High School Astronomy Syllabus

Course Title: Astronomy
Grade Level: 10-12
Prerequisites: Algebra I (Geometry or Algebra II recommended)
Instructor: Dr. Dicy
Email: TBD

Course Description

This course explores the **fundamental principles of astronomy**, including the motions of celestial bodies, the nature of stars and galaxies, the structure of the universe, and humanity's place in the cosmos. Topics will include planetary science, stellar evolution, cosmology, and space exploration. Students will engage in hands-on activities, data analysis, and observational projects using telescopes and online simulations.

The course is **conceptual and mathematical**, incorporating **basic algebra and scientific reasoning** but focusing on **understanding rather than complex calculations**.

Course Objectives

By the end of this course, students will be able to:

1. Explain the **motions of celestial objects** and how they relate to the night sky.
2. Describe the **life cycle of stars**, including their formation and end stages.
3. Understand the **structure and evolution of galaxies** and the universe.
4. Analyze data from telescopes, space missions, and astronomical surveys.
5. Discuss the latest **discoveries in exoplanets, black holes, and cosmology**.
6. Develop **critical thinking and scientific literacy** in space science.

Topics Covered

Unit 1: Introduction to Astronomy & The Night Sky

- History of Astronomy (Ancient Astronomy to Modern Science)
- The Celestial Sphere & Observing the Night Sky
- The Motion of the Sun, Moon, and Planets
- Seasons, Eclipses, and Lunar Phases

Unit 2: The Solar System

- Formation of the Solar System
- Planets, Moons, and Their Characteristics
- Asteroids, Comets, and Dwarf Planets
- Space Exploration & Missions (NASA, SpaceX, etc.)

Unit 3: Light and Telescopes

- Nature of Light and the Electromagnetic Spectrum
- How Telescopes Work (Optical, Radio, Space-Based)
- Observing Techniques and Data Collection

Unit 4: Stars and Stellar Evolution

- Properties of Stars (Temperature, Size, Luminosity)
- H-R Diagram and Stellar Classification
- Star Formation & Nuclear Fusion
- The Life Cycle of Stars (Main Sequence to Black Holes)

Unit 5: The Milky Way & Galaxies

- The Structure of the Milky Way Galaxy
- Different Types of Galaxies
- Supermassive Black Holes & Active Galactic Nuclei

Unit 6: Cosmology & The Universe

- The Big Bang Theory and Evidence for Expansion
- Dark Matter and Dark Energy
- The Fate of the Universe

Unit 7: Exoplanets & Astrobiology

- Methods of Exoplanet Detection (Transit, Radial Velocity)
- Habitability and the Search for Life
- The Drake Equation & SETI

Unit 8: Human Space Exploration & Future Missions

- The International Space Station & Mars Missions
- Future of Space Travel (Artemis Program, Starship, etc.)
- The Ethical and Scientific Implications of Space Colonization

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Grading Policy

- **Homework & Classwork**: 20%
- **Projects & Observational Labs**: 25%
- **Quizzes & Tests**: 30%
- **Participation & Engagement**: 10%
- **Final Project**: 15%

Late Work Policy: Assignments are due at the start of class unless otherwise specified. Extensions may be granted for extenuating circumstances.

Observational Activities & Labs

Hands-on activities are a **core component** of this course. Students will engage in:

- **Stargazing Nights** (Observing planets, constellations, and deep-sky objects)
- **Using Stellarium or Star Charts** to track celestial movements
- **Building and Using Simple Telescopes**
- **Spectroscopy Labs** to analyze the light from stars
- **Simulated Exoplanet Detection** (using real NASA datasets)

Materials Needed

- Notebook or Binder
- Scientific Calculator
- Access to Stellarium (Free Software) or Astronomy Apps
- Telescope Access (if available in the school)

Expectations & Classroom Policies

- Be respectful and engaged in discussions.
- Follow all safety procedures for telescope use and lab activities.
- Ask questions and participate in group projects.
- Stay curious—astronomy is an ever-evolving science!

Final Project

Students will complete an **independent research project** on a topic of their choice related to astronomy. This could include:

- A **research paper** on a black hole, exoplanet, or space mission

- A **model or experiment** demonstrating an astronomical principle
- A **night-sky observation journal** with detailed sketches and analysis

Projects will be presented in the final weeks of the course.

Additional Resources

- **Textbook**: A recommended high school-level astronomy textbook (or OpenStax Astronomy)
- **Online Tools**: NASA's Eyes on Exoplanets, Stellarium, Zooniverse Citizen Science
- **APOD (Astronomy Picture of the Day)** for daily discoveries

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Final Notes

Astronomy is one of the most exciting sciences because it connects us to the **wider universe**. This course will be interactive, engaging, and hands-on. Students are encouraged to keep up with **current astronomical discoveries** and share their insights in class!