PRINCIPLES AND PRACTICE OF ENGINEERING (PE)

ELECTRICAL & COMPUTER: POWER SPECIALTY

YOUR COMPLETE GUIDE TO THE PE POWER EXAM & PE LICENSE

Everything you need to know to prepare for the NCEES PE Electrical: Power exam, **earn your Professional Engineer (PE) license,** and take full legal authority over your power engineering career.

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Aligned to the NCEES PE Electrical & Computer: Power CBT Exam Specifications | Effective October 2025 | NCEES Examinee Guide November 2025

📌 **For domestic candidates (United States) AND international candidates worldwide.**
This guide covers every domain of the October 2025 PE Power exam specifications, the full NCEES registration process, exam-day procedures, and the complete international engineering licensure pathway.

Visit shailearning.com to learn more about the PE Power mentorship program and to book a 1-on-1 call.

A Personal Note to You

If you are reading this, you have already made one of the best decisions of your engineering career — the decision to take the PE Power exam seriously.

I know exactly what it feels like to look at that decision and wonder where to start. I came from Ghana, earned my engineering degree, moved to the United States, and had to figure out every step of the PE licensure process without a mentor who had walked that road ahead of me. Nobody handed me a clear roadmap. I built mine through research, through trial and error, and through a lot of conversations with other engineers who were figuring it out the same way.

That is why I built ShaiLearning. And that is why I wrote this guide.

I am now licensed in New Jersey, Illinois, and Pennsylvania. I have spent more than a decade working in power generation, transmission, distribution, and renewables. I understand this exam not just as someone who has studied it, but as someone who uses the knowledge it tests every day on real projects.

This guide is built entirely around the October 2025 NCEES PE Electrical & Computer: Power exam specifications — the official document that defines exactly what NCEES will test you on. Every domain chapter in this guide maps directly to one of the nine domains in those specifications. I have written each section in plain, direct language designed to give you clarity before you go deep on the technical content.

A few things to note before you begin: this version of the guide intentionally omits engineering equations and worked calculations. That content is coming in a companion edition. What this guide gives you is something equally important — a clear map of the territory. When you finish reading it, you will know exactly what each domain tests, why it matters for real power engineering practice, how the exam is structured and administered, and what your preparation strategy should look like from this day forward.

The PE Power exam is one of the most challenging professional licensing exams in engineering. It is also entirely passable with the right preparation. Come along with me and let's get started.

Shaibu Ibrahim, P.E., PMP, NABCEP PVIP

Licensed in NJ · IL · PA | IEEE Senior Member | Founder, ShaiLearning.com

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Chapter 1: What the PE Power License Really Means

Before we talk about exam domains, study strategies, and NCEES specifications, I want to make sure you understand what you are actually working toward. Because the Professional Engineer license is **not just a certificate** on your wall. It is a **legal authorization**, and that distinction matters more than most engineers realize until after they have it.

The Legal Authority to Seal Engineering Work

In the United States, only a licensed Professional Engineer can sign and seal engineering plans and calculations for public submission. That means that when a design goes to a government agency, a utility company, a municipality, or a client for regulatory approval, it must carry the stamp of a PE who assumes full professional and legal responsibility for that work.

Without a PE license, you can absolutely do excellent engineering work — but you cannot put your name on it for legal purposes. Someone else has to. When you pass the PE Power exam and receive your license, that changes entirely. You become the engineer of record (EoR). Your stamp is the statement that says: I reviewed this. It meets the applicable codes and standards. I stand behind it.

Why Power Engineering Specifically

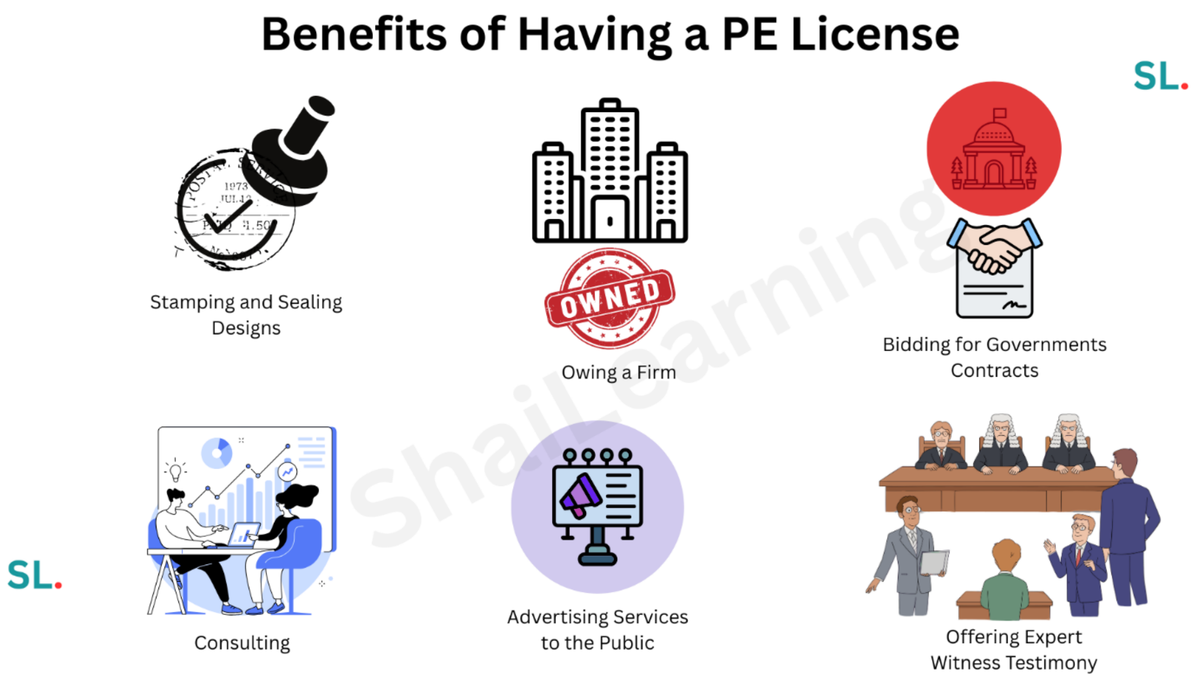
The PE Power exam covers the systems that every modern society depends on — power generation, transmission, distribution, substations, protection systems, and increasingly, the renewable energy and storage technologies that are reshaping the grid. These are not niche applications. They are the backbone of every hospital, every school, every data center, every factory, every bank, and our homes. Wherever electricity is needed, this specialty plays an important role.

The October 2025 NCEES update specifically added energy storage systems (BESS), inverter-based resources (IBR), and grid-forming/grid-following inverter concepts to the exam specifications. That tells you something important about where the profession is going: the demand for licensed power engineers who understand both traditional systems and emerging grid technologies has never been higher.

What the PE License Opens Up

Practically speaking, the PE license gives you capabilities that unlicensed engineers simply do not have:

- The legal authority to sign and seal drawings and calculations for public submission
- The ability to open and operate your own independent engineering consulting practice
- Use of the legally protected title "Professional Engineer" in most U.S. jurisdictions
- Qualification to serve as an expert witness in engineering-related legal proceedings
- Access to senior-level government and public sector engineering roles that require licensure
- The standing to supervise and sign off on the work of junior engineers building their own PE experience records



From Shai

When I passed the PE exam, I did not immediately open a practice or change jobs. But what changed was how I was seen, and more importantly, how I saw myself. Licensure signals to your employer, your clients, and the engineering community that this engineer has demonstrated competence beyond their work experience alone. It changes conversations. It changes what people bring to you. And it changes what you can charge for your expertise.

Want to go deeper?

For a full breakdown of the PE Power licensure pathway, including salary data, state-by-state analysis, and how the FE exam connects to the PE — visit shailearning.com to read more.

Chapter 2: Who This Exam Is For — Eligibility, Domestic & International

The PE Power exam is designed for engineers who have both the educational background and the professional experience to practice independently. Understanding the eligibility requirements clearly at the start will save you months of confusion and potential missteps.

The Four Requirements

Most U.S. states use the same foundational framework for PE licensure. The details vary by state, but the four pillars are consistent:

1. An engineering degree from an ABET EAC-accredited program (or its international equivalent).
2. A passing score on the Fundamentals of Engineering (FE) exam.
3. A minimum of four years of progressive engineering experience under the supervision of a licensed PE. Years may differ depending on your degree qualifications and state board requirements.
4. A passing score on the Principles and Practice of Engineering (PE) exam.

Education Requirements

The standard educational path to PE licensure in the United States is a four-year bachelor's degree in engineering from a program accredited by the Engineering Accreditation Commission of ABET. Most recognized electrical engineering programs at U.S. universities carry this accreditation.

If you were educated outside the United States, your degree is **not automatically disqualifying**, but it will require evaluation through the NCEES Credentials Evaluation Service. Chapter 17 of this guide covers the international pathway in full detail.

The FE Exam — Your First Milestone

The Fundamentals of Engineering (FE) exam is the first formal milestone on the path to PE licensure. Passing it earns you the Engineer Intern (EI) or Engineer-in-Training (EIT) designation. In most states, passing the FE is a prerequisite before you can sit for the PE exam.

The FE Electrical and Computer exam is the most relevant track for engineers pursuing the PE Power license. It is a 110-question, 6-hour computer-based exam offered year-round at Pearson VUE test centers. The NCEES fee is $225.

> 📌 **Note — ShaiLearning FE Resources**
> ShaiLearning offers dedicated FE Electrical & Computer exam preparation, including a complete guide, mentorship, and study resources. Visit shailearning.com for the full FE pathway before returning to this PE guide if that helps. Otherwise, let's continue with the PE guide.

