Project-Based Teaching

In alignment with the Outcome-Based Education (OBE) philosophy and the requirements for cultivating students' ability to solve complex engineering problems in engineering education, core professional courses such as "Electrical Systems of Power Plants," "Relay Protection in Power Systems," and "High Voltage Technology" implement project-based teaching, seamlessly integrating this approach throughout all practical stages—including course design, comprehensive practical training, and graduation projects.

Basic Knowledge-Based Projects: These projects focus on fundamental topics such as circuits, electronics, electrical machinery, and electrical control; they involve building small-scale devices and designing simple power supply and distribution schemes, thereby strengthening students' engineering modeling and basic computational skills;

System Design Projects: For core modules such as power systems, relay protection, and high-voltage insulation, students will work in groups to develop comprehensive engineering solutions—including regional power grid power flow calculations, substation lightning protection systems, and relay protection setting schemes—thereby training their system design capabilities and their ability to balance multiple constraints;

Innovative Comprehensive Projects: These projects integrate cutting-edge advancements in the fields of new energy, ultra-high voltage transmission, and smart grids; they leverage "Big Innovation" projects and academic competitions to develop novel electrical equipment and distributed energy storage systems, thereby fostering innovative thinking and literature research skills. Students work in groups to complete project research, scheme design, simulation verification, report writing, and final defense; this entire process simulates the operational workflow of real-world electrical engineering projects while simultaneously honing teamwork, collaboration, oral and written communication skills, thereby supporting the fulfillment of graduation requirements related to teamwork and communication.

Blended Learning

The core professional courses adopt a blended closed-loop teaching model combining "online MOOC self-directed learning + offline classroom in-depth discussions," establishing a comprehensive educational process spanning the pre-class, during-class, and post-class phases, thereby aligning with the objectives of fostering students' self-directed learning and lifelong learning capabilities.

Online resource support: Leveraging MOOC resources for national-level first-class courses (such as "Power System Analysis" and "High Voltage Technology"), supplemented by Yu Classroom, course QQ groups, and other platforms to distribute course materials, simulation demonstrations, industry engineering videos, and chapter-based self-assessment exercises; online learning, unit quizzes, and note-taking activities are integrated into the formative assessment process;

Three-stage classroom implementation

Before class: Distribute online preview tasks; use self-assessment data to identify knowledge gaps; and precisely plan the key and challenging sections of the lesson;

During class: provide focused explanations of common difficulties, conduct group discussions, and administer on-the-spot quizzes; for cutting-edge topics such as smart grids and new energy, adopt a flipped classroom approach—where students independently share their research findings, while instructors integrate elements of ideological and political education into the curriculum by incorporating case studies from major national engineering projects;

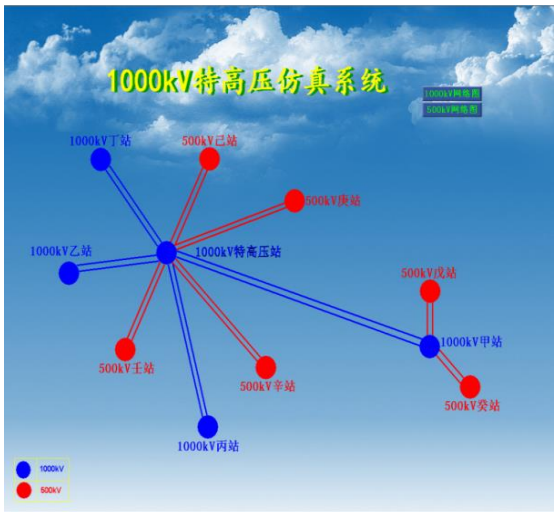
After class: online Q&A sessions, assignment of engineering case study tasks, and distribution of cutting-edge industry resources to broaden students' perspectives;

Empowerment through smart tools: routine use of Rain Classroom and similar platforms to facilitate attendance tracking, in-class quizzes, and assignment grading; leveraging virtual simulation-based online resources to compensate for limitations in offline practical training duration; balancing online self-directed learning with offline hands-on practice; and comprehensively enhancing students' proficiency in utilizing digital tools.

