

**B.E., DEGREE EXAMINATIONS MAY/JUNE 2013**

Fifth Semester

**AERONAUTICAL ENGINEERING**

AER109: Aircraft Propulsion

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL Questions:-**

**PART A (10x1=10 Marks)**

1. Thrust depends on
  - A. Jet velocity
  - B. Mass flow
  - C. Air speed
  - D. All of the above
2. Bypass ratio is
  - A. Mass flow of air
  - B. mass-flow of air passing through the core
  - C. mass-flow of air bypassing the engine core
  - D. None of the above
3. Subsonic is defined as a speed lower than
  - A. 85-95% of the speed of sound
  - B. 65-85% of the speed of sound
  - C. 75-95% of the speed of sound
  - D. 55-65% of the speed of sound
4. De-laval nozzle used in
  - A. Subsonic inlets
  - B. Transonic inlets
  - C. Supersonic inlets
  - D. Hypersonic inlets
5. Instabilities of axial compressors depends on
  - A. rotating stall
  - B. surge
  - C. unstable
  - D. All the above
6. Centrifugal compressors are sometimes termed as
  - A. Axial flow compressors
  - B. Radial flow compressors
  - C. Intermittent flow compressors
  - D. None of the above
7. Combustion chamber is located at the cylinder head as
  - A. Swirl combustion
  - B. Pre combustor
  - C. Air cell chamber
  - D. Indirect combustion
8. Flame tube cooling is used to
  - A. Cool the injector temp
  - B. Cool the combustion chamber
  - C. Cool the Swirl vane
  - D. None of the above
9. Crossflow turbines are designed as an
  - A. Reaction
  - B. impulse
  - C. Intermittent
  - D. None of the above Which one of the

10. Impulse turbine depends on
- |             |                     |
|-------------|---------------------|
| A. Force    | B. Time             |
| C. Momentum | D. All of the above |

**PART B (10 x 2 = 20 Marks)**

11. List out the factors affecting thrust.
12. Differentiate between reciprocating engine and jet engine.
13. Define Boundary layer separation
14. What is meant by supersonic inlet?
15. Define prewhirl.
16. Differentiate centrifugal and axial compressors.
17. List out the factors affecting combustion.
18. What are the different methods used for flame stabilization?
19. Define limiting factor
20. What are common methods employed for blade cooling?

**PART C (5 x 14 = 70 Marks)**

21. a) Explain about the working principle of turbojet engine and its advantages.  
(OR)  
b) Briefly explain the various methods of thrust augmentation.
22. a) Discuss about Stall in subsonic inlets.  
(OR)  
b) Briefly explain about Shock swallowing by area variation
23. a) Sketch the performance characteristic curves of centrifugal compressor and axial flow compressor. What conclusions can be made from these curves?  
(OR)  
b) Classify gas turbine combustion chambers and Bring out the advantages and limitations of any three types of combustion chambers from structural design and combustion performance point of view?
24. a) At the mean diameter of a gas turbine the blade velocity is 350 m/s. The blade angles at inlet and exit are  $20^\circ$  and  $54^\circ$  respectively, and the blades at this section are designed to have a degree of reaction of 50%. The mean radius of the blades is 0.216m and the blade mean height is 0.07m. Assuming the blades are designed according to vortex theory calculate.

(OR)

- b) Explain the following types of expansion in the nozzle flows  
(i) Under expansion (ii) Over expansion (iii) Optimal expansion
25. a) With help of a neat diagram, explain the working principle of ram jet engines

**(OR)**

- b) Briefly explain about the working principle of integral rocket and its limitations