Progressive Engineering Experience

Most states require four years of progressive engineering experience under the supervision of a licensed PE before you can apply for the PE exam. The word progressive is important: state boards are looking for evidence that your responsibility and complexity of work increased over time, not just that you logged four years.

Your experience must be documented and verifiable. NCEES offers the NCEES Record system — a portable professional portfolio that you build over time and use across state applications. Start building it from your first engineering job, not from when you decide to apply for licensure.

> 💬 **From Shai**
> Some states allow a master's degree to reduce the experience requirement from 4 years to 3, and a PhD may reduce it by 2 years (i.e., you only count 2 years of required professional engineering experience). I was a victim of 'assuming' my number of years of experience when I was applying for my first PE license, but I received a notice of deficiency and had to wait longer.
>
> Always confirm the exact requirement with your target state board. The requirements vary enough that assuming can cost you months or years of waiting.

Who Can Take the PE Power Exam Internationally

Engineers educated and working outside the United States can absolutely sit for the PE Power exam — provided they meet the NCEES eligibility requirements as evaluated by their target state board. Pearson VUE test centers that administer NCEES exams are available outside the United States in Canada, Japan, Saudi Arabia, the UAE, Egypt, and Turkey.

📌 Note — International Candidates

The complete international pathway — NCEES Credentials Evaluation, state board selection strategy, documenting international experience, and international exam center locations — is covered in full in Chapter 17 of this guide.

Chapter 3: Registering for the Exam — Step by Step

The NCEES registration process is straightforward once you know the sequence. What trips people up is not the process itself but doing the steps out of order or missing key details. Here is exactly how it works.

Step 1 — Review Your State Board's Requirements

Before you do anything else, go to the website of the state licensing board where you plan to apply and read their specific requirements. Eligibility to sit for the NCEES PE exam is determined by each individual state board — not by NCEES directly. Some boards require pre-approval before you can register for the exam. Others allow you to register first and complete the licensure application afterward. This difference alone can affect your timeline by months.

Step 2 — Create Your MyNCEES Account

Every candidate needs a MyNCEES account. Go to MyNCEES.org and follow the instructions. The name you register with must be in English and must exactly match the government-issued ID you will present at the Pearson VUE test center. NCEES is strict about name matching — a discrepancy can prevent you from testing with no fee refund.

Each person may have only one MyNCEES account. Your account is also where you access the NCEES PE Power Reference Handbook and purchase official practice exams.

Step 3 — Register and Pay for the Exam

Log in to your MyNCEES account, select "Register for an exam," and follow the onscreen instructions. The NCEES exam fee for the PE Power exam is $400, payable by MasterCard, VISA, or American Express. This fee is required every time you register, including any retake attempts.

International candidates approved through a foreign entity are assessed a nonrefundable $25 international scheduling fee at registration.

Step 4 — Receive Your Authorization to Schedule

After you have registered and your state board has approved your application, you will receive an email from NCEES notifying you that you are authorized to schedule your exam. This is your green light. From that point, you have 12 months to sit for the exam. If you do not test within 12 months, you forfeit the registration fee.

Step 5 — Schedule at a Pearson VUE Test Center

NCEES exams are administered exclusively at Pearson VUE test centers. Log in to your MyNCEES account, select the "Schedule" button, and follow the instructions. Schedule as far in advance as possible — test centers have limited capacity and seats are reserved first-come, first-served. You must schedule at least one business day before your exam appointment.

Testing Windows for PE Power

The PE Power exam is offered year-round, which gives you significant scheduling flexibility compared to PE exams offered only once or twice a year. NCEES policy allows you to attempt the exam once per testing window and no more than three times in any 12-month period.

Testing Window	Months Available
Window 1	January – March
Window 2	April – June
Window 3	July – September
Window 4	October – December

Rescheduling and Cancellation

If you need to reschedule, you must do so at least 48 hours before your appointment. A $50 rescheduling fee is paid directly to Pearson VUE. Cancellation also requires 48 hours notice with a fee payable to Pearson VUE.

NCEES makes emergency exceptions for documented situations including car accidents, medical emergencies, death of an immediate family member, military duty, and court appearances. Documentation must be submitted to NCEES within 14 days of your originally scheduled appointment.

If you need to cancel your exam registration entirely (not just the appointment), log in to MyNCEES and select Cancel. You will receive a refund of the NCEES registration fee less a $50 administrative fee.

🔗 **Want to go deeper?**
For a personalized registration walkthrough based on your specific state or country, book a 1-on-1 call at shailearning.com/book-a-call. We will go through your situation step by step.

Chapter 4: Preparing for Exam Day at the Test Center

The PE Power exam is nine hours long. That is a long time to perform under pressure, and what happens before the first question appears on your screen matters just as much as how well you studied. Let me walk you through exactly what exam day looks like.

Arrive 30 Minutes Early

Get to the Pearson VUE test center 30 minutes before your scheduled appointment time. This is not a suggestion. If you arrive late, you may be turned away and lose your exam fee with no recourse.

What to Bring

The Pearson VUE check-in process is thorough. Here is exactly what you are allowed to bring into the testing room:

- One NCEES-approved calculator (without the cover). A TI-30XS calculator is also available on-screen if needed.
- One current government-issued photo ID. The name on your ID must exactly match your appointment confirmation. Digital IDs are not accepted.
- Eyeglasses (without the case)
- A light sweater or non-outerwear jacket
- The key to your test center locker, if applicable
- Any items on the Pearson VUE Comfort Aid List (earplugs, noise-canceling headphones, tissues — no preapproval needed)

Everything else — phone, smartwatch, wallet, bags, books, notes, pens, food, beverages — must be stored in a test center locker before you enter the testing room.

The Check-In Process

Upon arrival, you will review and digitally sign the NCEES Exam Rules and Agreement. A Pearson VUE representative will take a digital photo of you and you will provide a palm vein scan — NCEES uses biometric verification to protect exam integrity. You will provide another palm vein scan each time you enter and exit the testing room.

You will be provided with two reusable booklets and three markers for scratch work. No outside paper or writing instruments are permitted.

Calculator Policy

Review the NCEES calculator policy before exam day. The approved list is available on the NCEES exams page. Bring your approved calculator without its case. Spare calculators and cases may be stored with your belongings outside the testing room.

Reference Materials Provided During the Exam

The PE Power exam is closed book, but NCEES provides the following materials as searchable electronic PDFs throughout the entire exam:

- NCEES PE Electrical and Computer: Power Reference Handbook
- NFPA 70-2020 (National Electrical Code)
- NFPA 70E-2021 (Standard for Electrical Safety in the Workplace)
- NFPA 497-2021 (Classification of Flammable Liquids, Gases, or Vapors)
- NFPA 499-2021 (Classification of Combustible Dusts)
- NFPA 30B-2023 (Code for the Manufacture and Storage of Aerosol Products)
- ANSI C2-2017 (National Electrical Safety Code — NESC)

Only one chapter of any standard can be open at a time. Use the search box on the left side of the reference material — the Ctrl+F search function is not available. Chapter 15 of this guide covers how to navigate these references efficiently under exam conditions.

From Shai

Do not wait until exam day to learn how the reference software works. The NCEES YouTube channel shows exactly how to search and navigate the on-screen references. Watch it. Then practice. Finding a specific NEC article in 60 seconds versus 3 minutes is the difference between finishing with time to review and running out of time.

Chapter 5: Understanding the Exam Format

The NCEES PE Electrical and Computer: Power exam is a nine-hour, 80-question computer-based test. Understanding the format before you sit down to your first practice session will help you train more efficiently and avoid surprises on exam day.

Exam Time Breakdown

Component	Time Allocated
Total appointment time	9 hours
Nondisclosure Agreement review	2 minutes
Tutorial	8 minutes
Actual exam time	8 hours 50 minutes
Scheduled break (optional, mid-exam)	Included in exam time — use wisely
Total questions	80

Two-Section Format

The exam is divided into two sections. You will receive the full exam time at the beginning and manage your own pacing. After you have worked through approximately the first half of the questions, you will be prompted to review and submit that section. Once submitted, you cannot return to those questions. You will then have the option to take your scheduled break.

Manage your time carefully across both sections. Many candidates spend too long on difficult questions early and find themselves rushing through easier questions in the second half.

Question Types

Most questions on the PE Power exam are traditional multiple-choice with a single correct answer. However, the exam also includes alternative item types:

- **Multiple correct options:** More than one answer choice may be correct. Read these carefully.
- **Point and click:** You click on part of a graphic or diagram to answer the question.
- **Drag and drop:** You drag items to match, sort, rank, or label.

- **Fill in the blank:** You type a numerical response. There is no multiple-choice safety net for these.

All question types — traditional and alternative — are scored the same way. There is no penalty for a wrong answer. If you are unsure, answer the question anyway. Never leave a question blank.

Scheduled and Unscheduled Breaks

The scheduled break occurs after you review and submit the first half of the exam. You may leave the building. Any unused break time does not extend your remaining exam time, so return promptly and allow time for the proctor to re-admit you.

You may also take unscheduled breaks at any time by raising your hand to notify a proctor. However, unscheduled break time is deducted from your exam time. You are not permitted to leave the building during unscheduled breaks.

Receiving Your Results

Exam results are typically available 7 to 10 days after you test. You will receive an email from NCEES with instructions to view your results in your MyNCEES account. Results are reported as pass or fail only.

If you do not pass, you will receive a diagnostic report showing your performance in each knowledge area, expressed as a scaled score from 0 to 15. The report compares your performance to the average performance of passing candidates in each domain. This is your primary tool for planning a targeted retake strategy.

