

COMPETENCY PROFILE:

# ELECTRICAL ENGINEER

## ROLE OVERVIEW

Electrical engineers are professionals responsible for developing electrical systems, components, and equipment during the pre- and post-production stages. Their responsibilities include engineering design, analysis, and implementation of electrical systems, testing and ensuring compliance with safety and regulatory standards, and making post-production improvements. They are also involved in project management, quality assurance, value/cost optimization, and process improvement.

Electrical engineers work in diverse organizations and industries, including power generation, telecommunications, manufacturing, construction, and the automotive sector. They can be employed by utility companies, engineering firms, government agencies, electrical equipment manufacturers, consulting firms, and research institutions. Their expertise is in demand wherever electrical systems and equipment are involved.

For success, electrical engineers require both technical and interpersonal abilities. Technical skills encompass expertise in engineering and electrical schematic design, electric power, and control systems, alongside research and development techniques.

They have a robust understanding of electrical principles, codes, and standards relevant to their industry. Interpersonal skills are also crucial for an electrical engineer's success. Practical communication skills are essential for collaborating with cross-functional teams, presenting technical information, and liaising with clients and stakeholders. Problem-solving is necessary to identify and resolve complex electrical issues.

## ALSO KNOWN AS:

- Design Engineer
- Project Engineer
- Test Engineer
- Electrical Design Engineer

## NATIONAL OCCUPATIONAL CLASSIFICATION:

- 21310 – Electrical and electronics engineers

## EDUCATION AND EXPERIENCE

- A bachelor's degree in electrical or electronics engineering or a similar discipline is necessary. This degree provides a foundation in electrical engineering principles like circuit analysis and systems design, blending theoretical and practical learning for entry-level roles.
- Master's or doctoral degrees in electrical engineering or related fields are essential for specialization in power systems, signal processing, or telecommunications. These degrees emphasize original research and advanced engineering concepts to foster innovation.
- In Canada, acquiring a license from a provincial or territorial engineering association is required to work as a Professional Engineer (P.Eng.), enabling one to approve engineering drawings and reports. The process includes completing an accredited engineering program, undergoing three to four years of supervised work experience, and passing a professional practice exam.
- A mandatory three to four years of supervised work experience after graduation is crucial for developing professional abilities, practical problem-solving, and understanding the impact of engineering decisions.
- Engineers become eligible for registration as Professional Engineers after meeting work experience and examination criteria. This enhances their credibility and capacity for more significant roles, including overseeing projects and teams.
- Continuous advancements in the electrical engineering field necessitate lifelong learning and professional development. Engineers are encouraged to engage in activities such as workshops, attain specialized certifications, and participate in engineering societies to stay updated with new technologies and practices.

## TECHNICAL



### Research and Development

Applies scientific methods and techniques using empirical and measurable observation in their research to improve, correct, or increase knowledge in a field of study to solve specific problems.

- Builds on existing technology through an iterative process to develop new concepts in electrical engineering.
  - Power architecture
  - Control systems
  - Microprocessor systems
  - System Integration
  - Electric circuit simulation and analysis
- Organizes or applies a repetitive development cycle to incorporate electrical theory principles into engineering projects
- Reads current literature, attends meetings, or conferences, and talks with colleagues to stay abreast of new technology or competitive products.

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### Engineering Design

Oversees the technical elements of engineering project planning and design to guarantee safe, efficient, and practical construction.

- Conducts electrical design reviews to develop engineering specifications or cost estimates for design concepts.

- Designs electrical components or systems, focusing on enhancing recyclability and incorporating natural, renewable, or recycled materials.
  - Adjusts or changes designs to meet desired functionality and operational standards, ensuring the creation of robust and dependable electrical systems.
  - Proposes technical design or process changes to improve electrical products or systems' efficiency, quality, or performance.
  - Engages with subject matter experts during the system design development phase to achieve the best possible design.
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## **Engineering Review and Analysis**

Reviews and analyzes relevant information about technical designs and complex systems to develop appropriate solutions.

- Assesses the functionality, replicability, costs, and other factors to be considered to develop appropriate technical solutions to engineering-related problems.
  - Evaluate electrical systems in specific areas of expertise to improve the efficiency, operations, or performance of a product, part, or system.
  - Develops various levels of electrical test scenarios to test and simulate product environments and conditions.
  - Writes, reviews, or maintains engineering documentation to promote consistency in all engineering aspects.
  - Coordinates development-related deliverables and documentation with appropriate parties (suppliers, buyers, designers, project management, safety teams, and regulatory bodies).
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## **Project Team Management**

Oversees a team of professionals to effectively and efficiently produce the required output to ensure project[s] are completed on time and within budget.