Contextualized Teaching

By closely aligning with real-world production and operation scenarios in the power industry, this approach utilizes the UHV substation virtual simulation platform as the primary vehicle, supplemented by real engineering footage and typical power system accident case studies to create immersive classroom environments. This methodology transforms abstract high-voltage and power system theories into intuitive and concrete representations, while simultaneously fostering in students a sense of engineering social responsibility and awareness of green sustainable development, thereby ensuring alignment with the professional engineering graduation requirements.

Substation Operation and Maintenance Simulation Scenario: Leveraging the 3D full-substation model of the UHV substation virtual simulation platform, this system fully simulates the entire workflow of on-site operations, including routine inspections, infrared temperature measurement of equipment, meter verification, high-voltage insulation testing, and standard switching operations; the platform integrates five-prevention locking mechanisms and a high-voltage safety distance warning system, which will display real-time pop-up alerts when students perform non-compliant operations, visually demonstrating the mandatory safety regulations for high-voltage work, reinforcing the fundamental safety standards, and fostering a professional awareness of adherence to industry codes of conduct.



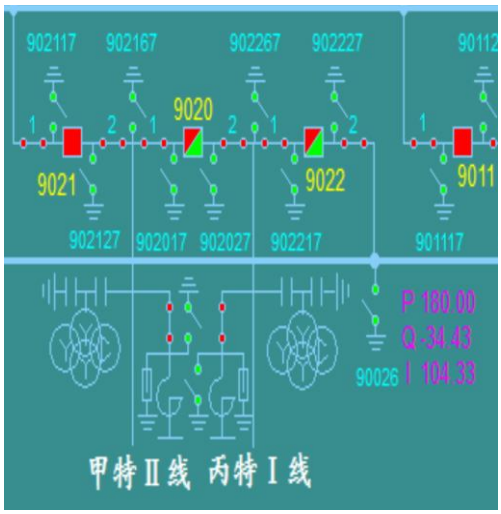




Figure 1-2: Grid topology and O&M operation simulation model of the UHV substation virtual simulation platform

Major Power Engineering Scenario: By integrating real-world case studies—including China's ultra-high voltage (UHV) power transmission systems, new energy power stations, and emergency power supply projects (such as the Heshenshan supporting electrical engineering project)—and by comparing China's power industry development with that of other countries, this scenario illustrates the profound impact of the industry's evolution on society and the environment, while fostering patriotic sentiment, a sense of social responsibility, and a commitment to sustainable development;

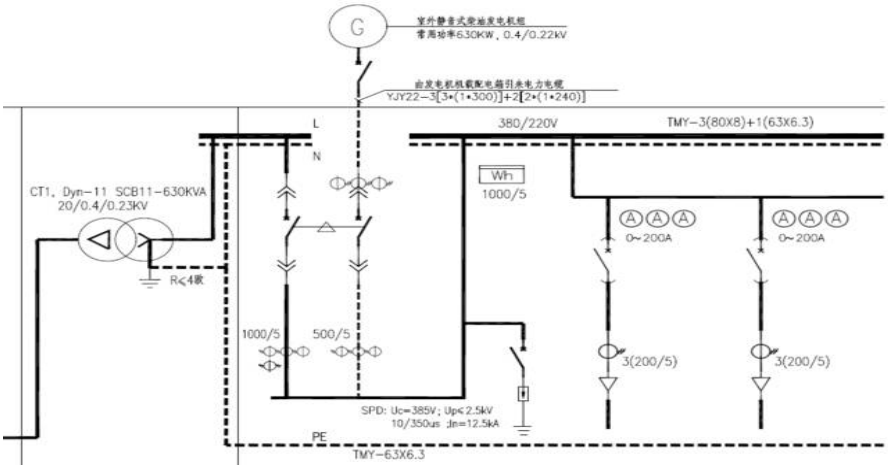






Figure 1-3: Course-based Ideological and Political Education instructional video and emergency power supply electrical wiring diagram

Simulation dynamic scenario: Leveraging an ultra-high voltage substation platform and EMTP/MATLAB simulation software, this system dynamically visualizes physical processes—such as system transients and overvoltages—that are difficult to replicate in real-world field conditions, thereby reducing the difficulty of theoretical comprehension and enhancing proficiency in utilizing modern simulation tools.