Scoring

Your exam score is based on the total number of correct answers. There are no deductions for wrong answers. The raw score is converted to a scaled score that adjusts for minor variations in difficulty across different exam forms administered on different days. NCEES does not publish a fixed passing score because it varies slightly with each form.

📌 Pretest Items

A limited number of questions on each exam are unscored pretest items — questions NCEES is evaluating for potential use in future exams. These questions look identical to scored questions and are randomly distributed throughout the exam. You cannot identify them, so treat every question as if it counts.

Chapter 6: Domain 1 — Measurement and Instrumentation

6 to 9 Questions | NCEES PE Power Exam Specifications, October 2025

Before a power system can be operated, maintained, or designed with confidence, it has to be measured accurately. Domain 1 covers the instruments and methods engineers use to take reliable measurements from live power systems — and to verify that critical components like cables, motors, and grounding electrodes are performing within safe limits.

With 6 to 9 questions, this domain may carry fewer questions than Protection or Circuit Analysis, but it is foundational. Every other domain ultimately depends on the reliability of the measurements that feed it.

What NCEES Tests in Domain 1

NCEES specifies three knowledge areas for this domain:

A. Instrument Transformers and Metering

Instrument transformers are the devices that make it safe to measure high-voltage and high-current power systems using standard metering equipment. Current transformers (CTs) step down high currents to measurable levels — typically 5 A secondary — while voltage transformers (VTs, also called potential transformers or PTs) step down high voltages to usable measurement values, typically 120 V secondary.

The PE exam tests your understanding of CT and VT transformation ratios, accuracy classes (metering class versus protection class), and burden — the total impedance connected to the transformer secondary. A key safety concept that appears on the exam is what happens when a CT secondary circuit is accidentally opened while the primary is energized: the result is a dangerous high-voltage condition on the secondary terminals that can destroy the CT and injure personnel.

Metering systems built around instrument transformers — including watt-hour meters, demand meters, and power quality analyzers — are also tested in this knowledge area.

Key Concept — CT Saturation

When a CT is driven beyond its linear operating range by a very large fault current, it saturates — the magnetic core can no longer faithfully reproduce the primary current in the secondary. Saturated CTs produce distorted secondary currents that can cause protective relays to misoperate. Understanding CT saturation and how to prevent it through proper CT selection is tested in both Domain 1 and Domain 9 (Protection).

B. Insulation Testing

Electrical insulation in cables, motors, transformers, and switchgear degrades over time due to heat cycling, moisture absorption, contamination, and mechanical stress. Insulation testing gives engineers a way to assess insulation condition before it fails in service — allowing planned maintenance rather than emergency response.

The most widely used insulation test is the megohmmeter test (megger test), which applies a DC voltage — typically 500 V, 1000 V, or 2500 V depending on the equipment — and measures the resulting insulation resistance in megaohms or gigaohms. Two time-based indices are calculated from megger readings to characterize insulation condition:

- **Dielectric Absorption Ratio (DAR):** The ratio of the 60-second resistance reading to the 30-second reading. A DAR above 1.25 generally indicates acceptable insulation.
- **Polarization Index (PI):** The ratio of the 10-minute resistance reading to the 1-minute reading. A PI above 2.0 is generally considered good insulation; a PI below 1.0 suggests moisture contamination or significant deterioration.

C. Ground Resistance Testing

Effective grounding is essential for system protection and personnel safety. Ground resistance testing measures the resistance between a grounding electrode and true earth — a value that must be low enough to allow fault current to flow freely and activate protective devices.

The fall-of-potential method is the most widely used test procedure. A test current is driven between the electrode under test and a remote current electrode placed far enough away to be outside the zone of influence. A potential electrode is then moved between them to measure voltage drop at different distances, producing a resistance plot from which the true ground resistance is read.

Soil resistivity measurements — used to design grounding grids for substations, generating plants, and industrial facilities — are also tested in this knowledge area. The four-electrode Wenner method is the standard approach for soil resistivity surveys.

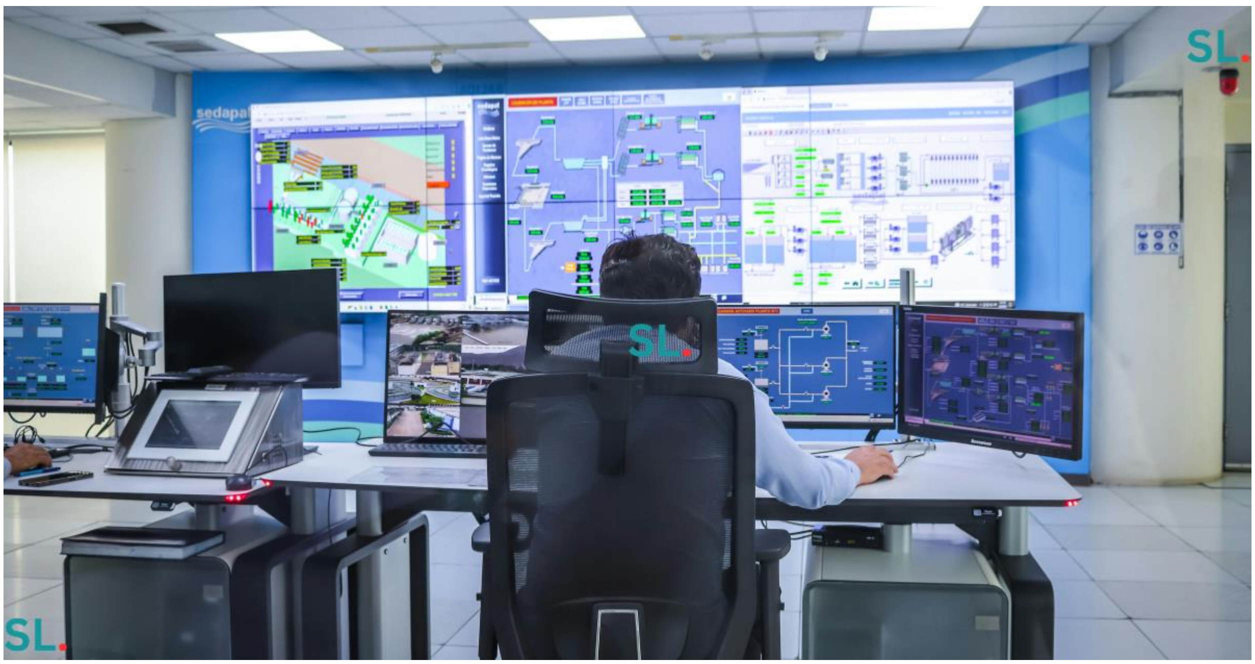
🔗 **Want to go deeper?**

For technical coaching on instrument transformers, insulation testing calculations, and ground resistance methods for the PE Power exam, visit shailearning.com

Chapter 7: Domain 2 — General Applications

8 to 12 Questions | NCEES PE Power Exam Specifications, October 2025

Domain 2 is one of the broadest domains on the PE Power exam, covering a set of practical power engineering applications that span multiple system types and disciplines. With 8 to 12 questions, it is among the higher-weighted domains and rewards candidates who have experience across diverse electrical system types.



What NCEES Tests in Domain 2

NCEES specifies five knowledge areas for this domain:

A. Lightning Protection

Lightning is among the most destructive natural forces that affect electrical systems. Lightning protection systems are engineered to intercept direct strikes and safely conduct the resulting impulse current to earth, protecting structures, equipment, and the people inside.

The PE exam tests your understanding of protection zone concepts — specifically how rolling sphere models and zone-of-protection calculations determine where air terminals (lightning rods) must be placed. Down conductor sizing, routing, and spacing requirements are also tested, as are the applicable NFPA and IEEE standards that govern system design.

B. Surge Protection

Even when lightning does not make a direct strike, the electromagnetic energy from nearby strikes, combined with switching transients from breaker operations, capacitor bank switching, and motor starting, generates voltage surges that travel through power distribution systems. These transient overvoltages can damage or destroy sensitive equipment.

Surge protective devices (SPDs) and surge arresters are the primary tools for limiting these overvoltages. The PE exam tests surge arrester selection — including voltage rating, discharge current rating, and voltage protection level — and how arrester performance must be coordinated with the insulation withstand levels of the equipment being protected.

C. Illumination and Lighting

Lighting design is a practical application of electrical engineering that consistently appears on the PE Power exam. The key concepts are photometric quantities and their application in calculating illumination levels for interior and exterior spaces.

You need to understand the relationships between lumens (total light output), lux and foot-candles (illuminance at a surface), candela (luminous intensity), and luminous efficacy (lumens per watt). The zonal cavity method for interior lighting calculations appears in the NCEES Reference

Handbook. NEC requirements for lighting branch circuits, load calculations, and wiring methods are also tested.

D. Energy Management and Demand Calculations

Energy management involves understanding how electrical energy is consumed, measured, and billed — and how load management strategies can improve efficiency and reduce costs. The PE exam tests your ability to calculate energy consumption in kilowatt-hours, calculate peak demand in kilowatts, and apply demand factors and load factors in real-world load analysis scenarios.

These calculations are foundational to utility billing analysis, load forecasting, power system planning, and the economic justification of energy efficiency investments. They also form the basis for demand response programs and time-of-use rate optimization.

E. Grounding

Grounding is one of the most frequently tested topics on the PE Power exam, appearing in multiple domains because of how fundamental it is to both system protection and personnel safety.

