

# 20-DAYS ROCKETRY



## Executive Summary

This report presents a structured 20-day online rocketry course designed for learners from Grade 8 and above, with no upper age limit. The program offers a comprehensive introduction to rocketry and space technology, combining foundational theory with practical, hands-on learning. Participants will explore key aspects of rocket design, propulsion systems, materials, safety protocols, and operational procedures, culminating in the construction and launch of a high-performance model rocket.

The curriculum leverages insights from advanced aerospace training programs to deliver a robust and engaging educational experience that enhances problem-solving skills and fosters a deep appreciation for STEM principles. To further enrich learning, students will have the opportunity to apply their knowledge at a dedicated rocket lab and launch facility located on a 0.5-acre site in Bidadi, Karnataka.

Upon successful completion of the course, participants will be awarded two certificates, one recognizing the completion of the program and another acknowledging their active participation in the rocket launch event empowering them with both theoretical understanding and practical experience in aerospace technology.



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## Introduction

This document details the 20-day online rocketry course, tailored to provide an in-depth educational experience centered around a specific high-performance model rocket. The course aims to equip participants with the knowledge and skills necessary to understand advanced model rocketry, from fundamental principles to practical assembly and operational considerations. The content is informed by real-world training insights, ensuring a professional and comprehensive curriculum that bridges theoretical concepts with tangible applications.

## Course Goal

To provide students from Grade 8 to any age with a foundational understanding of rocketry and space technology, specifically through the lens of a high-performance model rocket, fostering an appreciation for STEM principles, critical thinking, and problemsolving skills.

## Overall Course Outcomes

Upon successful completion of this 20-day program, participants will be able to: Understand the basic principles of rocketry and satellite technology, with a focus on high-performance model rocket dynamics. Identify key components of advanced model rockets and their functions, including specialized propulsion systems. Apply fundamental physics concepts related to flight and orbital mechanics to real-world rocketry scenarios. Engage in hands-on activities, including model rocket construction and basic satellite design concepts, emphasizing precision and safety. Develop an appreciation for the history and future of space exploration, contextualized by modern rocketry advancements. Enhance problem-solving and critical thinking abilities through analysis of rocket performance and design considerations. Collaborate effectively in a team environment, simulating real-world engineering challenges

## Model Rocket Specifications

The course will focus on a specific model rocket with the following key design details



### CHARACTERISTIC

### VALUE

Approximate Height

1.77 meters

Approximate Weight

12 Kg

Motor Class

Upper L Class

Propellant

KNSU

Target Apogee

2 km

Maximum Thrust

2,600 N

This rocket serves as a practical case study throughout the course, allowing participants to apply theoretical knowledge to a tangible, high-performance system.

# Daily Breakdown and learning outcomes

## Week 1

### Introduction to Rocketry

#### Day 1

##### History of Rocketry & Space Exploration

Trace the incredible journey of rocketry from ancient Chinese fire arrows to the era of reusable SpaceX rockets. Learn about visionaries like Tsiolkovsky, Goddard, and Von Braun who laid the foundation for space travel. Understand how global competition during the Space Race led to monumental milestones such as the Moon landing and the ISS.

#### Day 2

##### Basic Physics of Flight

Discover how the four forces—thrust, drag, gravity, and lift—work together to make rockets soar. Conduct simple experiments to visualize these forces in action. Understand Newton's laws of motion and how they govern every

#### Day 3

##### Rocket Components & Functions

Explore the anatomy of a rocket, including the nose cone, body tube, fins, and recovery system. Learn how each part contributes to aerodynamics, stability, and flight success.

#### Day 4

##### Stability: Centre of Gravity & Pressure

Understand how the Centre of Gravity (CG) and Centre of Pressure (CP) determine a rocket's stability in flight. Discover why correct fin placement and shape are critical for balanced motion. Reinforce concepts through hands-on paper rocket experiments and stability tests.

