Combustion in Air-breathing Aero Engines
Assignment No. 10

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. A gas turbine combustor is more complicated than a straight pipe with fuel injection because in a straight pipe gas turbine combustor
   a) heat loss is too high
   b) frictional losses are too high
   c) kinetic energy loss is too high
   d) pressure loss is too high

   Ans: d) In absence of a diffuser pressure losses are too high

2. In a gas turbine combustor swirlers are required to ensure
   a) flame stabilization
   b) minimum pressure loss
   c) avoid combustion instability
   d) achieve good pattern factor

   Ans: a) Since flow velocities are high, some flame stabilization mechanism for e.g. swirler is required.

3. In a gas turbine combustor the turbulence Reynolds number is of about
   a) 30
   b) 300
   c) 3000
   d) 30000

   Ans: d)

4. What is the characteristic breakup time of a water jet of radius 1 cm purely due to Rayleigh-Plateau instability is given by.
   a) 0.13 seconds
   b) 0.3 seconds
   c) 1 second
   d) 3 seconds
Ans: b) \( t_b \approx 2.91 \sqrt{\frac{\rho R_0^3}{\sigma}} \)

5. The fastest growing mode of the above jet corresponds to a wavelength of
a) 0.902 cm
b) 4.51 cm
c) 9.02 cm
d) None of the above.

Ans: c) \( \lambda_{\text{max}} \approx 9.02R_0 \)

6. In a gas turbine combustor the pressure loss is proportional to Mach number to the power alpha. Alpha is
a) 1
b) 2
c) 3
d) None of the above.

Ans: b)

7. An axial swirler has a swirl blade angle of 45 degrees and a similar swirler of same diameter has a swirl blade angle of 60 degrees. If all flow conditions are same, the ratio of the geometric swirl number of former to latter is about.

a) 0.314
b) 0.577
c) 0.900
d) 1.214

Ans: b) Use \( S = (R/4L) \tan \alpha \)

8. In a gas turbine combustor atomization is caused by
a) Rayleigh Plateau instability
b) Aerodynamic forces
c) Turbulence
d) Darrieus Landau instability

Ans: b)