In the context of Domain 2, the primary focus is on system grounding — how the neutral of a power distribution system is intentionally connected to earth — and equipment grounding — how exposed conductive parts of electrical equipment are bonded together and to earth to eliminate shock hazards under fault conditions. NEC Article 250 governs grounding and bonding in detail and is one of the most heavily tested NEC articles on the PE Power exam.

📌 **NEC Article 250 — Most Tested Grounding Article**

Know the distinction between the grounded conductor (the system neutral), the equipment grounding conductor (the safety ground), and the grounding electrode conductor (connecting the system to earth). These terms are frequently confused — and frequently tested. Article 250 of the 2020 NEC is your primary reference.

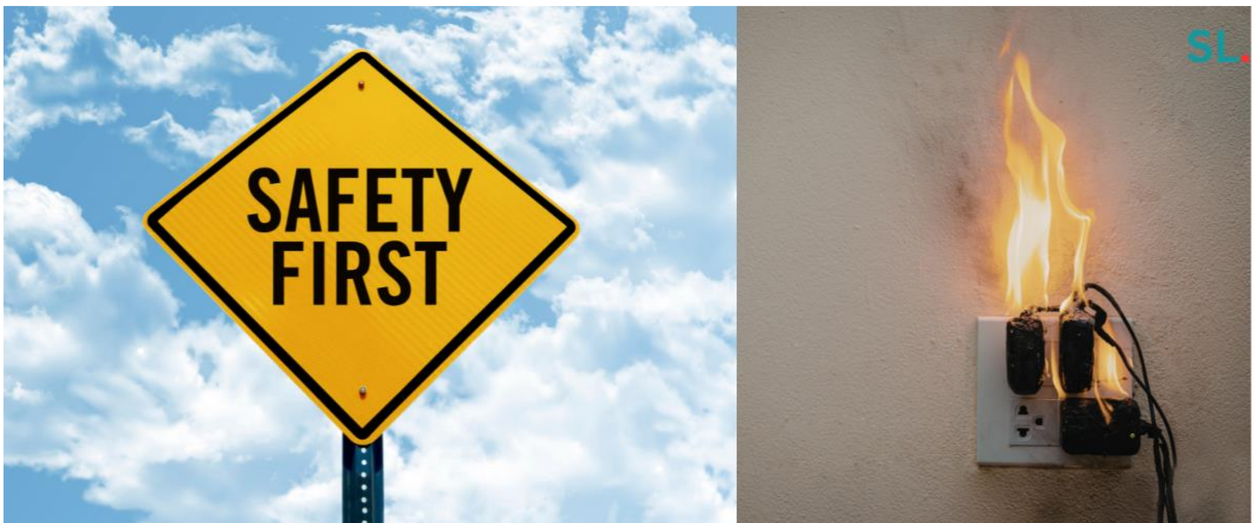
🔗 **Want to go deeper?**

For a targeted review of NEC Article 250 grounding concepts, surge-protection device selection, and energy-management calculations, visit shailearning.com.

Chapter 8: Domain 3 — Electrical Safety

10 to 15 Questions | NCEES PE Power Exam Specifications, October 2025

Electrical Safety is one of the three highest-weighted domains on the PE Power exam, tied with Circuit Analysis and Protection at 10 to 15 questions. It is also one of the domains that candidates most consistently underestimate — because the word "safety" sounds conceptual when in reality this domain requires specific calculations, code-driven engineering decisions, and a detailed working knowledge of NFPA 70 and NFPA 70E.



From Shai

When I was studying for the PE exam, I treated electrical safety with the same technical intensity I gave to relay coordination. That approach paid off. Do not make the mistake of thinking that safety questions are easier than analysis questions. Arc flash incident energy calculations and NEC conductor sizing are just as mathematically demanding as fault current analysis — they just use different source material.

What NCEES Tests in Domain 3

NCEES specifies four knowledge areas for this domain:

A. Wiring Methods and Installations

The National Electrical Code (NFPA 70-2020) governs wiring methods — how conductors are run, supported, protected, and terminated throughout electrical installations. The PE exam tests your ability to apply NEC requirements for conductor sizing, conduit fill, ampacity correction factors, and the selection of appropriate wiring methods for different environmental conditions and occupancy types.

Key NEC chapters and articles in this area include Article 310 (conductors for general wiring — ampacity tables, temperature rating correction, and conduit fill derating), Article 300 (general wiring requirements for all installations), and Articles 330 through 398 covering specific wiring methods such as metal-clad cable, rigid conduit, flexible conduit, and cable tray systems.

B. Hazardous Locations

Hazardous locations are areas where flammable gases, flammable vapors, flammable liquids, or combustible dusts may be present in quantities sufficient to produce a fire or explosion hazard. Engineers who design electrical installations for petrochemical facilities, refineries, grain handling facilities, pharmaceutical plants, paint spray booths, or any environment with similar hazards must classify these areas and select electrical equipment rated for those conditions.

The NEC uses two parallel classification systems. The Class/Division system — Classes I, II, and III for gas/vapor, dust, and fibers respectively, with Division 1 (hazard normally present) and Division 2 (hazard abnormally present) — is the traditional North American approach and is still dominant in the PE exam. The Zone system, aligned with IEC international standards, is also covered in the NEC but less heavily tested.

NFPA 497 (provided during the exam) covers classification of flammable liquids, gases, and vapors. NFPA 499 (also provided) covers combustible dusts. Both must be navigated efficiently under exam conditions.

C. Special Occupancies and Systems

Certain occupancies impose electrical installation requirements that go well beyond the general NEC provisions because of the specific risks they present. The PE exam tests your understanding of what makes these occupancies different and what code requirements apply:

- **Healthcare Facilities (NEC Article 517):** Require essential electrical systems with automatic transfer, isolated power systems in patient care areas, and specific grounding arrangements to protect patients from micro-shock hazards.
- **Emergency Systems (NEC Article 700):** Must supply power to lighting and equipment essential for safety within 10 seconds of normal power loss.
- **Legally Required Standby Systems (NEC Article 701):** Required by laws, codes, or regulations for orderly process shutdown but not necessarily life safety.
- **Optional Standby Systems (NEC Article 702):** Intended to protect private business operations or provide comfort where automatic restoration is not critical.

D. Shock and Burns — Arc Flash and Electric Shock Hazards

Two of the most serious hazards facing electrical workers are electric shock and arc flash. NFPA 70E-2021, the Standard for Electrical Safety in the Workplace, is the governing document for safe work practices and is one of the six standards provided during the PE Power exam.

Electric shock hazard analysis involves understanding the NFPA 70E approach boundaries that define safe working distances for qualified and unqualified workers: the Limited Approach

Boundary, the Restricted Approach Boundary, and the Prohibited Approach Boundary for shock. These boundaries are determined from voltage level and are found in NFPA 70E Table 130.4(E).

Arc flash hazard analysis is the calculation-intensive component of this knowledge area. An arc flash event releases tremendous energy in milliseconds — the resulting pressure wave, intense heat, and molten metal fragments kill and injure workers every year. The incident energy at a working distance, expressed in calories per square centimeter (cal/cm²), determines the minimum arc-rated PPE required.

The PE exam tests two methods for arc flash hazard analysis: the incident energy analysis method (using IEEE 1584 methodology to calculate incident energy from system parameters) and the PPE category method (using NFPA 70E Table 130.5(G) to assign PPE categories based on task type and system characteristics). Candidates should understand both methods and when each is applicable.

📌 Arc Flash — What the Exam Specifically Tests

Know how to determine the arc flash boundary — the distance at which the incident energy equals 1.2 cal/cm² (the threshold for second-degree burns on unprotected skin).

Know NFPA 70E Table 130.5(G): the four PPE categories, their associated incident energy ranges (up to 4, up to 8, up to 25, up to 40 cal/cm²), and the minimum PPE required for each.

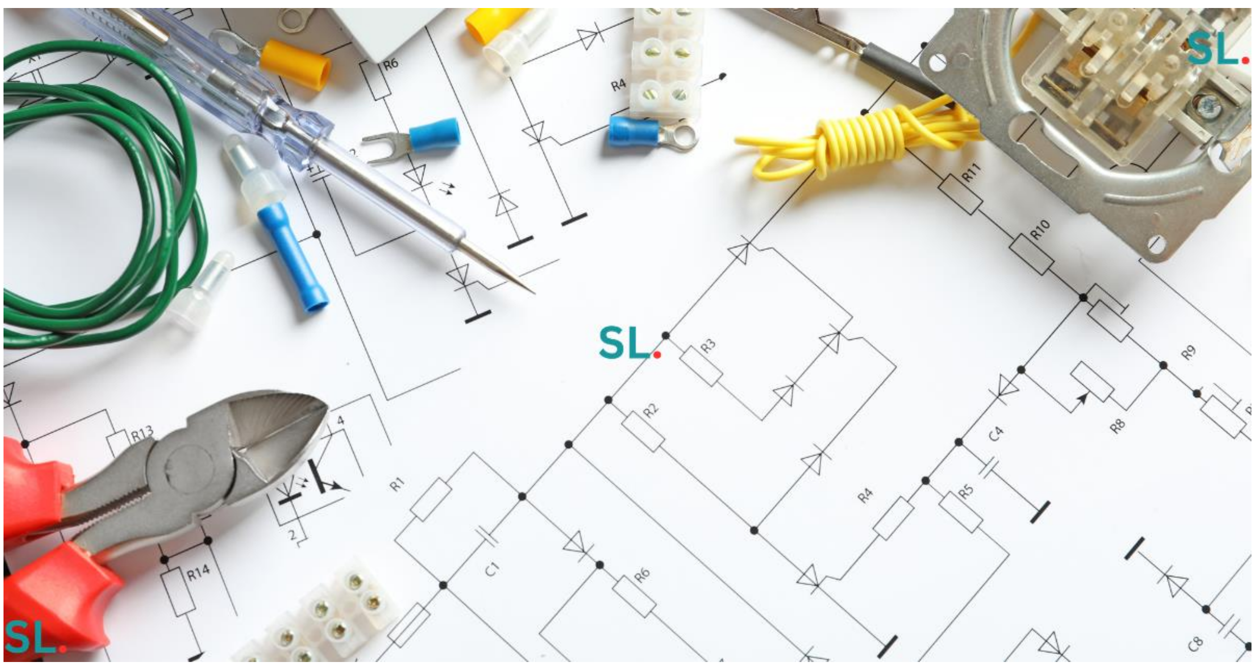
Know the difference between the arc flash boundary (an incident energy boundary) and the shock approach boundaries (voltage-based boundaries). These are separate analyses.

