Register Number: ……………………..

B.E DEGREE EXAMINATIONS: APRIL/MAY 2014

(Regulation 2009)

Fifth Semester

AERONAUTICAL ENGINEERING

AER109: Aircraft Propulsion

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. In an ideal otto cycle the combustion process will occur at constant
   a) Volume
   b) Temperature
   c) Pressure
   d) Heat

2. The ram efficiency is defined by the ratio of ram pressure rise to _____
   a) Static pressure
   b) Ambient pressure
   c) Outlet dynamic head
   d) Inlet dynamic head

3. An oblique shock is better than normal one because the _____ is less
   a) Outside pressure
   b) Pressure rise
   c) Temperature
   d) Speed

4. The higher the_____, the greater will be the percentage loss in pressure across a normal shock.
   a) Pressure
   b) Mach number
   c) Temperature
   d) All of these

5. In an axial flow compressor one set of stator blades and one set of rotor blades constitute a _____
   a) Pair
   b) Stage
   c) Stator
   d) Reaction

6. _____ turbines develop torque by reacting to the gas or fluid's pressure or mass.
   a) Reaction
   b) Impulse
   c) Rotor
   d) Pelton

7. Any interruption of the fuel supply also can result in a _____
   a) Flame stable
   b) Flameout
   c) Turbulence
   d) Heat

8. The ratio of the _____ and _____ values of the whirl components at the exit is known as slip factor.
   a) Constant,pressure
   b) Pressure , ideal
   c) Actual,ideal
   d) Pressure, temperature

9. When afterburning engine operation is required, _____nozzles must be used.
   a) Convergent
   b) Convergent-Divergent
   c) Complex variable geometry
   d) Divergent

10. Nozzle pressure ratio is _____ in the subsonic cruise speed range of turbofan and turbojet engine.
    a) Zero
    b) 1 to 2
    c) 5 to 20
    d) 3 to 5

PART B (10 x 2 = 20 Marks)

11. What are the methods of thrust augmentation?

12. Differentiate between two – stroke and four stroke piston engines.

13. What is the purpose of an aircraft gas turbine inlet?

14. Draw the types of flow in straight wall diffusers.

15. Define surging and stalling.

16. Explain the air flow path in combustor.

17. What are the differences between impulse and reaction turbines?

18. Define Thrust reverser.

19. What is integral ram rocket?

20. Explain ramjet performance.

PART C (5 x 14 = 70 Marks)

21. a) (i) State the assumptions made in an ideal cycle of gas turbines. (6)

    (ii) What is meant by thrust? Derive the thrust equation for a general propulsion system. (8)

    (OR)

    b) In a gas turbine plant air enters the compressor at 1 bar and 7°C. it is compressed to 4 bar with an isentropic efficiency of 82%. The maximum temperature at the inlet to the turbine is 800°C. The isentropic efficiency of the turbine is 85%. The calorific value of the fuel used is 43.1 MJ/kg. The heat losses are 15% of the calorific value. Calculate the following:

    (i) Compressor work in KJ/kg

    (ii) Heat supplied in KJ/kg

    (iii) Turbine work in KJ/kg

    (iv) Net work in KJ/kg

    (v) Thermal efficiency

    (vi) Air fuel ratio

    (vii) Specific fuel consumption in kg/kWh

    Assume C_{pa} = 1.005 kJ/kg K, γ_a = 1.4, C_{pg} = 1.147 kJ/kg K, γ_g = 1.33

22. a) Derive the relation between area A_{max}/A_i and external deceleration ratio u_i/u_a. The subscript 'i' indicates inlet and 'a' indicates free stream.

    (OR)

    b) Explain the starting problem and boundary layer separation in supersonic inlets.

23. a) (i) A centrifugal compressor has to deliver 35 kg of air per sec. The impeller is 76 cm diameter revolving at 11,500 rpm with an adiabatic efficiency of 80%. If the pressure ratio is 4.2:1,estimate the probable axial width of the impeller at the impeller tip if the radial velocity is 120m/s. The inlet conditions are 1 bar and 47°c. (7)

    (ii) Explain the principle operations of axial and centrifugal compressors. (7)

    (OR)

    b) (i) What are the important factors affecting combustion chamber performance? Explain in detail. (8)

    (ii) Briefly explain the operation of flame holder. (6)

24. a) (i) Explain elementary theory of axial flow turbine. (8)

    (ii) What are the Limiting factors in gas turbine design? (6)

    (OR)

    b) (i) Explain the matching computations of turbines and compressor. (8)

    (ii) What are the Methods of blade cooling? (6)

25. a) Explain the working of ramjet and scramjet engine with a neat diagram.

    (OR)

    b) Explain the following performance coefficients:

    (i) Nozzle coefficient

    (ii) Cross thrust coefficient

    (iii) Flow coefficient

(iv) Velocity coefficient

(v) Angularity coefficient

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