Entrance Exam Topics for Candidates Applying to the Master's Degree Programs in Space Technologies
Academic Year 2025/2026

1. Basics of Orbital Motion
   - Understanding Orbital Mechanics:
     • Why satellites stay in orbit and don't fall to Earth or drift away.
     • The role of gravity and motion in maintaining orbital paths.
   - Types of Orbits and Their Applications:
     • Low Earth Orbit (LEO), Geostationary Orbit, and Polar Orbits.
     • Uses in weather monitoring, GPS, and communications.
   - Principles of Motion in Space:
     • How speed and altitude affect a satellite's trajectory.
     • Why objects closer to Earth move faster in orbit.
   - Orbital Transfers:
     • Basic principles of how spacecraft change orbits.

2. Space Environment
   - Unique Conditions in Space:
     • Vacuum, extreme temperatures, and radiation.
     • Effects of microgravity on materials and biological systems.
   - Radiation in Space:
     • Sources of radiation (solar and cosmic).
     • Protection strategies for spacecraft and astronauts.
   - Space Debris:
     • Definition and causes.
     • Risks to satellites and space missions.

3. Spacecraft Basics
   - Satellite Components and Functions:
     • Solar panels, antennas, and onboard systems.
     • Roles in communication, navigation, and Earth observation.
   - Power Systems:
     • Use of solar panels and batteries.
     • Challenges in energy generation and storage.
   - Materials for Spacecraft:
     • Specialized materials for thermal and radiation protection.

4. Earth and Space Observations
- Earth Monitoring:
  • Climate, weather, and natural disaster tracking.
  • Contributions to agriculture, navigation, and communication.
- Planetary Exploration:
  • Missions to Mars, the Moon, and other celestial bodies.
  • Insights from Perseverance Rover, Artemis program, etc.
- Space Telescopes:
  • Role of Hubble and James Webb in studying the universe.

5. Practical Problem-Solving in Space
- Mission Challenges:
  • Handling power loss or trajectory changes.
  • Engineering solutions during space missions.
- Human Space Travel:
  • Physical and psychological challenges of long-duration missions.
- Mission Planning:
  • Balancing time, resources, and risks.

6. Global Importance of Space Exploration
- Benefits for Earth:
  • Applications in communication, navigation, and research.
- International Collaboration:
  • Joint missions like the International Space Station (ISS).
  • Treaties and regulations for peaceful exploration.
- Sustainability in Space:
  • Addressing space debris and orbital cleanup efforts.

7. Foundations of Astronomy and Space Science
- The Solar System:
  • Key facts about planets, moons, and celestial bodies.
  • Focus on Mars and the Moon as exploration targets.
- Rocket Science:
  • Principles of launching rockets and deploying satellites.
  • Challenges of reaching and operating in space.
- Gravity Beyond Earth:
  • How gravity functions on the Moon, Mars, and other bodies.

8. Foundations of Cell Biology and Biochemistry
- Chemical Elements of Life:
  • Essential elements and their biological roles.
- Biological Macromolecules:
  • Functions of proteins, DNA, and other macromolecules.
- Molecular Biology:
  • Central dogma: DNA → RNA → Protein.
  • Enzymes as catalysts and hormones as messengers.
- Cell Structure:
  • Prokaryotic vs. eukaryotic cells.
  • Organelles and their functions.

9. Human and Animal Physiology
- Overview of Organ Systems:
  • Musculoskeletal, Cardiovascular, Respiratory, Nervous, Immune, Endocrine, Digestive, and Reproductive systems.

10. Space Environment and Space Biology
- Biological Impact of Space:
  • Effects of microgravity and radiation on cells and organisms.
  • Relevance to astronaut health and space medicine.

11. Planetary Habitability
- Astrobiology Fundamentals:
  • Definition of habitable zones and influencing factors.
  • Icy worlds and extremophiles.
  • Importance of water in the search for life.
  • Overview of exoplanet discoveries.

12. Critical Thinking and Teamwork Skills
- Collaboration in Space Missions:
  • Importance of teamwork and communication.
  • Problem-solving among engineers and scientists.
- Decision-Making Under Pressure:
  • Simulated scenarios and emergency responses.
- Ethics in Space Exploration:
  • Debates on asteroid mining and planetary colonization.
  • Balancing science with environmental and ethical concerns.

13. Logical and Analytical Thinking
- Data Interpretation:
  • Analyzing satellite imagery and planetary data.
- Problem Solving:
  • Calculations for travel time and satellite speeds.
- Strategic Planning:
  • Designing space missions within budget and time constraints.

14. Broader Impacts of Space Exploration
- Space Technologies in Daily Life:
  • Spin-offs like GPS, advanced materials, and medical innovations.
- Future of Space Exploration:
  • Prospects for Moon bases, Mars missions, and private space ventures.