Chapter 9: Domain 4 — Circuit Analysis

10 to 15 Questions | NCEES PE Power Exam Specifications, October 2025

Circuit Analysis is the analytical foundation of all power engineering. If measurement tells you what a system is doing, circuit analysis tells you why — and what it will do under any condition you can model. With 10 to 15 questions, this is one of the three highest-weighted domains on the PE Power exam.

Many engineers approach this domain with confidence based on their undergraduate circuit theory coursework. That confidence is sometimes misplaced. The PE exam tests circuit analysis as applied to three-phase power systems, fault analysis, and transformer systems — not simple resistive loop problems. The tools of power systems circuit analysis — symmetrical components, per-unit normalization, and phasor representation — require dedicated study.



What NCEES Tests in Domain 4

NCEES specifies six knowledge areas for this domain:

A. Three-Phase Circuits

Three-phase systems are the standard for power transmission and distribution, and virtually every engineering problem on the PE exam involves three-phase analysis in some form. This knowledge area covers balanced and unbalanced three-phase circuits, delta and wye connections and the transformation relationships between them, three-phase power calculations (real, reactive, and apparent power), power factor, and the significance of neutral current in unbalanced systems.

The 30-degree phase shift inherent in delta-wye transformer connections — with the high-voltage side leading or lagging the low-voltage side depending on the winding configuration — is a critical concept that appears in both circuit analysis and protection questions.

B. Symmetrical Components

Symmetrical components is one of the most powerful analytical tools in power engineering, and it is heavily tested on the PE Power exam. The method, developed by Charles Fortescue, resolves an unbalanced three-phase system into three balanced sequence networks: positive-sequence (balanced, normal phase rotation), negative-sequence (balanced, opposite phase rotation), and zero-sequence (all three phases co-phasal, no rotation).

The practical value of symmetrical components is that unbalanced fault analysis — which would be mathematically intractable using phase quantities alone — becomes straightforward using sequence networks. The PE exam tests fault current calculations for all standard fault types: three-phase bolted faults, single-line-to-ground faults, line-to-line faults, and double-line-to-ground faults.

C. Per-Unit System

The per-unit system normalizes all electrical quantities — voltage, current, power, and impedance — as dimensionless fractions of chosen base values. This normalization eliminates the need to explicitly convert quantities using transformer turns ratios when analyzing systems with multiple voltage levels, making calculations in large interconnected power systems far more manageable.

The PE exam tests per-unit base conversions — specifically converting impedance from one base system to another — which is a very common calculation when combining data from different manufacturers' equipment or when mixing old and new system data.

D. Phasor Diagrams

Phasors are the frequency-domain representation of sinusoidal electrical quantities. A phasor diagram shows the magnitude and phase relationships between voltages and currents in a circuit, which is essential for power factor analysis, transformer analysis, synchronous machine analysis, and understanding the operating principles of directional protective relays.

The ability to draw and interpret phasor diagrams correctly under exam conditions — particularly for unbalanced systems, transformer banks with non-standard connections, and sequence network analysis — is a skill that requires practice.

E. Single-Phase Circuits

Single-phase analysis is the foundation for understanding three-phase systems and appears in its own right for single-phase loads, residential distribution, UPS systems, and certain industrial applications. The exam tests AC circuit analysis using complex impedance, series and parallel RLC circuits, resonance, and power factor in single-phase systems.

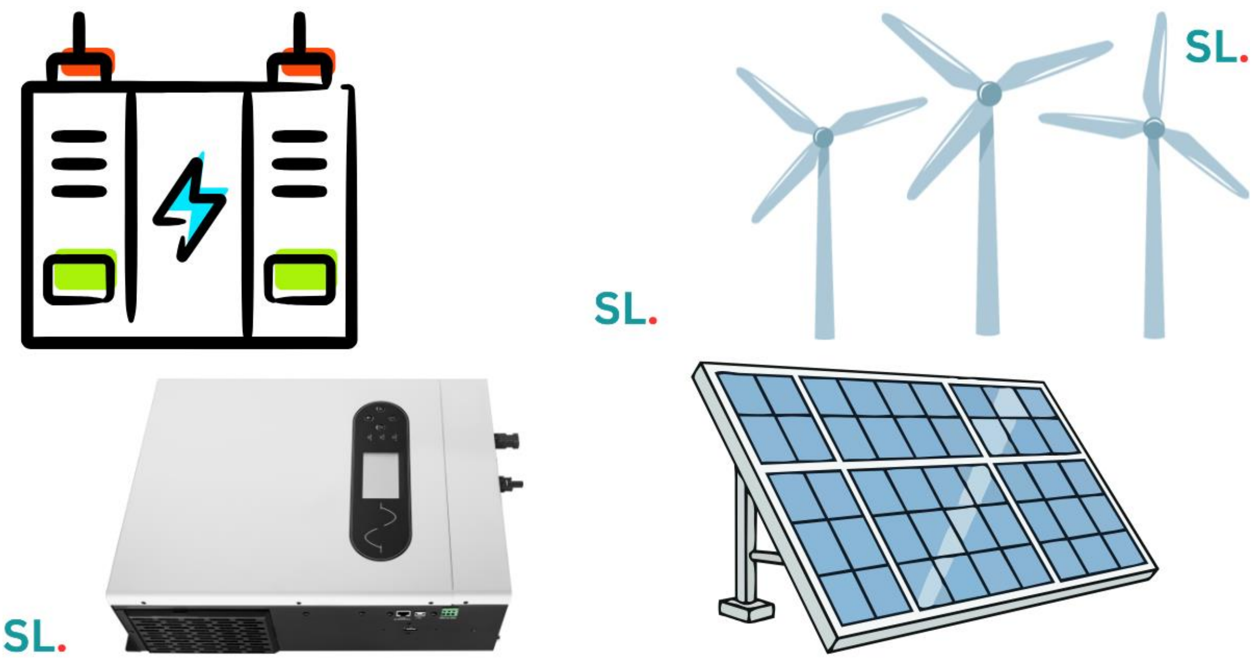
F. Direct Current Circuits

DC circuit analysis covers Kirchhoff's voltage and current laws, Thevenin and Norton equivalent circuits, superposition, and maximum power transfer. These methods apply to battery systems, DC distribution systems, control and relay circuits, and the DC bus in power electronics applications. The Thevenin equivalent circuit is also used in power flow analysis and fault current calculations, making this knowledge area more broadly connected than it might initially appear.

Chapter 10: Domain 5 — Power Electronic Circuits and Control Devices

5 to 8 Questions | NCEES PE Power Exam Specifications, October 2025

Power electronics has moved from a specialized niche to a mainstream power engineering discipline. Battery storage systems, solar PV inverters, variable frequency drives, and electric vehicle charging infrastructure are now standard elements of the power grid — and the October 2025 PE Power exam update explicitly reflects this shift. The addition of inverter-based resources (IBR) and energy storage to this domain is one of the most significant changes in the new specifications.



If you are using study materials published before 2025, this is one domain where you need updated resources. The exam will test content on grid-connected inverters and battery storage systems that older study guides simply do not cover.

What NCEES Tests in Domain 5

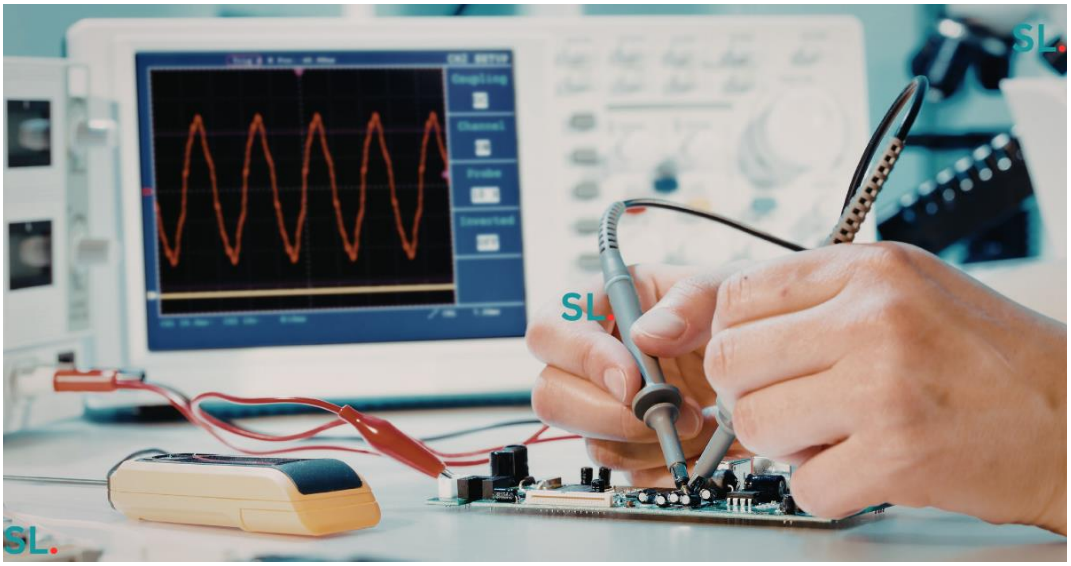
NCEES specifies two knowledge areas for this domain:

