Classical Electrodynamics and Classical Mechanics II

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

Knowledge:
1. Explain the concepts of vector and scalar potentials in Classical Electrodynamics.
2. Describe the Gauge transformations including Lorentz and Coulomb gauge in detail.
3. Understand the Helmholtz theorem and provide a proof for it.
4. Analyze the inhomogeneous wave equation and its implications.
5. Apply the Green function for the inhomogeneous wave equation.

Comprehension:
1. Distinguish between different gauge transformations and their significance in electromagnetic theory.
2. Evaluate the fields and radiation of simple radiating systems like localized oscillating sources and electric dipoles.
3. Interpret the angular distribution of radiation produced by an oscillating dipole.
4. Analyze the behavior of radiation from moving charges using Lienard-Wiechert potentials.
5. Explain the phenomenon of Rayleigh's scattering and its impact on the color of the sky.

Application:
1. Apply the knowledge of vector and scalar potentials to solve problems related to electromagnetic fields.
2. Utilize the concepts of radiation by moving charges to analyze scenarios involving accelerated charges.
3. Calculate the radiation produced by various types of moving charges such as those with low velocities and relativistic velocities.
4. Design and analyze a center-fed linear antenna using principles learned in the course.

Analysis:
1. Assess the different types of radiation produced by accelerated charges including bremsstrahlung, synchrotron radiation, and Cherenkov radiation.
2. Examine the factors affecting the angular distribution of radiation from an oscillating dipole.
3. Compare and contrast the fields and radiation from different radiating systems.
4. Evaluate the role of gauge transformations in simplifying the equations of electromagnetism.

Synthesis:
1. Develop solutions to complex problems involving the fields and radiation of electromagnetic systems.
2. Formulate strategies to study and understand the radiation by different types of moving charges.
3. Design experiments to observe and study the radiation patterns produced by oscillating dipoles and moving charges.

Evaluation:
1. Critically analyze the validity and implications of the Helmholtz theorem in electromagnetic theory.
2. Assess the efficiency of different gauge transformations in simplifying electromagnetic equations.
3. Evaluate the impact of Rayleigh's scattering on the color of the sky and its relevance in atmospheric physics.