- Develop project plans and set milestones to facilitate successful project completion.
  - Takes corrective measures to address technical issues when projects deviate from their planned path, ensuring timely completion.
  - Allocates resources effectively to maximize their utilization.
  - Documents insights gained from project execution to improve risk mitigation strategies in future projects.
  - Manages tasks according to the approved scope of work to deliver quality reports on schedule and within budget.
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## **Electric Power Systems**

Performs calculations and simulations to verify power systems and components are accurately designed, manufactured, and calibrated to perform as intended, withstand expected stress, and be protected against failures.

- Assesses power systems to ensure international standards and local regulations are followed for appropriate system response, equipment performance, and safety.

- Schedules power system analyses to ensure they are carried out in all project phases, adapting the level of detailing and accuracy according to the operational phase.
  - Assesses power system technologies and models to recommend solutions that improve efficiency and reliability.
  - Conducts stress tests on electrical systems to verify their quality requirements.
  - Performs analysis to determine and rectify potential failure modes and effects.
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## **Quality Assurance and Quality Control**

Follows appropriate processes directed by global engineering standards and industry best practices to ensure quality is maintained throughout operations.

- Analyze product proposals and specifications to determine feasibility or application to establish quality control standards.
  - Directs testing activities for components and equipment under designated conditions to ensure operational performance meets project specifications with proven reliability.
  - Coordinates production activities with other functional units, such as procurement and manufacturing, to ensure standardization and consistency.
  - Raises and addresses any issues with quality to ensure standardization.
  - Ensures that all personnel are aware of the quality assurance and quality control guidelines and can comply with them.
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## **Troubleshooting**

Identifies, solves, and reports on operating problems and inefficiencies in current equipment, processes, or systems to determine effective solutions.

- Addresses issues with new or existing products related to design, materials, or processes to enhance manufacturing efficiency.
- Works with the appropriate parties to design, install, or troubleshoot electrical equipment for reliability and maintenance.
- Documents problems and their resolutions to prevent recurrence or enable swift future resolution.
- Identifies and analyzes electrical system issues to develop effective troubleshooting strategies to minimize downtime and improve efficiency.



## Communication

Positively directs outcomes by delivering communication that better understands goals and objectives, captures interest, and gains support for immediate action.

- Creates and evaluates technical reports and presentations, ensuring high quality for internal and external audiences.
- Provides power systems design and communicates relevant supporting information to development and construction teams working on projects.
- Maintains communications with the team and external stakeholders to exchange information, assess progress, and reassign work as needed.
- Listens to team members to address concerns and integrate ideas, values, and new information where appropriate.

## Collaboration

Engages in professional collaborative efforts with team members, including sharing information and expertise, utilizing input from others, and recognizing others' contributions to work towards common goals.

- Provides operational expertise and technical direction as appropriate to ensure harmonious and efficient operations.
- Works cooperatively with multiple stakeholders, demonstrating a willingness to consider alternative approaches, ideas, or insights.
- Shares relevant and valuable knowledge, experience, or expertise to aid team members in accomplishing their objectives more efficiently or effectively.
- Provides team members with constructive feedback and perspective to aid in completing a task or goal.

## Attention to Detail

Reviews completed work by monitoring and checking information, efficiently organizing tasks and resources, or all areas involved in achieving an objective.

- Scrutinizes models, tests, and simulation results to ensure validity and accuracy in results or findings.
- Routinely ensures that procedures and standards are followed thoroughly to complete tasks.
- Double-check the accuracy of the information and work to provide accurate and consistent work.
- Catches, documents, and corrects own errors or omissions, where applicable, to ensure efficiency and safety.



## Regulatory Compliance

Adheres to specific regulations, codes, and legislation within a defined jurisdiction to ensure the health and safety of others.

- Reviews and applies relevant regulations, legislation, and standards to ensure the project complies with them.
- Applies engineering codes and statutes of a defined jurisdiction in the design process to ensure a safe workplace.
- Applies knowledge of regulations, codes, standards, and safety, including local engineering procedures and practices, to ensure the safe operation of facilities and systems.