A. Power Electronics — Converters, Inverter-Based Resources, and Variable Frequency Drives

Power electronics circuits use semiconductor switching devices (diodes, thyristors, MOSFETs, IGBTs) to convert electrical energy between different forms. The four fundamental conversion types tested on the PE exam are:

- **Rectifiers (AC to DC):** Convert AC power to DC. Single-phase and three-phase rectifier circuits, output voltage calculations, ripple characteristics, and the impact of rectifiers on power quality through harmonic generation are tested.
- **Inverters (DC to AC):** Convert DC from batteries, solar panels, or other DC sources into AC power for grid connection or AC loads. The October 2025 update specifically adds grid-following inverters (which synchronize to an existing grid voltage) and grid-forming inverters (which can establish grid voltage and frequency independently) as exam topics.
- **DC-to-DC Converters:** Step-up (boost), step-down (buck), and buck-boost converter topologies appear in battery management systems, photovoltaic MPPT controllers, and EV charging applications.
- **Variable Frequency Drives (VFDs):** Adjust AC motor speed by simultaneously varying the output frequency and voltage. VFDs are the dominant motor speed control method in industrial applications and generate characteristic harmonic currents (5th, 7th, 11th, 13th harmonics) that affect power system power quality.

Energy storage systems — specifically batteries and ultracapacitors — are explicitly listed in the October 2025 specifications. Candidates should understand battery state of charge, charge/discharge characteristics, inverter interface requirements, and NEC Article 706 (Energy Storage Systems), which was added to the NEC in the 2017 edition and governs battery installations.



📌 New for October 2025 — IBR and BESS

The October 2025 specifications explicitly added inverter-based resources (IBR) and battery energy storage systems (BESS) to Domain 5. This content also connects to Domain 7 (Electric Power Devices) which lists alternative power generation (PV, wind) and electrical energy storage separately. Study both domains together for maximum efficiency.

B. Relays, Switches, Boolean and Ladder Logic

Control systems in power facilities use discrete switching devices, electromechanical relays, and programmable controllers to automate operations, sequence equipment, and respond to fault conditions. The PE exam tests your understanding of control circuit design using Boolean logic principles and ladder logic diagrams — the graphical representation of relay-based control logic that is standard throughout industrial power facilities.

Key concepts include: coil and contact operation in electromechanical relays, normally-open versus normally-closed contact logic, time-delay relays (on-delay and off-delay), seal-in circuits, and the translation of a verbal control sequence description into a correct ladder logic diagram. This knowledge area is distinct from the protective relay analysis in Domain 9 — here the focus is on control logic, not protection system design.

🔗 Want to go deeper?

For updated study resources covering grid-forming inverters, BESS integration, and VFD harmonic analysis aligned to the October 2025 exam specifications, visit shailearning.com.

Chapter 11: Domain 6 — Rotating Machines

5 to 8 Questions | NCEES PE Power Exam Specifications, October 2025

Rotating machines — motors and generators — are the workhorses of the power system. They convert between electrical and mechanical energy at every scale imaginable: from small fractional-horsepower motors in commercial building HVAC to multi-hundred-megawatt generators at large power plants. Understanding how these machines operate and what determines their performance is fundamental to power engineering practice.

What NCEES Tests in Domain 6

NCEES specifies two knowledge areas for this domain:

A. Machine Types and Applications

The PE exam covers four categories of rotating machines:

- **Induction Motors:** The most common motor type in industrial and commercial applications worldwide. The equivalent circuit of the induction motor — which models stator and rotor winding resistances, leakage reactances, core loss, and magnetizing reactance — is the primary analytical tool for calculating motor performance. Key quantities tested include slip (the per-unit difference between synchronous speed and rotor speed), efficiency, power factor, starting current, starting torque, and the torque-speed relationship.

- **Synchronous Generators:** The machines that produce virtually all the electrical energy delivered to the grid. The synchronous reactance model and the internal voltage phasor diagram are the tools for analyzing generator performance, voltage regulation, and stability limits. Key concepts include the relationship between real power output and power angle (torque angle), the relationship between reactive power output and field excitation, and the effect of armature resistance on voltage regulation.

- **Synchronous Motors:** Synchronous machines operated as motors. Because field excitation can be independently controlled, synchronous motors can be operated at leading power factor — making them valuable for power factor correction in large industrial facilities where reactive power charges are significant.

- **DC Machines:** While less common in new installations than in previous decades, DC motors and generators appear on the PE exam in the context of specific industrial applications, traction systems, and legacy equipment. Understand the different DC machine configurations (series, shunt, compound) and their torque-speed characteristics.

B. Motor Starting

When an induction motor starts, it draws a starting current — called locked-rotor current — that typically ranges from 6 to 8 times the motor's full-load current. This starting current surge can cause significant voltage dips on the supply system, trip overcurrent protection devices set for running protection, and impose mechanical stress on the driven equipment.

The PE exam tests the following motor starting methods and their trade-offs:

- **Direct-On-Line (DOL) Starting:** The simplest method — the motor is connected directly to full voltage. Full starting torque is available immediately, but starting current is at maximum.
- **Reduced-Voltage Starting:** Autotransformer starters, wye-delta starters, and soft starters all reduce starting current by reducing the voltage applied to the motor during starting. Starting torque is also reduced — proportional to the square of the voltage reduction.
- **Variable Frequency Drive Starting:** VFDs allow the motor to accelerate gradually from zero speed by starting at low frequency and voltage and ramping both up together. This method provides the smoothest acceleration and the best control over starting current and torque.

NEC Article 430, which governs motors, motor circuits, and controllers, is one of the most extensively tested NEC articles on the PE Power exam. Candidates must know how to size motor branch circuit conductors, motor overload protection (Article 430.32), and motor branch circuit short-circuit and ground-fault protection (Article 430.52 and Table 430.52).

🔗 **Want to go deeper?**

For a focused review of NEC Article 430 motor circuit calculations and induction motor equivalent circuit analysis, visit shailearning.com or book a 1-on-1 session.

Chapter 12: Domain 7 — Electric Power Devices

8 to 12 Questions | NCEES PE Power Exam Specifications, October 2025

Electric power devices are the hardware that makes the grid function: the transformers that step voltages up and down across the transmission and distribution system, the capacitor banks that correct power factor and support voltage, the energy storage systems that are beginning to reshape how the grid handles variability, and the generation technologies that are diversifying the power supply mix.

What NCEES Tests in Domain 7

NCEES specifies five knowledge areas for this domain:

A. Transformers

Transformers are the most extensively tested topic in the Electric Power Devices domain. The transformer equivalent circuit — including primary and secondary winding resistances, leakage reactances, core loss resistance, and magnetizing reactance — is the analytical model for calculating voltage regulation, efficiency, and short-circuit parameters.

Transformer connections receive significant attention on the PE exam. Delta-delta, wye-wye, delta-wye, and wye-delta configurations each have different implications for voltage transformation ratios, the inherent 30-degree phase shift (present in all delta-wye configurations), zero-sequence current flow paths, and third-harmonic circulation. These connection characteristics directly affect how protection engineers design differential relay systems.

Additional transformer topics tested include: voltage regulation (the percentage change from no-load to full-load secondary voltage), per-unit impedance and how it is used in fault current calculations, autotransformer advantages and limitations, tap changing under load (TCUL) mechanisms, and NEC Article 450 requirements for transformer overcurrent protection and installation.

B. Capacitors

Capacitor banks are installed in power distribution systems primarily to supply reactive power locally — improving power factor, reducing reactive current on feeders, and supporting bus voltage levels. The PE exam tests capacitor bank sizing calculations for target power factor correction, the impact of harmonics on capacitor bank performance and life (resonance between capacitor banks and system inductance can amplify harmonic currents to destructive levels), and switching transient considerations.

C. Electrical Energy Storage

New for October 2025: electrical energy storage systems — batteries and ultracapacitors — are explicitly listed as exam content in Domain 7. Battery energy storage systems (BESS) are being deployed at utility scale, commercial facilities, and microgrids for applications including peak shaving, frequency regulation, spinning reserve, and backup power.

Candidates should understand battery system fundamentals: state of charge, depth of discharge, round-trip efficiency, C-rate (the ratio of charge/discharge current to rated capacity), and how battery specifications affect system sizing. NEC Article 706 (Energy Storage Systems) governs the installation of battery systems and is one of the newer articles candidates need to know for the October 2025 exam.

Ultracapacitors (supercapacitors) offer very high power density and nearly unlimited cycle life at the cost of much lower energy density compared to batteries. They are used where rapid, repeated charge-discharge cycles are required — regenerative braking, grid frequency regulation, and power quality applications.

D. Alternative Power Generation

Photovoltaic (PV) systems and wind generation are the two alternative power generation technologies most heavily tested on the PE Power exam. For PV systems, candidates must understand: PV cell and module I-V characteristics, maximum power point tracking (MPPT), string and array configuration (series strings for voltage, parallel strings for current), inverter sizing and types, DC and AC disconnect requirements, NEC Article 690 installation requirements, and utility interconnection procedures.

