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

III B.Tech II Semester Regular/Supplementary Examinations,May 2010
Aerospace Propulsion - II
Common to Aeronautical Engineering, Metallurgy And Material Technology
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. What is an equilibrium diagram and explain with neat sketches the method of finding the equilibrium points. [16]

2. What do you understand by thrust vector control? Explain in detail the various methods to control the thrust vector of a solid rocket motor. [16]

3. (a) What factors do affect the efficiency of an axial flow turbine and how?
   (b) Differentiate between an axial flow and radial turbine. [8+8]

4. Describe the principles of electro static thrusters and the ionization schemes used there in. [16]

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

6. Write short notes on the following with respect to the liquid propellant rocket motor:
   (a) Gelled propellants
   (b) Cold gas propellants
   (c) Safety and environmental concerns regarding liquid rocket motors.
   (d) Regenerative cooling. [4+4+4+4]

7. A ramjet is to propel an aircraft at Mach 3 at high altitude where the ambient pressure is 8.5 kPa and the ambient temperature T_a is 220 K. The turbine inlet temperature T is 2540 K. If all components are ideal, i.e. frictionless determine the following:
   (a) The thermal efficiency
   (b) The propulsion efficiency
   (c) The overall efficiency

   Let the specific heat ratio (γ) be 1.4 and fuel-to-air ratio, f = 0.03. [16]

8. Mention the factors considered for material selection of motor casing of a solid propellant motor? Explain the various materials used for same. [16]

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

III B.Tech II Semester Regular/Supplementary Examinations,May 2010
Aerospace Propulsion - II
Common to Aeronautical Engineering, Metallurgy And Material Technology
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the progressive, regressive and neutral burning of propellant grain of a solid propellant rocket motors, with thrust vs. time variation graphs. Show the various geometries of grains. [16]

2. How the nuclear power can be used for propulsion? Explain the difference between nuclear fission and fusion. [16]

3. What is meant by an operating line? What are the assumptions involved in the determination of an operating line? [16]

4. What are the various assumptions made while analyzing an ideal ramjet engine? Explain the conditions occurring at the exit of diffuser section and combustion chamber. [16]

5. 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 gas angles. Mean blade speed is equal to 250ms^{-1}. Assuming Cp = 1.15 kJkg^{-1}s^{-1} and $\gamma = 1.333$, estimate the number of stages required.
[16]

6. Explain the propellant feed systems used in liquid propulsion rockets and compare them. [16]

7. The data for a rocket engine is given below:
Thrust coefficient = 1.2
Propellant flow rate = 20 kg/s
Combustion chamber pressure = 15 x 10^5 N/m^2
Exhaust nozzle throat diameter = 5 cm
From the above data compute the velocity of thrust, specific impulse, effective jet velocity and characteristics velocity. [16]

8. Explain about thrust vectorcontrolling in VTOL. [16]

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

III B.Tech II Semester Regular/Supplementary Examinations,May 2010
Aerospace Propulsion - II
Common to Aeronautical Engineering, Metallurgy And Material Technology
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive a relationship for the overall efficiency of an ideal ramjet engine.
   (b) How actual ramjet engine cycle deviates from an ideal ramjet engine cycle? [8+8]

2. Explain the various components of a typical large liquid propellant rocket used for a space mission, with help of a diagram. [16]

3. (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]

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

5. Discuss the thrust augmentation by water-alchoal injection method. Draw T-S diagram. [16]

6. Explain briefly the meanings of following terms
   (a) Booster rocket stage.
   (b) Retro rockets.
   (c) Sustainer stage.
   (d) Earth satellite. [4+4+4+4]

7. write short notes on :
   (a) Photon propulsion
   (b) Free radical propulsion
   (c) Nuclear fusion
   (d) Problems associated with plasma jet propulsion. [4+4+4+4]

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

III B.Tech II Semester Regular/Supplementary Examinations,May 2010
Aerospace Propulsion - II
Common to Aeronautical Engineering, Metallurgy And Material Technology
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Define total and specific impulse of rockets. Explain the significance of specific impulse. [16]

2. Write short notes on the following:
   (a) Internal and external air cooling of turbine blades
   (b) Internal and external liquid cooling of turbine blades. [8+8]

3. Explain the working principle of solor soil. [16]

4. (a) Explain the selection criteria for liquid propellants considering the following factors:
      i. Economic factors
      ii. Physical properties.
      iii. Ignition and flame properties.
   (b) Write a note on 'liquid monopropellants'. [8+8]

5. (a) What are the various problems that come across while designing a supersonic diffuser for a ramjet engine and how these problems can be reduced/eliminated?
   (b) Write a detailed note on 'variable geometry ramjet engine'. [8+8]

6. What are the selection criteria of solid propellants? How their properties are characterized? [16]

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

8. For a free vortex based design of a gas turbine show that
   $r\,C_{a2}\,\tan\,\alpha_2 = constant$
   where 'r' is the radius of the blade at any point from its root to tip, 'C_{a2}' is the axial velocity at the mean diameter of the blade, 'α_2' is the air angle at the exit angle of the nozzle blade at its mean diameter. [16]

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