

IV B.Tech I Semester Supplementary Examinations, November 2005
SPACE TECHNOLOGY
(Aeronautical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the salient features of a liquid propellant rocket with the help of a neat diagram. What are its areas of application? [10]
 (b) Define the following terms: [2x3]
 - i. Specific propellant consumption
 - ii. Mass Ratio
 - iii. Specific power.
2. A rocket projectile has the following characteristics: [16]
 Initial weight = 200 lb
 Weight after rocket operation = 130 lb
 Payload, non-propulsive structure etc=110 lb.
 Rocket operating duration=3.0 sec
 Average specific impulse of propellant = 240 sec.
 Determine mass ratio, propellant mass fraction, propellant flow rate, thrust, specific propellant consumption, thrust to weight ratio, acceleration of vehicle, effective exhaust velocity, total impulse, specific power and the impulse-to-weight ratio.
3. (a) Show that burnout velocity of a single stage motor rocket moving vertically is given by $V_b = g I_{sp} \ln \left(\frac{m_o}{m_o - m_f} \right)$ where m_o is initial mass of the missile, m_f is mass of the fuel and I_{sp} is the specific impulse. State any assumptions, if made. [8]
 (b) What is multistaging? why is it employed? Which factors decide the number of stages for a given vehicle? [8]
4. For a cruciform type of missile discuss [5+6+5]
 - (a) Causes of induced roll
 - (b) Design consideration for lateral control
 - (c) Damping in roll.
5. (a) What are the various types of drag involved in missiles and how performance is affected by them? [10]
 (b) Write a note on 'Free flight dispersion'. [6]
6. (a) Discuss briefly the solar system. [8]
 (b) What are the modifications made by Newton to Kepler's laws of planetary motion. [8]

7. (a) How does the flat turn maneuvers differ for cruciform missile and monowing vehicle. [8]
- (b) A surface to surface missile, achieves burnout velocity ' V_b' ' at an altitude of ' h_b' ' with a flight path angle of ' γ_b' '. Obtain an expression for the range covered by the missile. State assumptions if any. [8]
8. Write notes on any four of the following: [4+4]
- (a) Various types of forebody shapes
 - (b) Launching problems
 - (c) Cryogenic engines
 - (d) A typical two body problem
 - (e) Spin stabilization
 - (f) Problems associated with re-entry.

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