TRANSMISSION AND DISTRIBUTION PROGRAM

Master of Engineering - Transmission & Distribution Engineering

Gonzaga University's School of Engineering and Applied Science (SEAS) offers a fully online Master of Engineering (METD) degree and a Graduate Certificate in Transmission and Distribution (T&D) Engineering for the electric utility industry. Courses are offered online over an eight-week period by practicing power industry engineers. Students may register and take courses asynchronously from anywhere in the world. (Visit our website at: www.Gonzaga.edu/tadp (http://gonzaga.edu/tadp/))

Admissions

1. Students applying to Gonzaga University must submit Gonzaga's Graduate Application, which can be accessed online at https://www.gonzaga.edu/gradapply (https://www.gonzaga.edu/gradapply/).
2. Along with the application for graduate study, each program at Gonzaga has distinct admission requirements. Please refer to the table below to view that detailed information.

Program Name	How to Apply Link
Certificate in Transmission & Distribution Engineering	https://www.gonzaga.edu/school-of-engineering-applied-science/degrees-and-programs/transmission-distribution/certificate/apply (https://www.gonzaga.edu/school-of-engineering-applied-science/degrees-and-programs/transmission-distribution/certificate/apply/)
Master's in Transmission & Distribution Engineering	https://www.gonzaga.edu/school-of-engineering-applied-science/degrees-and-programs/transmission-distribution/masters/apply (https://www.gonzaga.edu/school-of-engineering-applied-science/degrees-and-programs/transmission-distribution/masters/apply/)

Required Qualifications

B.S. Degree in Civil, Mechanical, Electrical, or other engineering fields[1] (from an ABET-accredited institution, if the institution is within the US)

[1] Due to the level of mathematics involved in most T&D courses, students should have a background in the following topics before applying for admission:
- Calculus III: Parametric and polar coordinates, vectors, partial derivatives, multiple integrals.
- Ordinary Differential Equations: Solution methods for first order equations and for second and higher order linear equations. Includes series methods and solution of linear systems of differential equations.

Master in Transmission & Distribution Engineering Degree Requirements

Minimum of Thirty (30) credits that must include:

- 9 credits in core courses (TADP 541 Electric Distribution System Design, TADP 542 Substation Design, TADP 641 Power System Analysis)
- 3 credits in TADP 556 Engineering Leadership

To receive the METD the student must have an average cumulative grade point of 3.0 or better in the T&D program.

Code	Title	Hours
TADP 521	Utility Communications	3
TADP 540	Transmission Line Design: Introduction	3
TADP 541	Electric Distribution System Design	3
TADP 542	Substation Design	3
TADP 543	Electrical Grid Operations	3
TADP 544	Project Development and Construction Method	3
TADP 545	System Protection	3
TADP 547	Underground System Design	3
TADP 548	Transmission Line Design: Electrical Aspects	3
TADP 549	Transmission Line Design: Structure and Foundation	3
TADP 551	Renewables and Grid Integration	3
TADP 553	System Automation	3
TADP 640	Transmission Line Design - Advanced	3
TADP 641	Power System Analysis	3
TADP 556	Engineering Leadership	3
TADP 680	Special Topics	4

Certificate in Transmission & Distribution Engineering

The 15 credit T&D Engineering certificate consists of any five (3 credit) Gonzaga T&D graduate courses. Students may use three 1-credit T&D classes for one of these courses. (TADP 500 Essential Fundamentals of Power Systems and TADP 501 Essential Fundamentals of Transmission Line Components are foundational courses and thus do not count toward the Certificate). A cumulative GPA of 3.00 from the T&D Program will be required for the award of the certificate.

Courses

TADP 500. Essential Fundamentals of Power Systems. (3 Credits)
This course is intended for engineers without the required knowledge of electric power systems. The course will provide a comprehensive review of materials associated with generation, transmission, and distribution systems; foundation of electrical circuits as applied to power systems; and modeling and analysis of power systems. NOTE: This foundation course will not count toward the 15 credit T&D Certificate or 36 credit T&D Master's in Engineering.

TADP 501. Essential Fundamentals of Transmission Line Components. (2 Credits)
This course is intended for engineers without the required knowledge in transmission line design work. This course provides a comprehensive review of all the essential foundational material associated with the design of transmission line components such as transmission line structures, foundation designs, cable behavior, codes, and standards. NOTE: This foundation course will not count toward the 15 credit T&D Certificate or 36 credit T&D Master's in Engineering.

TADP 521. Utility Communications. (3 Credits)
This course is an introduction into the world of communications, with an emphasis on applications in the electrical utility space. The course is intended for those whose specialty is not communications engineering but need an overview of the evolving communications technology as a pre-requisite for the future Smart Grid; this includes power-track engineers, project managers, etc.

TADP 540. Transmission Line Design: Introduction. (3 Credits)
Introduction to structures, conductors, insulation, survey techniques, terrain modeling, computer-aided design, NESC code requirements. Each major step in an overhead line design process will be analyzed and discussed using data from a recently constructed line. Advantages and disadvantages of some modern design tools will be established.

