

## 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)  $\lambda_{\max} \approx 9.02 R_0$

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 swirler 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) Darrius Landau instability

Ans: b)