Operational Practical Teaching

Aligning closely with the core objective of cultivating applied professionals, this initiative establishes a four-tier practical training system comprising: "Basic Verification Experiments – Comprehensive Design Practical Training – Virtual Simulation Operations – Enterprise-Grade Practical Applications"; leveraging 18 specialized laboratories on campus, multiple simulation platforms, and off-campus practical training bases to provide hands-on training that supports the graduation requirements for engineering research and engineering design programs.

On-campus tiered practical training

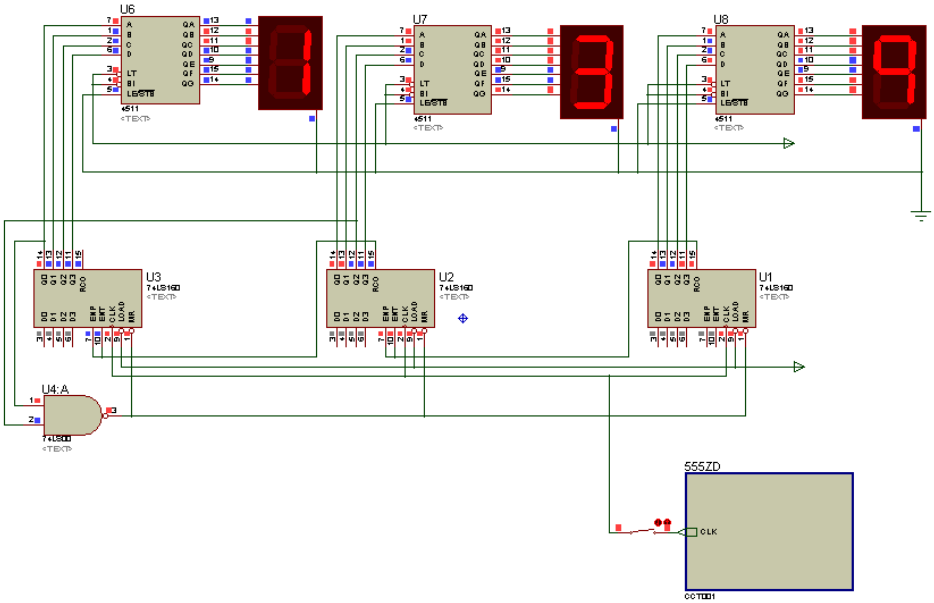
Basic Verification Practical Training: Conduct in-class foundational experiments covering circuits, motors, electronics, etc.; become familiar with the standard operating procedures for laboratory instruments and equipment; learn how to collect and analyze data according to established protocols; and develop scientific research habits;