Wind generation introduces variable and intermittent output characteristics, different generator types (cage induction generators, doubly-fed induction generators, and permanent magnet synchronous generators with full-converter interface), and the power electronic converter systems that interface variable-speed generators to the fixed-frequency grid.

E. Testing

Factory and field testing of transformers, switchgear, and other power equipment verifies that devices are performing correctly and safely. Common tests that appear on the PE exam include transformer turns ratio testing, insulation resistance (megger) testing, power factor (Doble) testing of insulation systems, dielectric withstand testing, and partial discharge testing. Understanding what each test measures and what abnormal results indicate is the practical knowledge NCEES is testing here.

From Shai

Transformers are the topic I see trip up the most candidates in this domain — not because the concepts are too difficult, but because the range of tested content is wider than most people anticipate. Delta-wye phase shift, per-unit impedance conversion, differential protection compensation, autotransformer ratings, and NEC Article 450 all draw from transformer fundamentals. Build this foundation carefully.

Chapter 13: Domain 8 — Transmission and Distribution Analysis

8 to 12 Questions | NCEES PE Power Exam Specifications, October 2025

Transmission and Distribution Analysis is where power system design comes together at the system level. This domain covers how electrical energy moves from where it is generated to where it is consumed — through networks of overhead lines, underground cables, transformers, and substations operating at high, medium, and low voltage.

What NCEES Tests in Domain 8

NCEES specifies eight knowledge areas for this domain:

A. Voltage Drop

Voltage drop calculations determine how much voltage is lost as current flows through the impedance of a conductor. The PE exam tests voltage drop for both single-phase and three-phase circuits using conductor resistance and reactance values from NEC Chapter 9 tables and the NCEES Reference Handbook. The NEC recommends (but does not mandate) that feeder and branch circuit voltage drops not exceed 3% individually and 5% combined.

B. Voltage Regulation and Support

Voltage regulation is the percentage difference between the receiving-end voltage at no load and at full load for a given sending-end voltage. Acceptable voltage regulation requires active management of reactive power across the distribution system through capacitor banks, on-load tap changers, step voltage regulators, and synchronous condensers.

C. Power Factor Correction

Low power factor increases the current required to deliver a given real power, increasing conductor I^2R losses and reducing the effective capacity of transformers and cables. The PE exam tests the sizing of capacitor banks needed to correct from an existing power factor to a target power factor, and the system benefits that result from correction.

D. Power Quality

Power quality encompasses all deviations from the ideal sinusoidal voltage waveform at rated frequency and magnitude: voltage sags (short-duration voltage dips), voltage swells, harmonic distortion, flicker, transients, and voltage unbalance. The PE exam tests the sources of these disturbances — particularly harmonic generation from nonlinear loads such as VFDs and switching power supplies — and their effects on power system equipment.

E. Fault Current Analysis

Fault current analysis calculates the magnitude of current that flows when a short circuit occurs on a power system. These calculations are used to select circuit breakers and fuses with adequate interrupting ratings, to set and coordinate overcurrent protection devices, and to verify the integrity of grounding systems.

The three-phase bolted fault is the most severe fault type and sets the maximum interrupting duty for switching equipment. Symmetrical components, covered in Domain 4, are the mathematical tool used to analyze unbalanced fault types.

F. Transformer Connections

The specific configuration of transformer windings — delta-delta, delta-wye, wye-wye, wye-delta, and the less common zigzag configurations — determines zero-sequence current flow paths, harmonic suppression, and phase shift between primary and secondary voltages. These characteristics are fundamental to both power system analysis and protection relay design.

G. Power Flow

Power flow analysis (also called load flow analysis) determines the steady-state distribution of real and reactive power across a power network, the resulting bus voltages and angles, and the loading on each transmission line and transformer. The PE exam tests the conceptual framework of power flow: load buses (P and Q specified), generator buses (P and |V| specified), and the swing bus (|V| and angle specified as reference).

H. Power System Stability

Power system stability is the ability of a power system to return to a state of equilibrium following a disturbance — a fault, a generator trip, or a large load change. Steady-state stability involves the maximum power that can be transmitted before synchronism is lost under gradual loading. Transient stability involves the system's response to large, sudden disturbances — the classic equal-area criterion provides a graphical method for assessing transient stability that appears on the PE exam.

> 🔗 **Want to go deeper?**
> Transmission and distribution analysis is one of the broadest domains on the exam — eight sub-topics, each with its own set of analytical tools and NEC/NESC references. For a structured review of the sub-topics where candidates most commonly lose points, visit shailearning.com.

Chapter 14: Domain 9 — Protection

10 to 15 Questions | NCEES PE Power Exam Specifications, October 2025

Protection Systems is the final domain and, in terms of difficulty and exam weight, arguably the most demanding. With 10 to 15 questions — one of the three highest-weighted domains — Protection also tends to be the domain that candidates are least prepared for, because protective relay engineering is a specialty that many licensed engineers have limited daily exposure to.

From Shai

I want to be completely direct with you about this domain: if your engineering work does not regularly involve relay settings, coordination studies, or protection engineering, you will need to dedicate meaningful study time to Domain 9. This is not optional. The range of relay types, the coordination analysis, the CT selection requirements, and the sequence network connections for each fault type are not topics you can skim and expect to pass. Budget one full month of your study plan for this domain.

What NCEES Tests in Domain 9

NCEES specifies four knowledge areas for this domain:

A. Overcurrent Protection

Overcurrent protection is the fundamental layer of power system protection. It detects currents above a set threshold and initiates tripping of a circuit breaker or other interrupting device. In the IEEE/ANSI relay designation system, overcurrent relays are designated:

- **Device 50 (Instantaneous Overcurrent):** Trips with no intentional time delay when current exceeds the pickup setting. Used for high-level fault detection close to the source.
- **Device 51 (Time-Overcurrent):** Trips with a time delay that decreases as the fault current magnitude increases, following an inverse time-current characteristic (TCC). This inverse relationship provides the time discrimination needed for coordination between multiple series-connected devices.

Time-overcurrent relays operate according to standardized curve shapes: standard inverse (SI), very inverse (VI), and extremely inverse (EI), each with a different degree of time-current inverseness. The choice of curve shape is part of the coordination study. Extremely inverse curves are commonly used where fuse-saving coordination is desired; very inverse curves are often used for feeder overcurrent relays coordinating with downstream fuses.

B. Protective Relaying

Beyond overcurrent protection, the PE exam tests several specialized relay functions:

- **Differential Protection (Device 87):** Compares the current entering a protected zone (a transformer, generator, or bus) to the current leaving it. Under normal conditions, these currents balance. A fault inside the protected zone creates a differential (unbalance) that trips the relay. Differential protection is highly selective — it responds only to faults within the zone, not faults elsewhere on the system. For power transformers, differential protection requires compensation for the inherent 30-degree phase shift of delta-wye windings.

- **Distance Protection (Device 21):** Measures the apparent impedance from the relay location to the fault point. Because line impedance is proportional to line length, a distance relay can determine approximately where on a transmission line a fault has occurred. Distance protection uses zone settings (Zone 1, Zone 2, Zone 3) to cover different portions of the protected line with different time delays.

- **Undervoltage and Overvoltage (Devices 27/59):** Detect abnormal voltage conditions. Undervoltage protection (27) responds to voltage below a threshold — often indicating a fault, loss of generation, or an overloaded system. Overvoltage protection (59) responds to voltage above a threshold — which can damage equipment and cause insulation failure.

- **Pilot Protection Schemes:** Communication-based protection that allows relays at both ends of a transmission line to exchange information about the direction or magnitude of fault current. This enables high-speed tripping of all fault types on the line, including faults that appear as external to one of the terminal relays.

C. Protective Devices

The PE exam tests the characteristics and application of the physical interrupting devices that clear fault currents:

- **Fuses:** Single-operation interrupting devices that melt when carrying fault current above their rating. Fuse selection involves matching the fuse minimum-melt and total-clearing time-current characteristics to system protection requirements and verifying that the fuse interrupting rating exceeds available fault current.
- **Circuit Breakers:** Reusable interrupting devices with mechanical operating mechanisms and arc interruption capability. The interrupting rating of every circuit breaker must be verified against the available fault current at its installation location.
- **Reclosers:** Automatic circuit interrupters installed on distribution feeders that open and attempt to reclose after a fault. Because most faults on overhead distribution lines are transient (caused by tree branches, wildlife, lightning, or conductor contact), the recloser gives the arc time to extinguish before re-energizing the line. Typical recloser sequences are one instantaneous operation followed by two or three time-delay operations before lockout.

D. Coordination

Coordination is the practice of setting protective devices in series so that the device closest to the fault always operates first, isolating only the faulted section while leaving the maximum portion of the system energized. Proper coordination requires plotting the time-current characteristics (TCCs) of all devices in the protection chain on a common log-log scale and verifying that adequate time margins exist between them.

The minimum coordination interval between two overcurrent devices — the time margin required to ensure that the upstream device does not trip before the downstream device clears the fault — is typically 0.2 to 0.3 seconds for electromechanical relays and 0.1 seconds for modern digital relays, depending on circuit breaker interrupting time and other factors.

The PE exam tests TCC coordination analysis, fuse-to-fuse coordination, relay-to-fuse coordination, and the identification of coordination gaps or overlaps that would cause incorrect device operation.

