

Code No: 07A62103

R07**Set No. 2**

III B.Tech II Semester Examinations, December 2010
AEROSPACE PROPULSION-II
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

1. (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]
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 is the effect of pitch on the blade root fixing?
(b) Write a note on turbine blade cooling methods. [8+8]
4. Explain the propellant feed systems used in liquid propulsion rockets and compare them. [16]
5. Explain the various modes of propellant graining in the case of solid propellant rocket. [16]
6. (a) What are the salient features of re-entry vehicles?
(b) Write notes on the following:
 - i. Space shuttle
 - ii. Multistaging. [8+4+4]
7. Write short notes on the following:
 - (a) Dimensional analysis and its application in generating turbine characteristics.
 - (b) Equilibrium running lines [8+8]
8. 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]

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R07**Set No. 4**

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

Answer any FIVE Questions
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1. Compare various methods available for thrust augmentation. Explain the reheating method in detail. What are its advantages and disadvantages? [16]
2. Describe the concept of solid-core reactor with the help of a schematic diagram. [16]
3. What is meant by an operating line? What are the assumptions involved in the determination of an operating line? [16]
4. 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° . Also, they have equal outlet & inlet blade angles and equal inlet & outlet gas angles. Mean blade speed is equal to 250 ms^{-1} . Assuming $C_p = 1.15 \text{ kJ kg}^{-1} \text{ s}^{-1}$ and $\gamma = 1.333$, estimate the number of stages required. [16]
5. (a) What are the advantages and disadvantages of Integral Ram-rocket over a simple ramjet engine? What are the applications of an Integral ram-rocket?
 (b) Write a short note on the development of SCRAMJET. [10+6]
6. A rocket nozzle has a throat area of 18 cm^2 and combustion chamber pressure of 25 bar. If the specific impulse is 127.42 seconds and Weight flow rate 44.145 N/s . determine
 (a) The thrust coefficient,
 (b) Propellant weight flow coefficient,
 (c) Specific propellant consumption, and
 (d) The characteristic velocity. [16]
7. Write notes on the following with respect to the solid propellant rocket motor:
 (a) Rocket motor case
 (b) Igniters. [8+8]
8. Explain the construction of "Thrusters" and their design features. Where they are used? [16]

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R07**Set No. 1**

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1. Identify the components of a solid propellant rocket motors with a sketch. Explain briefly the components. [16]
2. What are the characteristics of liquid propellants and the types of liquid propellants. Give the examples of each. [16]
3. (a) Explain the following with respect to a rocket motor:
 - i. Impulse to weight ratio
 - ii. Total impulse.
 (b) Differentiate between a rocket and a missile. [4+4+8]
4. Compare the compressor and turbine characteristics with the help of relevant diagrams. [16]
5. How do you estimate gas bending stresses in a rotor blade? [16]
6. Describe the bleed burn cycle for employing thrust augmentation. [16]
7. Describe the principles of electro magnetic thrusters and the ionization schemes used there in. [16]
8. 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 MJ kg^{-1} . The properties of the combustion gases are same as those of air, i.e. $\gamma = 1.4$, $R = 287 \text{ kJ kg}^{-1} \text{K}^{-1}$. The velocity of air at the diffuser exit is negligible. Assuming, $\eta_D = 0.90$, $\eta_B = 0.98$, $\eta_j = 0.96$, stagnation pressure loss in the combustion chamber $= 0.002 p_{02}$, calculate 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

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(g) Thrust produced

(h) Air flow rate.

[16]

FIRSTRANKER

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R07**Set No. 3**

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Answer any FIVE Questions
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1. Compare the solid propulsion systems with liquid propulsion systems and mention their comparative advantages and usage. [16]
2. Write a short note on the following:
 - (a) Matching of compressor and turbine
 - (b) Blade cooling methods. [8+8]
3. What are the design considerations of a propellant grain of a solid propellant rocket motor? [16]
4.
 - (a) Explain the principle of afterburner in thrust augmentation.
 - (b) Explain the distinct features, advantages, and disadvantages of the following with respect to solid rocket motor:
 - i. Jetavators
 - ii. Moveable nozzle (ball/socket/gimbal ring) [8+8]
5.
 - (a) Differentiate between total impulse and specific impulse.
 - (b) Describe the over expanded and under expanded nozzle. [8+8]
6. Explain the significance of flow coefficient and blade loading coefficient with the help of $\Psi - \Phi$ diagram for a 50% reaction turbine stage. [16]
7. Discuss the advantages and disadvantages of scramjet. [16]
8. Explain the ideal flight performance of a low thrust electric propulsion system. [16]
