



# INSTITUTE OF AERONAUTICAL ENGINEERING

Dundigal, Hyderabad -500 043

## DEPARTMENT OF AERONAUTICAL ENGINEERING

### TUTORIAL QUESTION BANK

<b>Course Title</b>	<b>INTRODUCTION TO SPACE TECHNOLOGY</b>			
<b>Course Code</b>	<b>A42106</b>			
<b>Academic Year</b>	<b>2016-2017</b>			
<b>Course Structure</b>	<b>Lectures</b>	<b>Tutorials</b>	<b>Practical's</b>	<b>Credits</b>
	5	-	-	4
<b>Team of instructors</b>	<b>C.Satya Sandeep</b>			

#### **OBJECTIVES:**

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S.No	Question	Bloom Taxonomy level	Course outcomes
<b>UNIT-I</b>			
<b>FUNDAMENTALS OF ROCKET PROPULSION</b>			
<b>PART A (Short answer type questions)</b>			
1	Write a short note on space environment	Knowledge	1
2	What is gravity turn trajectories	Understand	1
3	Write a short note on launch vehicle	Knowledge	2
4	Explain 2D equations for rockets and missiles	Understand	1
5	Write a short note on rocket propulsion	Knowledge	1
6	Write a short note on Aerospace plane	Knowledge	9
7	Write a short note on solid propulsion	Understand	9
8	Write a short note on liquid propulsion	Knowledge	5
9	Write a short on Planetary and lunar Explorers.	Knowledge	8
10	Write a short note on solid propellants	Understand	1
11	Write a short note on liquid propellants	Apply	1
12	Write a short on Planetary and lunar Explorers.	Understand	2

13	Explain Rocket equation.	Apply	2
14	Write classification of space propulsion engines.	Apply	1
15	What are the advantages of liquid propulsion over Solid rocket propulsion?	Apply	2
16	What is meant by specific impulse	Apply	3
17	What are the advantages of staging	Knowledge	1
<b>PART B (Long answer type questions)</b>			
1	Write a detailed note on space mission using an example.	Knowledge	7
2	Explain in detail about Solid Rocket propulsion.	Understand	7
3	Explain the necessity of Launch Vehicle Satellite criteria in space technology.	Apply	5
4	Explain briefly about different propulsion systems in launching.	Understand	6
5	Explain Basic configuration of Liquid propellant rocket system using neat sketches.	Understand	1
6	Explain Multi-stage Rocket system.	Knowledge	4
7	A rocket of total mass 100 tonnes carrying a spacecraft of 5 tonne and engine develop a constant exhaust velocity of 3500m/s. The structural mass is assumed to be 15% of the total mass. Calculate final velocity of rocket.	Apply	2
8	Explain Injection process in Liquid propellant rocket system.	Understand	3
9	Write a detail note on Van Allen belts.	Apply	1
10	Explain briefly about birth of sun.	Knowledge	9
11	Write about necessary of cooling in liquid-fuelled rocket engines.	Knowledge	1
12	Explain gravity turn trajectories.	Knowledge	1
13	Write a short note on sun	Knowledge	1
14	Explain about nebula	Apply	1
15	What are the requirements of space exploration	Apply	2
<b>PART C (Critical questions)</b>			
1	Write about the propellants of solid propulsion	Knowledge	1
2	Write a note on rocket equation	Knowledge	1
3	Explain the importance of specific impulse	Knowledge	1
4	Explain about the injection techniques in liquid rocket motor	Apply	1
5	Discuss about modern space propulsion techniques	Apply	2

**UNIT-II**  
**ATMOSPHERIC RE-ENTRY**

**PART A (Short answer type questions)**

1	What is Atmospheric reentry?	Knowledge	1
2	Explain different types of reentry vehicles	Understand	1
3	Explain the concept of Aero- braking	Understand	1
4	Explain the concept of Aero- capture	Knowledge	2
5	Explain the concept of Aero- assist	Knowledge	2
6	What is Re-entry vehicle and explain different types.	Apply	5
7	What factors influence the design of reentry mission	Apply	5
8	What is meant by double dip reentry	Knowledge	4
9	What is meant by skip reentry	Knowledge	4
10	Compare skip and double dip reentry	Differentiate	5

**PART B (Long answer type questions)**

1	Derive an expression for Skip re-entry.	Knowledge	1
2	Derive an expression for Double-dip Re-entry.	Apply	3
3	Derive an expression for Lifting body re-entry.	Knowledge	3
4	Write difference between lifting body and ballistic re-entry vehicles.	Apply	1
5	What is Ascent and Descent of entry vehicle	Understand	2
6	Write a brief note on Aero-braking	Understand	2
7	Write a brief note on Aero-capture	Understand	3
8	Write a notes on Steep Ballistic re-entry	Understand	1
9	Explain the anatomy of a about a reentry capsule	Knowledge	3
10	Discuss on advantages disadvantages of steep skip and double dip reentry	Differentiate	4

**PART C (Critical questions)**

1	Differentiate between Ballistic entry and lifting entry	Understand	1
2	Discuss about the temperatures generated during reentry	Understand	2
3	Give some practical examples of double dip and skip reentry	Understand	2
4	Explain the advantages of aero braking	Understand	3
5	Describe about aero capture.	Knowledge	1

**UNIT-III**  
**FUNDAMENTALS OF ORBITAL MECHANICS, ORBITAL MANUEVERS**

**PART A (Short answer type questions)**

1	Explain the concept of Two body motion.	Knowledge	1
2	Write different types of orbits.	Knowledge	1
3	Explain basic orbital elements.	Knowledge	2