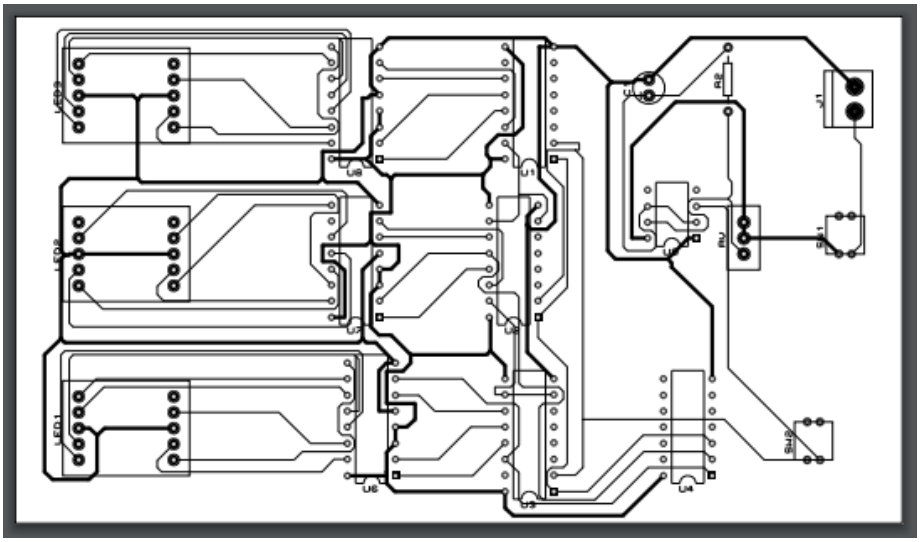




Figure 1−4: On-site demonstration of laboratory student group-based practical sessions

Comprehensive Design Practical Training: Through various course design projects and centralized professional practical training sessions, students are tasked with independently completing system construction, parameter tuning, and simulation verification based on provided engineering requirements, thereby enhancing their comprehensive design capabilities;





