## [Open-Source CEM and Additive Manufacturing, Year 1] [Whittier College] [Profs. J. Hanson, F. Park, S. Zorba, S. Lagan, G. Piner] [Nayeli Camacho, Shaun Dunnick] WBS Task Names Hardware Acquisition (Weight=10%) 3D Printer Acquisition Obtain quotes Complete purchase 3D Printer Filament Acquisition Obtain quotes Complete purchase GPU/Multicore Server Perform market comparisor Obtain quotes Complete purchase RF Lab Hardware RF cables and connectors Recruitment (Weight=5%) Standard undergraduate recruitment procedure Undergraduate STEM researchers Undergraduate app/code designers Run Published CEM Codes (Weight=5%) Initial CEM Training, Linux Accts. CEM Training Account creation Updating CEM Code Unpack and test original code Course Integrations (Weight=10%) Physics Courses Algebra-Based Physics II Calculus-Based Physics II Optics Electromagnetic Theory Computational Physics Computer Science Courses Computer Logic and Digital Circuit Design Digital Signal Processing Introduction to Data Science with Python Machine Learning Primary CEM Research, Semesters 1 and 2 (Weight=10%) CEM Simulations, Data Visualization 3D visualization of RF horn design Time-domain computations, phase analysis S-Parameters analysis Inclusion of coaxial cable in simulation Embed in various media Machine Learning Optimization Background research for algorithms Learning genetic programming styles CEM implementation with basic RF horn RF antenna optimization Additive Manufacturing, Semesters 1 and 2 (Weight=10%) Printing with PLA Filament Updating prior designs Practice file format conversion Print test object Print PLA antenna model Printing with Electrifi Filament Print test object Perform resistivity measurements Print simple antenna Print complex antenna Application Development, Semesters 1 and 2 (Weight=10%) Creating Project Plan with Students Creating kanban taskflow Experimenting with Android SDK Updating prior code Designing Visual Environment Updating prior designs Displaying content on Android app Primary CEM Research, Summer 2025 (Weight=20%) CEM Simulations, Data Visualization Time-domain computations, phase analysis S-Parameters analysis Inclusion of coaxial cable in simulation Embed in various media Machine Learning Optimization 3D visualization of optimized antenna Explore array optimizations in ice, Hpol Additive Manufacturing, Summer 2025 (Weight=20%) Printing with Electrifi Filament Updating prior designs Continue printing complex antenna Real S-parameter measurement Real radiation pattern measurement