Hall Ticket No | | | | | | | | | | | Question Paper Code:AAE551

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech VI Semester End Examinations (Regular) - May, 2019

Regulation: IARE – R16

AEROSPACE PROPULSION AND COMBUSTION

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Construct a simple line diagram of gas turbine and explain with p-V, T-s diagram how it functions? **[7M]**

   (b) The effective jet velocity from a jet engine is 2700m/s. The forward flight velocity is 1350m/s and the air flow rate is 78.6 kg/s. Calculate the thrust, thrust power & propulsive efficiency. **[7M]**

2. (a) Demonstrate the working principle with neat diagram for (i) Turboprop, (ii) Turbojet. **[7M]**

   (b) Calculate the air-fuel ratio and overall efficiency of a German turbojet plant used petrol having a calorific value of 43MJ/kg. The fuel consumption is 0.18 kg per hour N of thrust, when the thrust is 9KN. The aircraft velocity is 500 m/s the mass of air passing through the compressor is 27kg/s. **[7M]**

UNIT – II

3. (a) Explain different thrust augmentation methods for improving the thrust of an engine with a neat sketch. **[7M]**

   (b) The following data are suggested as a basis for the design of a single-sided centrifugal compressor: power input factor is 1.04, slip factor is 0.9, rotational speed is 290 rev/s, overall diameter of impeller 0.5 m, eye tip diameter is 0.3 m, eye root diameter is 0.15 m, air mass flow rate is 9 kg/s, inlet stagnation temperature, T_{01} 295 K, inlet stagnation pressure p_{01} is 1.1 bar, isentropic efficiency is 0.78. Determine the pressure ratio of the compressor and the power required to drive it assuming that the velocity of the air at the inlet is axial. **[7M]**

4. (a) What is the need for turbine blade cooling and explain about different types of turbine blade cooling. **[7M]**

   (b) Draw and explain the velocity diagram for axial flow turbine. Explain in detail about ramjet engine with a neat sketch **[7M]**

UNIT – III

5. (a) Estimate the starting problem in case of supersonic inlets. What is shock swallowing by area variation? **[7M]**

   (b) A turbojet engine powering an aircraft flying at an altitude of 11,000m where $T_a = 216.7$ K and $P_a = 24.444$ k P_a. The flight Mach number is 0.9. The inlet conditions to the nozzle are 1000 K and 60 kPa. The specific heat ratio of air and gases at Nozzle is 1.4 and 4/3. The nozzle efficiency is 0.98. Determine the thrust per inlet frontal area for C-D nozzle. **[7M]**

6. (a) Explain the difference forces acting on a propeller with a neat sketch. **[7M]**

   (b) What is the need for variable area nozzle and explain the methods used to attain in with a neat diagram. **[7M]**

UNIT – IV

7. (a) Illustrate the difference between annular and cannular type combustion chamber with a neat diagram. **[7M]**

   (b) Illustrate of different flow paths obtained in a combustion chamber in detailed. **[7M]**

8. (a) Explain in detail about different flame holders used inside a combustion chamber with a neat diagram. **[7M]**

   (b) Explain in brief different types of combustion chamber with neat sketch. **[7M]**

UNIT – V

9. (a) Define droplet combustion. Explain in detail about droplet combustion. **[7M]**

   (b) Explain in detail about flame propagation techniques to stabilize the flame. **[7M]**

10. (a) Briefly explain about discrete numerical simulation approach. **[7M]**

    (b) Explain the laminar premixed flame propagation with equations. **[7M]**

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