propellant flow |
| Gas generator mixture ratio                     | 0.23                          |
| Gas generator specific impulse                  | 85 s                          |

Determine the performance of the thrust chamber by calculating:  $I_s$ ,  $r$ ,  $F$ .

*Answers:* 276.1 s; 2.67; 39,737 N.

2. For a pulsing rocket engine, assume a simplified parabolic pressure rise of 0.005 s, a steady-state short period of full chamber pressure, and a parabolic decay of 0.007 s approximately as shown in the sketch below. Plot curves of the following ratios as a function of operating time  $t$  from  $t = 0.013$  to 0.2 s: (a) average pressure to ideal steady-state pressure (with zero rise or decay time); (b) average  $I_s$  to ideal steady-state  $I_s$ ; (c) average  $F$  to ideal steady-state  $F$ .