4	How Ground traces are useful in Orbital mechanics	Knowledge	3
5	Write a short note on Augment of Periapsis	Knowledge	3
6	Write a short note on Inclination	Knowledge	2
7	Explain why spacecraft Ground tracks are used.	Knowledge	2
8	Write Different types of orbits used in ground tracks with neat sketches.	Understand	6
9	Describe how propulsion for maneuvers technique used in space condition	Knowledge	8
10	Write a note on conic type of elements	Apply	1
<b>PART B (Long answer type questions)</b>			
1	Derive an equation in terms of velocity at any point on a Circular orbit under two body motions?	Apply	1
2	Explain how to use a plane change combined maneuver, with an example?(with neat sketch)	Understand	1
3	Derive an equation in terms of velocity at any point on an Elliptical orbit under two body motions.	Knowledge	1
4	Describe Spacecraft ground tracking system and explain the process for rotating and non- rotating earth types. Describe plane changing process involve in bi-elliptical transfer?	Understand	1
5	Describe Spacecraft ground tracking system and explain the process for rotating and non- rotating earth types. Describe plane changing process involve in bi-elliptical transfer?	Understand	1
6	Explain briefly about the basic Orbital elements	Discuss	2
7	Discuss briefly about in-plane Orbit Changes	Knowledge	2
8	Explain about the Hohman Transfer	Knowledge	4
9	Explain about the propulsion for Maneuvers	Explain	4
10	Derive orbit equation	Apply	4
11	Write a short notes on bi elliptical change	Knowledge	2
12	Explain combined plane changes	Knowledge	3
13	Write about hyperbolic orbits	Knowledge	4
<b>PART C (Critical questions)</b>			
1	What is the purpose of a two body problem	Knowledge	1
2	Sketch and explain orbital elements	Understand	2
3	Discuss about the ground trace	Understand	2
4	Discuss some practical propulsion maneuvers	Knowledge	3
5	According to your knowledge which is the optimum orbital transfer. Support your theory.	Understand	1
<b>UNIT 4</b>			
<b>SATELLITE ATTITUDE DYNAMICS</b>			

<b>PART A (Short answer type questions)</b>			
1	Write a short note on YO-YO mechanism.	Knowledge	1
2	Write a short note on momentum-control devices	Understand	2
3	Explain the concept of spacecraft attitude sensors.	Understand	2
4	Write a short note on attitude determination	Knowledge	3
5	Explain the concept of types of stabilizations used.	Understand	6
6	Write a short note on stabilization of a spacecraft	Understand	6
7	How thrusters are used in space craft spinning technology.	Knowledge	4
8	Explain the concept of Momentum wheels used in space crafts	Knowledge	2
9	What are the advantages of yo yo mechanism	Understand	3
10	What is gravity gradient satellite	Knowledge	3
<b>PART B (Long answer type questions)</b>			
1	Briefly describe the phenomena of Torque free axis symmetric rigid Body	Knowledge	3
2	Write about the Attitude Control for Spinning Spacecraft's	Understand	4
3	Explain Attitude control for Non-Spinning spacecraft's	Understand	3
4	Explain Yo-Yo Mechanism	Knowledge	5
5	Describe the Gravity Gradient satellite	Understand	3
6	Explain the Dual spin Spacecraft-attitude determination	Understand	4
7	State the applications of Yo-Yo mechanism	Knowledge	4
8	Write down the applications and advantages of dual spin spacecraft altitude determination	Knowledge	3
9	Explain how spacecraft altitude control is achieved	Understand	4
10	Differentiate the parameters of spinning and non-spinning aircrafts	Differentiate	5
<b>PART C (Critical questions)</b>			
1	Examine about magnetic torques used in attitude Control of spacecraft stabilization.	Knowledge	4
2	Explain how spacecraft attitude sensors used in attitude determination	Knowledge	3
3	Examine about thrusters used in attitude control of spacecraft stabilization?	Understand	4
4	Explain Yo-Yo mechanism with equations	Differentiate	5
5	Explain the best method for spacecraft altitude determination	Knowledge	4

<b>UNIT 5</b>			
<b>SPACE MISSION OPERATIONS</b>			
<b>PART A ( Short answer type questions)</b>			
1	Prepare note on Operational engineering support	Knowledge	7
2	Prepare note on Tracking network	Explain	8
3	Classify various types of ground supporting systems in space operation	Understand	9
4	Explain MOC	Knowledge	7
5	Explain POC	Explain	7
6	Differentiate between MOC and POC	Understand	8
7	Write a note on operational engineering support	Knowledge	9
8	Explain high level space mission operations architecture	Explain	7
9	What is Mission? How concept involved in mission classification.	Understand	8
10	Explain the difference between Core team and mission team responsibilities.	Knowledge	7
<b>PART B (Long answer type questions)</b>			
1	Sketch and explain the supporting ground system architecture	Knowledge	5
2	Explain the mission phases of a spacecraft	Explain	4
3	Clearly discuss the team responsibilities during a space missions	Understand	2
4	Explain about the Mission diversity	Knowledge	4
5	What are the core operations in a spacecraft	Knowledge	2
6	Explain the Standard operations and practices	Explain	5
7	Discuss about the team interfaces in a space vehicle	Understand	3
8	What is operational engineering support and explain briefly the requirement of it.	Knowledge	4
9	Write a brief note on Tracking network.	Knowledge	5
10	What are Standard operations in MOC and POC	Explain	3
<b>PART C (Critical questions)</b>			
1	Prepare note on Operational engineering support.	Understand	3
2	Discuss about ground support for space usage	Knowledge	4
3	Describe the main parts of a space shuttle	Knowledge	5
4	How coordination in different teams is achieved	Explain	3
5	Discuss the anatomy of a space mission	Understand	3

**Prepared by**

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