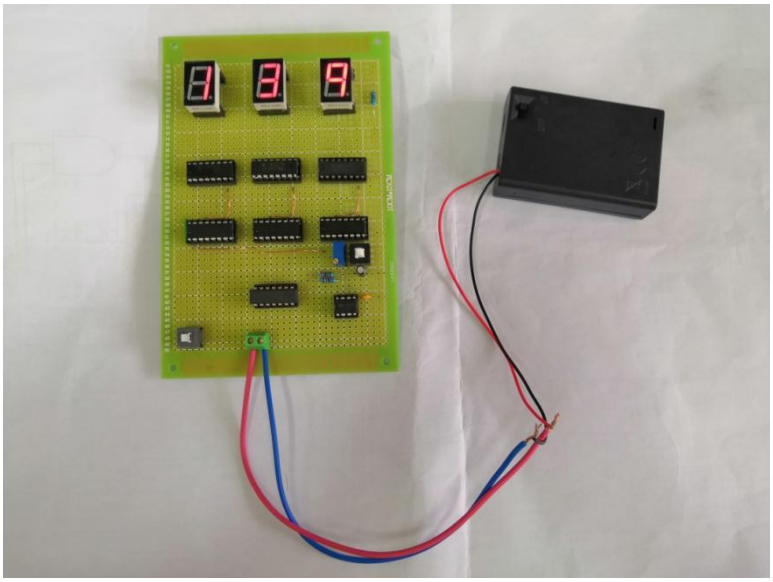
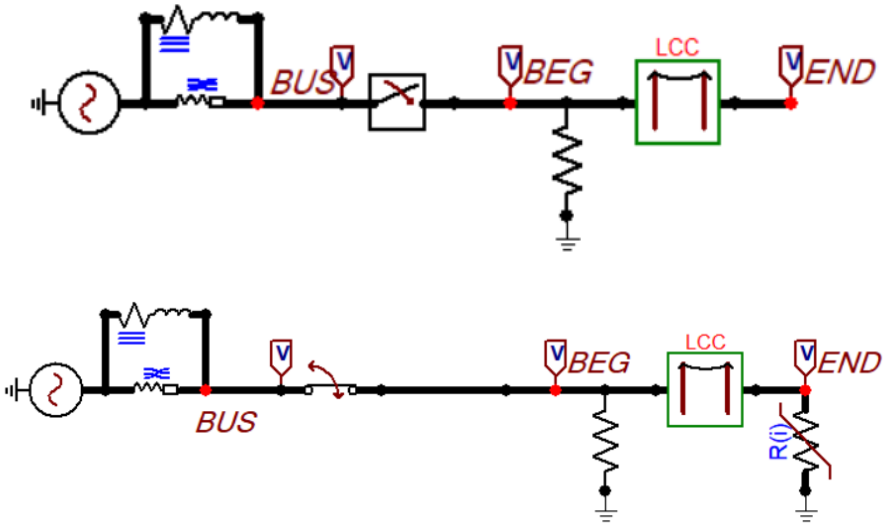
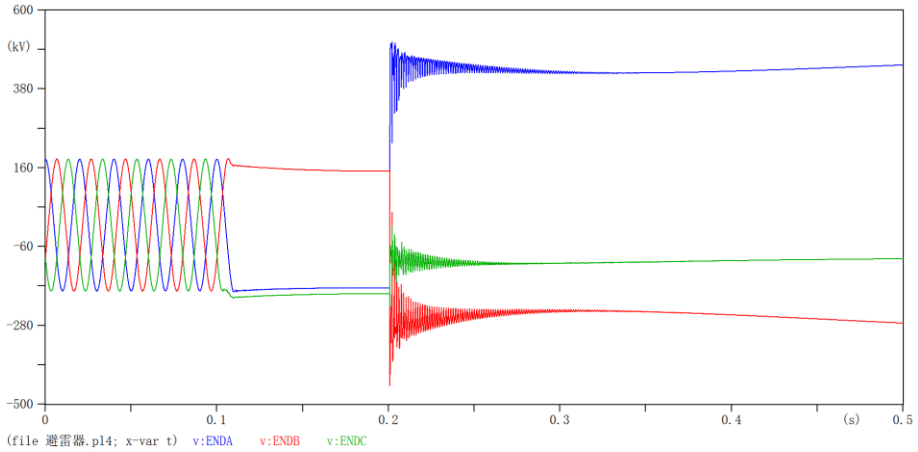
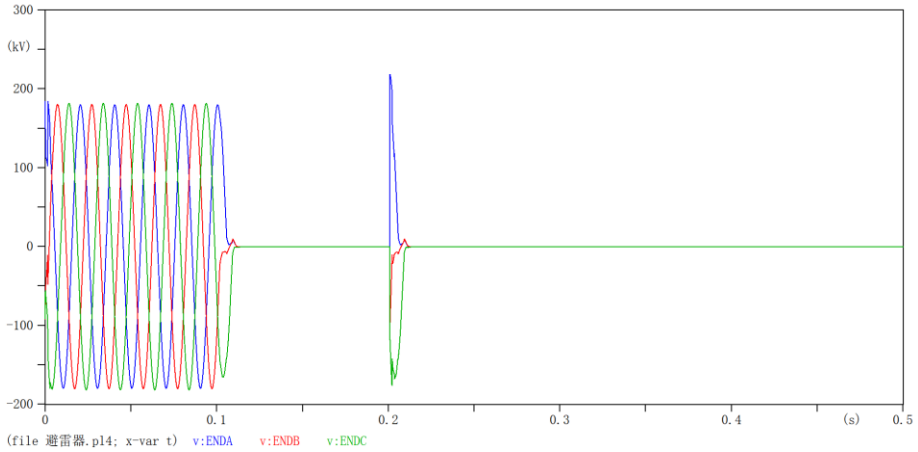


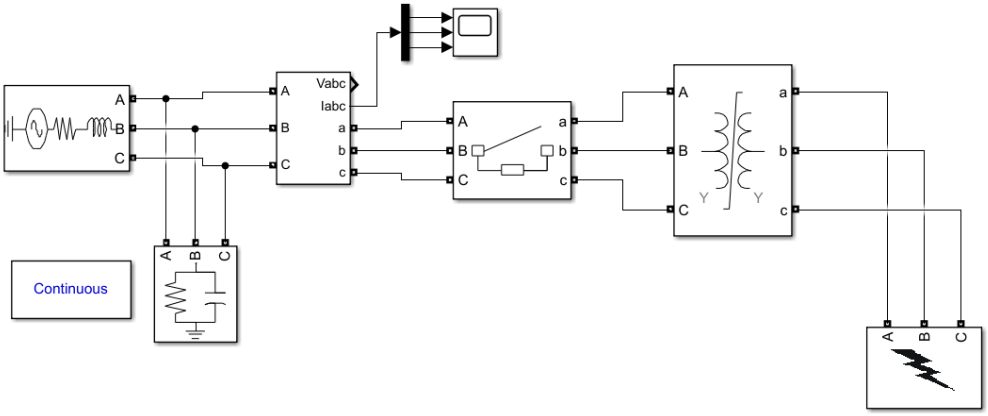
Figure 1−5: Schematic diagram of the counter circuit simulation, PCB layout, and the final physical prototype.

