Code No: 07A52104 **R07** **Set No. 2**

III B.Tech I Semester Examinations,May 2011
AEROSPACE PROPULSION-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What is inlet buzz? Explain its origin and the method to control it. [16]
2. What do you understand by the term combustion? Explain the significance of various types of pressure losses occurring in gas turbine combustors. [16]
3. Enumerate the purpose of an aircraft gas turbine nozzle. [16]
4. What is ram recovery point and enumerate its significance in subsonic inlets. [16]
5. A centrifugal compressor has a pressure ratio of 4:1 with an isentropic efficiency of 80% when running at 15,000 rpm and inducing air at 293 K. Curved vanes at inlet give the air at pre-whirl of 25^0 to the axial direction at all radii and the mean dia of eye is 250 mm. The absolute air velocity at inlet is 150 m/s. Impeller tip dia is 600 mm. Calculate the slip factor. [16]
6. Explain the process of cooling of combustion products with the air in a combustion chamber using an appropriate sketch. [16]
7. Enumerate three different methods of thrust augmentation and explain any two of them in detail with appropriate sketches. [16]
8. (a) Derive an expression to calculate the pressure ratio on a stage.
   (b) A 50% reaction, axial flow compressor runs at a mean blade speed of 250 m/s. The pressure ratio developed by the machine is 1.3. Determine the blade and air angle if the mean flow velocity is 200 m/s. Condition at inlet are4 1 bar and 300 K. [8+8]

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Code No: 07A52104 **R07** **Set No. 4**

III B.Tech I Semester Examinations,May 2011
AEROSPACE PROPULSION-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. List eight major functions of an exhaust nozzle. [16]
2. Enumerate the significance of temperature distribution at burner exit with suitable curve. [16]
3. What is a nacelle? Explain the subsonic inlet nomenclature with a neat sketch. [16]
4. Explain in detail the working of a typical GE combustor with a neat sketch. [16]
5. Explain briefly the following performance parameters:
   (a) Power input factor,
   (b) Pressure coefficients and
   (c) Compressor efficiency. [16]
6. What are the basic requirements of compressors for aircraft applications? Do axial flow compressors meet them? Explain. [16]
7. A turbofan (approximately same size as a commercial turbofan engine) operates at sea level and moves at 269.7 m/s. It ingests 121.1 kg/s of air into the core and five times this amount into the fan (the bypass ratio), which all exhausts through the fan exhaust. The fuel flow is negligible. The exit areas of the fan and core are 1.580 and 1.794 m^2, respectively. The exit pressures from the fan and core are 154.4 and 144.8 kPa, respectively. The exhaust velocities from the fan and core are 328.6 and 362.7 m/s, respectively. Find the thrust. [16]
8. Derive and explain significance of Prandtl relation obtained in the normal shock wave relations inside a supersonic inlet. [16]

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Code No: 07A52104 **R07** **Set No. 1**

III B.Tech I Semester Examinations,May 2011
AEROSPACE PROPULSION-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Discuss significance of boundary layer bleed flow on the performance of supersonic inlet. [16]
2. What are different types of nozzles used in aircraft engine? Briefly explain them. [16]
3. Define degree of reaction and derive an expression for the same. [16]
4. Derive Euler's energy equation for a turbo-machine and explain its physical meaning with a velocity diagram at rotor blade exit?? [16]
5. Explain in detail the process of ignition occurring inside a combustion chamber. [16]
6. What do you understand by vortex generators? Explain its role played in the internal flow physics of inlets using a schematic diagram. [16]
7. (a) Discuss briefly the contingencies experienced due to fuel injection inside combustors.
   (b) What are atomizers? Explain their significance by enumerating the requirements of a good atomizer. [16]
8. Briefly explain the phenomena of surge and choking in centrifugal compressors. [16]

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Code No: 07A52104 **R07** **Set No. 3**

III B.Tech I Semester Examinations,May 2011
AEROSPACE PROPULSION-I
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A three-stage axial flow compressor developing a pressure ratio of 3 delivers 10 Kg/s of air. The air enters the rotor with a velocity of 220 m/s and at an angle of 15^0. The velocity diagram is symmetrical. Determine the speed of compressor if the blade height is restricted to 25 mm at the inlet. Take inlet conditions, stagnation pressure and stagnation temperature are 1 bar and 300 K, degree of reaction = 0.5 and polytropic efficiency = 0.9. [16]

2. (a) Discuss the significance of total pressure recovery characteristic on the performance of supersonic inlets.
   (b) Discuss significance of cowl drag characteristic on the performance of supersonic inlet. [8+8]

3. A single-sided straight vaned centrifugal compressor is required to deliver 10kg/s of air with a total pressure ratio of 4:1 when operating at a speed of 16500rpm. The air inlet pressure and temperature are 1.013bar and 300K respectively. Calculate:
   (a) Tip speed of the impeller.
   (b) Actual rise in stagnation temperature.
   (c) Tip diameter.
   (d) Inlet eye annulus area.
   (e) Theoretical power required to drive the compressor. The air enters the eye axially with a velocity of 150m/s.

   [16]

4. Discuss briefly about different measures used for noise suppression in aircraft jet engines. [16]

5. Discuss briefly the contingencies experienced due to fuel injection inside combustors. [16]

6. Discuss in detail fluid flow through a rotor blade and the nomenclature associated with it? [16]

7. Consider Ear type air intakes for a subsonic airplane as that for Gnat / Ajit fighter plane. Show the internal layout for swallowed air to reach the engine. Explain its aerodynamics and thermodynamics in detail when the airplane takes a turn of about 10 in its yaw plane.

   [16]

8. (a) Balance the following equation and calculate the stoichiometric fuel to air ratio. $C_{10}\ H_{22} + Y\ 0_2 + 3.76\ Y\ N_2 \longrightarrow X\ H_20 + Z\ C0_2 + 3.76\ Y\ N$

   (b) Explain briefly the process of ignition occurring inside a combustion chamber. [10+6]

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