Code No: 07A62103 **R07** **Set No. 2**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE PROPULSION-II
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. With a neat sketch show the nozzle geometric parameters and explain the following:
   (a) Thrust coefficient
   (b) Discharge coefficient [8+8]
2. (a) What is the effect of pitch on the blade root fixing?
   (b) Write a note on forced convection air cooling of axial flow turbines. [8+8]
3. Explain the components of solid rockets and for which applications the rockets are used. [16]
4. Describe various types of injectors in liquid rockets, what are salient injector flow characteristics? [16]
5. Suppose you are planning to launch a pay load on a long journey to a planet, what type of light weight propulsion system would you suggest for the payload for its course correction? Explain the propulsion system. [16]
6. Describe the bleed burn cycle for employing thrurst augmentation. [16]
7. A ramjet engine operates at M = 1.5 at an altitude of 6.5 km. The diameter of the inlet diffuser at entry is 0.5 m and the stagnation temperature at the nozzle entry is 1600 K. The calorific value of the fuel used is 40 $MJkg^{-1}$. The properties of the combustion gases are same as those of air, i.e. $\gamma = 1.4$, R = 287 J $kg^{-1}K^{-1}$. The velocity of air at the diffuser exit is negligible. Assuming, Assuming the efficiency of diffuser combutionchamber and nozzle as 0.9, 0.98 and 0.96 respectively.
   the following:
   (a) Efficiency of the ideal cycle
   (b) Fuel-air ratio
   (c) Diffuser pressure ratio
   (d) Propulsive efficiency
   (e) Nozzle pressure ratio
   (f) Nozzle jet Mach number
   (g) Thrust produced
   (h) Air flow rate. [16]

8. Write short notes on the following aspects related to turbine blade failure:
   (a) Gerber's Curves
   (b) Creep curves. [8+8]

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Code No: 07A62103 **R07** **Set No. 4**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE PROPULSION-II
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. With the help of a diagram explain a typical ion propulsion system. What are the sources of losses in the system and how they are prevented? [16]

2. (a) Define Effective jet Mach number for a ramjet engine and derive the relationship for it.
   (b) Write a short note on External Drag of ramjet engine. [8+8]

3. (a) Explain the salient features of a solid rocket motor with the help of a suitable diagram.
   (b) Explain the following with respect to the solid propellant rocket motor:
      i. Relationship between the burning rate and chamber pressure.
      ii. Relationship between the burning rate and temperature. [8+4+4]

4. Following data refers to a single stage turbine:
   Mass flow, m = 20 kgs^{-1}
   Isentropic efficiency, $\eta t = 0.89$
   Inlet temperature, T_{01} = 1100 K
   Temperature drop, (T_{01} - T_{03}) = 145 K
   Inlet pressure, p_{01} = 4 bar
   Flow coefficient, $\Phi = 0.8$
   Swirl angle,$\alpha_3 = 10^0$
   Nozzle efflux angle, $\alpha_2 = 58^0 23'$
   Mean blade speed, U_m = 340 ms^{-1}
   Rotational speed, N = 250 rev s^{-1}
   Draw the velocity diagram. Calculate blade height and blade tip/root radius ratio at the nozzle inlet, nozzle exit, and rotor exit stations, 1, 2 and 3 respectively. [16]

5. Explain the injector configurations in liquid motors and their flow characteristics. [16]

6. Write detailed notes on the various losses incurred by the chosen cooling process and their effect on the turbine cycle efficiency. [16]

7. Explain briefly what is meant by
   (a) Hypergolic propellants.
   (b) UDMH
   (c) RFNA

(d) Gelled propellants. [4+4+4+4]

8. What is the importance of thrust vector contral in figher aircraft. Discuss the methods emplyoed. [16]

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Code No: 07A62103 **R07** **Set No. 1**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE PROPULSION-II
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the solid propellant grain design considerations and the features of various grain configurations. [16]

2. With the help of neat sketches, explain in detail the various methods of blade cooling. Further, explain how does the performance of a gas turbine is affected by cooling of the blades? [16]

3. Define and derive the relationship for gross thrust coefficient of a ramjet engine. Explain the behavioural characteristics of gross thrust coefficient with the related parameters with the help of plots for a fixed geometry ramjet engine. [16]

4. Mention the various advanced propulsion systems and describe the principle of electric propulsion. [16]

5. (a) Differentiate between total impulse and specific impulse.
   (b) Describe the over expanded and under expanded nozzle. [8+8]

6. A multi-stage gas turbine is to be designed with impulse stages, and is to be operated with an inlet pressure and temperature of 6 bar and 900 K respectively and an outlet pressure of 1 bar. The isentropic efficiency of the turbine is 85%. All the stages are required to have a nozzle outlet angle of 15^0. Also, they have equal outlet & inlet blade angles and equal inlet & outlet nozzle angles. Mean blade speed is equal to $250 ms^{-1}$. Assuming Cp = 1.15 $kJkg^{-1}s^{-1}$ and $\gamma = 1.333$, estimate the number of stages required. [16]

7. Explain the engine cycle for turbo pump feed liquid propellants. [16]

8. Explain the function of two nozzles employed for supersonic aircraft concorde.[16]

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Code No: 07A62103 **R07** **Set No. 3**

III B.Tech II Semester Examinations,APRIL 2011
AEROSPACE PROPULSION-II
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Compare the performances of chemical, Nuclear and electro dynamic rockets and discuss their application. [16]

2. What do you understand by Thrust Augmentation and why is it required? Explain various possible methods of achieving Thrust Augmentation. [16]

3. (a) Define 'Effective jet Mach number' for a ramjet engine and derive the relationship for it.
   (b) Write a detailed note on 'variable geometry ramjet engine'. [8+8]

4. In a single-stage impulse turbine the nozzle discharges the fluid on to the blades at an angle of 25^0 to the plane of rotation and the fluid leaves the blades with an absolute velocity of $300 ms^{-1}$ at an angle of 120^0 to the direction of motion of the blades. If the blades have an equal inlet and outlet angles and there is no axial thrust, estimate the blade angle, power produced per kgs^{-1} of the fluid. [16]

5. What is the advantage of using cryogenic propellants in liquid rockets? Mention the typical cryogenic propellants and their applications. What are the precautions taken while handling them? [16]

6. Describe the various factors considered for the design of a rocket. [16]

7. Discuss in detail about the quasi-steady and periodic fluctuating type of stresses acting on a conventional turbine blade, which could lead to crack initiation and eventual failure of the blade. [16]

8. Write notes on the following with respect to the solid propellant rocket motor:
   (a) Rocket motor case
   (b) Igniters. [8+8]

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