# Genetics and Heredity – 10th grade

## 1. Introduction to Advanced Genetics

- Review of Key Concepts: DNA, genes, alleles, inheritance.
- Modern Applications: Genetic research, personalized medicine, biotechnology.

## 2. Molecular Genetics and Gene Expression

- DNA Replication: Enzymes involved (helicase, DNA polymerase, ligase).

- **Central Dogma: Transcription (mRNA synthesis) and translation (protein synthesis).**
- **Gene Regulation: Operons in prokaryotes (lac operon), epigenetics (methylation, histone modification).**

**3. Advanced Inheritance Patterns**

- **Mendelian vs. Non-Mendelian Genetics: Polygenic traits, multiple alleles, pleiotropy.**
- **Epistasis and Linked Genes: How genes interact beyond dominant/recessive inheritance.**

- **Sex-Linked Inheritance: X-linked disorders (hemophilia, color blindness).**

**4. Meiosis, Mutations, and Genetic Variation**

- **Meiosis in Depth: Crossing over, independent assortment, chromosomal mutations.**
- **Types of Mutations: Silent, missense, nonsense, frameshift.**
- **Genetic Disorders and Pedigree Analysis: Autosomal vs. sex-linked inheritance.**

**5. Biotechnology and Genetic Engineering**

- **CRISPR and Gene Editing: How gene modification works and its applications.**
- **Cloning and Stem Cells: Ethical and scientific implications.**
- **Genetically Modified Organisms (GMOs): Benefits and controversies.**

**6. Ethical Considerations in Genetics**

- **Genetic Testing & Privacy: How much should people know about their genetic risks?**
- **Designer Babies and Eugenics: Should we alter human traits?**
- **Legal and Social Implications: Who owns genetic data?**

**7. Summary and Review**

- **Key Concept Recap: Gene expression, inheritance, mutations, biotechnology.**
- **Q&A Session: Addressing complex topics and ethical concerns.**
- **Homework: Research and present a genetic case study (e.g., CRISPR therapy, cloning debate).**

**8. Assessment & Homework**

- **In-Class Quiz: Covers molecular genetics, inheritance patterns, and biotech applications.**
- **Homework Assignment: Solve genetic problems, analyze a pedigree chart, and write a genetic ethics argument.**