Combustion in Air-breathing Aero Engines
Assignment No. 12

This assignment contains 8 multiple choice questions with 4 possible answers to each. Only one of the choice is correct and so select the choice that best answers the question. Correct choice rewards you with 1 point for each question. Wrong answers will reward you with 0 points (no negative marking). The questionnaire contains both numerical and concept-based questions. All the best!!!

1. For a scramjet engine, the flight Mach number is about M=9. The typical combustor entry Mach number is
   a) 10
   b) 6
   c) 3
   d) 1

Ans: $M_3 / M_0 \approx \sqrt{T_0 / T_3}$ and $T_0 / T_3 \sim 10$. Hence and is c) 3

2. In a supersonic Rayleigh flow, with heat addition by combustion, the Mach number
   a) Increase
   b) Decrease
   c) Remains constant
   d) Is undefined

Ans: b) decrease

3. In a subsonic Rayleigh flow, with heat addition by combustion, the Mach number
   a) Increase
   b) Decrease
   c) Remains constant
   d) Is undefined

Ans: a) increase

4. In a frictionless supersonic air flow with heat addition the T_0 / T_0^* at M=2 is given by

a) 0.59

b)0.69

c)0.79

d)0.89

Ans: c) by Rayleigh flow analysis

5. In a scramjet combustor the following phenomenon has the largest time scale

a) Compression
b) Mixing
c) Ignition
d) Compression

Ans: b) mixing

6. For a 1m long scramjet engine cruising at an altitude of 30km at M=7, the approximate flow residence time scale is best given by

a) 1 microsecond

b) 0.2 millisecond

c) 2 millisecond

d) 5 millisecond

Ans: c) 2millisecond. Time scale = L/U. L=1m, U=550m/s

7. The isolator serves the following function in a scramjet engine

a) compression of the incoming air

b) decouple inlet from pressure rise in combustor

c) enhanced fuel air mixing

d) achieve complete combustion

Ans: b)

8. Consider a scramjet combustor in which combustion is stoichiometric. The maximum combustor pressure to the combustor entry pressure is then best given by

a) 0.80

b) 0.97

c) 1.03

d) 5.00

Ans: d)