#### Day 5

##### Introduction to Rocket Construction

Get introduced to model rocket kits, materials, and essential construction tools. Learn about the importance of precision and alignment before starting your build. Emphasize safety

# Week 2

## Building & Launch



### Day 6

#### Building Rocket Part 1 (Motor & Fins)

Begin constructing your rocket by assembling the motor mount and attaching fins with accurate alignment. Learn how even minor misalignment affects flight stability and thrust direction. Gain hands-on experience in working with adhesives and structural



### Day 7

#### Building Rocket Part 2 (Nose Cone & Recovery)

Attach the nose cone and integrate the parachute-based recovery system into your rocket. Learn how recovery mechanisms prevent rocket damage upon landing. Test the smooth deployment of the parachute to ensure reliability during launch.



### Day 8

#### Safe Launch Procedures & Range Safety

Understand every step of a safe launch, including igniter wiring, launch pad setup, and pre-flight inspection. Learn how to maintain a secure distance, communicate on range, and handle misfires responsibly. Safety remains the top priority during all field operations.



### Day 9

#### Model Rocket Launch & Data Collection

Witness your rocket in action during a live or simulated launch session. Use onboard altimeters or tracking tools to collect altitude and performance data. Analyse flight results, identify possible errors, and discuss ways to improve rocket performance.



### Day 10

#### Introduction to Satellites

Transition from rockets to satellites by exploring their purpose and importance. Learn how satellites enable communication, navigation, weather forecasting, and Earth observation. Discover how they remain in orbit and the role rockets play in deploying them.

## Day 11

### Satellite Functions & Orbits

Study how satellites perform various tasks such as imaging, communication, and scientific monitoring. Understand the difference between LEO, MEO, and GEO orbits and how each serves unique purposes. Learn how rockets deliver satellites to these specific orbital paths.

## Day 12

### Satellite Components

Break down a satellite into its essential parts—solar panels, payload instruments, antennas, and computers. Understand the importance of each subsystem and how they interact for mission success. Explore real satellite case studies to connect theory with practice.

## Day 13

### Build a Simple Satellite Model

Design and build a small model satellite using easily available materials. Link each part of your model to a real-world subsystem like power or communication. This creative exercise builds understanding of engineering principles and design balance.

## Day 14

### Mission Concept & Design (Part 1)

Begin brainstorming ideas for a satellite mission with specific goals, such as environmental monitoring or disaster management. Define your satellite's purpose, target users, and potential impact. Collaborate with your team to turn ideas into a viable concept.

## Day 15

### Mission Concept & Design (Part 2)

Transform your conceptual mission into a basic design layout. Choose orbit types, decide payload instruments, and draft preliminary subsystem diagrams. Learn to think like aerospace engineers by balancing technical feasibility with real-world needs.



Satellite Technology  
Week 3

# Week 4

## Advanced Concepts & Presentation

### Day 16

#### Advanced Aerodynamics & Stability

Delve deeper into aerodynamics by studying drag types, fin efficiency, and aerodynamic heating during flight. Experiment with simulation software like OpenRocket to visualize rocket trajectories. Learn how small design tweaks can significantly influence flight performance.

### Day 17

#### Propulsion Systems & L-Class Motors

Explore the fundamentals of rocket propulsion, covering solid, liquid, and hybrid engines. Study the working principle of L-class motors and KNSU propellant used in your course rocket. Understand how burn rate and thrust curves define overall flight performance.

### Day 18

#### Multi-Stage Rockets & Advanced Recovery

Learn the concept of staging and how it allows rockets to reach higher altitudes and greater efficiency. Explore various recovery mechanisms, from dual-deployment parachutes to electronic tracking. Discuss real missions like Falcon 9 and Ariane 5 to see staging in action.

### Day 19

#### Satellite Subsystems in Detail

Dive into satellite engineering by exploring power, communication, thermal, and attitude control systems. Learn how these subsystems cooperate to keep satellites functional and oriented in space. Relate these concepts to your own mission design from Week 3.

### Day 20

#### Project Presentation & Course Review

Present your final satellite mission or rocket project before the group. Share what you've learned, from design and construction to launch and data analysis. Wrap up the course with feedback, reflection, and certification of your achievements.



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