Virtual Simulation Training: Utilizing virtual simulation platforms for power plants and ultra-high voltage substations, along with MATLAB and EMTP software, to conduct large-scale, high-risk power system simulation exercises, thereby mitigating the safety risks associated with high-voltage and high-current experiments;




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-200
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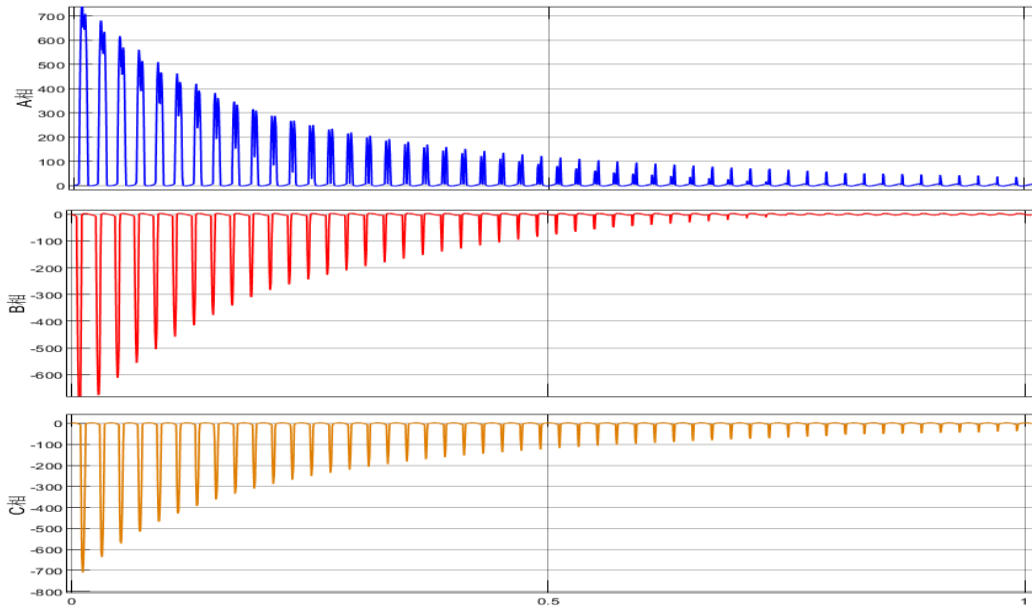


Figure 1−6: Power system simulation modeling and waveform results display

Off-campus Practical Training: A four-year program featuring two internship phases, during which students join power grid companies, power plants, and electrical manufacturing enterprises to participate in real-world project design, equipment commissioning, and system operation and maintenance, thereby aligning their experience with actual industry needs;



Figure 1−6: Actual photos of off-campus corporate internships

Extending Practical Innovation: By leveraging engineering training, electrical installation practical sessions, academic competitions, and innovation and entrepreneurship projects, students are encouraged to independently undertake projects such as electrical system fabrication and new energy system development, thereby cultivating their innovative mindset and hands-on skills; all practical sessions incorporate assessment components—including experimental reports and

project defense sessions—with a focus on fostering rigorous and pragmatic engineering research habits, while also emphasizing the development of teamwork division of labor, communication, and expression skills.





Figure 1–7: Scenes of students winning academic competitions and their award certificates