TADP 541. Electric Distribution System Design. (3 Credits)
Network planning, protection/fusing, conductor sizing, transformer specification & connections, arrestors, reactive compensation, underground cabling, substation overview. Students will learn the characteristics of distribution devices and how to select devices which contribute to the desired system performance. The course will cover the requirements of acceptable power quality and how to identify the different types of loads and their requirements for service.

TADP 542. Substation Design. (3 Credits)
System overview, design principles, types of substations, components, utilization, reliability, metering, voltage, protection, project plan, site, scheduling, major equipment, control houses, communication, SCADA, foundations, structural design, grounding.

TADP 543. Electrical Grid Operations. (3 Credits)
An examination and study of the fundamental technical principles and operating guidelines of reliable interconnected grid operations, and the standards of the North American Electric Reliability Corporation (NERC). Students will acquire the topical knowledge and context to understand the operation of large, interconnected utility systems. In addition, the students will develop a skill set that includes knowledge of how electricity is generated and delivered, as well as how these real-time processes are monitored and controlled. Students will also learn techniques and considerations for analyzing common grid emergencies and system disturbances to identify contributing causes and develop mitigations.

TADP 544. Project Development and Construction Method. (3 Credits)
System planning and project development, project proposals to management, project initiation, scheduling, cost management, resource management, permitting authority, land rights acquisition, overview of contracts, contractor selection, Gantt tracking. Students will study conductor types and uses, and learn strategies for developing and describing competing transmission projects. Given a specific transmission line project, the students will be able to develop a detailed project description in the form of a project plan.

TADP 545. System Protection. (3 Credits)
General concepts, symmetrical faults, asymmetrical faults, voltage and current transformers for protection, classification and functionality of relays, overcurrent protection, distribution feeder protection, transmission line protection with communications independent distance relaying, introduction to differential protection, and disturbance analysis.

TADP 547. Underground System Design. (3 Credits)
Introduction to cable systems: history of cables, solid dielectrics, comparison of overhead vs underground. Types of cable systems, cable manufacturing, accessories, basic cable design. Installation practice: pulling tensions, side wall pressures, t-line installation, distribution installation, tunnel installation, directional boring. Application considerations: hydraulic pressures/volumes, commissioning, operation and maintenance practice, industry guides/specifications, IEEE standards. Case studies and special topics.
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TADP 548. Transmission Line Design: Electrical Aspects. (3 Credits)
This course covers the electrical aspects of transmission line design which ensure acceptable reliability, safety and code compliance for transmission facilities. Topics include an introduction to the electrical aspects of a transmission line design, rules and requirements, design criteria and voltage levels, conductor selection and ratings, required clearances, REA manual, insulation, voltage flashover, EMF fields, corona, induction coordination, grounding requirements, pole grounding, guy wire grounding, and grounding measurements.

TADP 549. Transmission Line Design: Structure and Foundation. (3 Credits)
The course covers in-depth design of steel poles, concrete poles, and associated foundations. The major topics include: review of steel pole specifications, development of loading trees, design of steel poles including arms, attachment details, base plate,. anchor bolts and connections, manufacturing process, inspections of weld details, testing of steel poles, review of concrete pole specifications, design of concrete poles, comparison of steel vs. concrete poles, associated industry national standards, direct embedment and pier foundations, foundation optimization, and anchor foundations.

TADP 551. Renewables and Grid Integration. (3 Credits)
This course covers conventional generation, renewable generation, integration of renewables into the electric grid, and other renewable energy technology topics.

TADP 553. System Automation. (3 Credits)
Students will learn economic benefits of Smart Grids, network load flow analysis, radial load flow analysis, optimal topology, sectionalizing switches, fault location/isolation, microgrid technology, renewable technology, integrating renewable energy, system restoration, voltage/VAR control.

TADP 556. Engineering Leadership. (3 Credits)
Four broad areas of leadership will be covered: leadership roles and responsibilities (sponsor appreciation); communication; systems thinking and breakthrough leadership; leadership, change and ethics.

TADP 640. Transmission Line Design - Advanced. (3 Credits)
The course further develops strategies covered in T-Line course and introduces advanced concepts for designing overhead transmission lines.

TADP 641. Power System Analysis. (3 Credits)
This course will begin with a review of basic concepts of power systems, their components and how they are inter-related. An overview of the topology and members of the North American power grid will then be covered. The main portion of the course will refer to modeling of power systems, short circuit calculations, and load flow algorithms and methods. Students will learn how to apply the algorithms and methods using case studies in topics such as voltage regulation, VAR control, and relay setting and coordination. The course will wrap up with a brief segment on harmonic analysis and filter design.

TADP 680. Special Topics. (0-4 Credits)
May be repeated for credit.
Topic to be determined by instructor.

TADP 681. Special Topics. (1 Credit)
May be repeated for credit.
Topic to be determined by instructor.