ANSI/IEEE Device Number	Relay Function	Primary Application
21	Distance	Transmission line phase and ground fault protection
27	Undervoltage	Generator, motor, and bus voltage protection
32	Directional Power	Anti-motoring protection for generators
40	Loss of Field	Generator excitation failure protection
50	Instantaneous Overcurrent	High-speed fault detection, bus protection
51	Time Overcurrent	Feeder, motor, transformer overcurrent protection
59	Overvoltage	Equipment overvoltage protection
67	Directional Overcurrent	Loop feed and network distribution protection
78	Phase Angle / Out-of-Step	Generator stability and islanding protection
87	Differential	Transformer, generator, bus fault protection

📌 **ANSI Device Numbers — Know These for the Exam**

ANSI/IEEE device numbers appear throughout protection questions — in system diagrams, relay settings discussions, and protection coordination problems. Memorize the function of each number in the table above. They will appear without definition on the exam.

🔗 **Want to go deeper?**

Domain 9 is where PE Power mentorship has the highest return on investment for most candidates. A structured walk-through sequence, network analysis, TCC coordination methodology, and differential relay compensation, with someone who uses these tools professionally, accelerates learning dramatically. Learn more at shailearning.com.

Chapter 15: The Reference Standards — Your Tools Inside the Exam

The PE Power exam is closed-book in the sense that you cannot bring your own materials into the testing room. But it is not open-ended guesswork — NCEES provides six codes and standards plus the PE Power Reference Handbook as searchable electronic PDFs throughout the entire exam. How efficiently you navigate these documents under time pressure is a skill that can meaningfully shift your score.

The Six Reference Standards Provided

Standard	Edition	Primary Exam Applications
NFPA 70 — National Electrical Code (NEC)	2020	Wiring methods, conductors, motors (Art. 430), grounding (Art. 250), hazardous locations (Art. 500–506), transformers (Art. 450), PV systems (Art. 690), energy storage (Art. 706)
NFPA 70E — Electrical Safety in the Workplace	2021	Arc flash hazard analysis, PPE categories, approach boundaries, safe work practices, and LOTO requirements
NFPA 497 — Classification of Flammable Liquids, Gases, or Vapors	2021	Class I hazardous location classification in chemical process areas
NFPA 499 — Classification of Combustible Dusts	2021	Class II hazardous location classification (combustible dusts)
NFPA 30B — Code for Aerosol Products	2023	Hazardous location classification for aerosol product manufacturing and storage
ANSI C2 — National Electrical Safety Code (NESC)	2017	Overhead conductor clearances, utility line construction, supply and communication line grounding

The NEC — Your Most Important Reference

The National Electrical Code is the most heavily used reference standard on the PE Power exam and also the most complex to navigate under time pressure. The NEC spans over 900 pages across articles covering everything from basic wiring to specialized equipment and installations.

The key to using the NEC efficiently on the exam is building your navigation map in advance: know which article covers which topic, and practice finding specific provisions quickly. Here are the NEC articles that appear most frequently on the PE Power exam:

NEC Article	Topic	Why It Matters for PE Power
Art. 210–230	Branch Circuits, Feeders, Services	Load calculations, overcurrent protection sizing, service entrance design
Art. 240	Overcurrent Protection	Breaker and fuse sizing principles, supplementary overcurrent protection
Art. 250	Grounding and Bonding	Most-tested NEC article — system grounding, equipment grounding, bonding
Art. 310	Conductors for General Wiring	Ampacity tables (310.12/310.15), temperature correction, conduit fill derating
Art. 430	Motors, Motor Circuits, Controllers	Motor branch circuit sizing (430.22), overload protection (430.32), short-circuit protection (430.52)
Art. 450	Transformers and Transformer Vaults	Transformer overcurrent protection (450.3), installation requirements
Art. 500–506	Hazardous (Classified) Locations	Class/Division classification, equipment approval requirements
Art. 690	Solar Photovoltaic Systems	PV system design, DC disconnects, ground fault protection, and inverter requirements
Art. 700–702	Emergency and Standby Systems	Essential electrical systems, transfer switch requirements, and load requirements
Art. 706	Energy Storage Systems	Battery installation requirements — new content for October 2025

NFPA 70E — Arc Flash and Safe Work Practices

For PE exam purposes, the most important sections of NFPA 70E-2021 are: Article 130 (work involving electrical hazards), Table 130.5(G) (arc flash PPE categories), and Table 130.4(E) (approach distances for shock protection). Candidates should understand the structure of NFPA 70E well enough to navigate directly to these tables during the exam.

ANSI C2 — The National Electrical Safety Code

The NESC governs the installation, operation, and maintenance of utility electrical supply and communication lines. On the PE exam, NESC clearance requirements — minimum distances between overhead conductors and ground surfaces, buildings, roads, and other structures — appear in transmission and distribution analysis questions. Understanding the structure of the NESC (Part 1 for rules, Part 2 for overhead lines, Part 3 for underground lines) allows faster navigation during the exam.

📌 Electronic Reference Navigation — Critical Strategy

Only one chapter of any reference standard can be open at a time during the exam. The search function uses the sidebar search box — Ctrl+F is not available.

The NCEES YouTube channel demonstrates exactly how the reference software works in the exam environment. Watch this before exam day, it's 10 minutes that will save you significant time during the actual exam.

Build a personal reference index for the NEC. For each exam-relevant article, know its number, its location in the Table of Contents, and two or three key search terms that will find it quickly.

Chapter 16: Building Your Study Strategy

Having a study strategy is not optional for the PE Power exam. The exam covers nine technical domains, six reference standards, and four years of professional engineering practice, distilled into 80 questions over nine hours. Without a plan, even well-prepared engineers run out of time — or spend months studying the wrong things.

This chapter gives you the framework. Your mentor helps you build the specific version that fits your schedule, experience background, and target exam date.

Domain Priority — Based on Question Weight

Allocate your study time proportionally to the question weight of each domain, adjusted for your current knowledge gaps. Here is how the domains stack up:

Priority	Domain	Questions	Why This Priority
1	Domain 9: Protection	10–15	Highest weight + most candidates are underprepared + steepest learning curve
2	Domain 3: Electrical Safety	10–15	Highest weight + arc flash calculations are exam-intensive
3	Domain 4: Circuit Analysis	10–15	Highest weight + foundational for every other domain
4	Domain 8: T&D Analysis	8–12	Wide scope — 8 sub-topics, each requiring specific preparation
5	Domain 7: Electric Power Devices	8–12	Transformers heavily tested + new BESS/PV content
6	Domain 2: General Applications	8–12	Broad topic range — NEC Article 250 is critical
7	Domain 1: Measurement & Instrumentation	6–9	Lower weight but foundational for Protection domain
8	Domain 5: Power Electronics	5–8	New IBR/BESS content requires updated resources
9	Domain 6: Rotating Machines	5–8	Focused topic — targeted study is efficient here

The Six-Month Preparation Framework

For a working engineer committing 8 to 12 focused hours per week, six months is the right preparation window. Here is how to sequence those months:

Month	Focus Area	Target Outcome
Month 1	Circuit Analysis Foundations (Domain 4)	Command of per-unit system, symmetrical components, three-phase analysis, phasor diagrams
Month 2	Power Systems Hardware (Domains 7 + 8)	Transformers, T&D analysis, voltage regulation, power factor, fault current concepts
Month 3	Protection and Safety (Domains 9 + 3)	Relay coordination, TCC analysis, arc flash calculations, NEC safety articles, NFPA 70E
Month 4	Remaining Domains (5, 6, 1, 2)	Motors, power electronics, metering, grounding, lighting, energy management
Month 5	Practice Exams and Gap Analysis	Two complete timed 80-question sessions; domain-by-domain error analysis and targeted review
Month 6	Final Review and Exam Readiness	NEC navigation drills, reference standard speed practice, exam-day logistics confirmation

What the Diagnostic Report Tells You

If you have already attempted the PE Power exam and received a diagnostic report, it is your most valuable planning tool. The diagnostic report shows your scaled score (0 to 15) for each domain and compares it to the average performance of passing candidates.

Domains where your performance is significantly below the passing average represent your highest-priority retake focus areas. Domains where you scored near or above the passing average need maintenance review, not intensive study. A targeted retake strategy built on the diagnostic report is far more efficient than studying everything equally.

> 💬 **From Shai**
> The most common mistake I see from engineers who did not pass on the first attempt is spending their retake study time on the domains they already understand — because those domains are more comfortable. Do the uncomfortable thing. Dig into the domains where your diagnostic score was lowest. That is where your pass is waiting.

Ten Preparation Mistakes to Avoid

- **Not weighing your study time by domain question count:** More questions = more study time. It really is that simple.
- **Never practicing NEC navigation speed:** Build a personal NEC index and drill finding key articles in under 60 seconds.
- **Underestimating Domain 9:** Budget a full month for Protection. It will not be wasted.
- **Using pre-2025 materials without updating them:** Add IBR, BESS, NEC Article 706, and NEC 2020 content explicitly.
- **Never doing a full 9-hour timed simulation:** Stamina is real. Practice it.
- **Leaving questions blank:** No penalty for wrong answers. Guess on every unanswered question before time expires.
- **Starting only 6 to 8 weeks out:** That timeline works for some exams. The PE Power is not one of them.
- **Preparing without accountability:** A study partner, group, or mentor dramatically improves consistency and follow-through.
- **Waiting too long to build your experience record:** Start documenting your engineering work now, not when you are ready to apply.
- **International candidates picking the wrong starting state:** Some state boards process international applications far more efficiently than others. Choose strategically.

🔗 Want to go deeper?
For a personalized study plan built around your specific domain strengths, work schedule, and target exam date, apply for PE Power Mentorship at shailearning.com. Mentorship includes weekly coaching sessions, practice exam review, and direct access via 1-1 sessions.

Chapter 17: The International Engineer's Pathway to PE Licensure

I am going to write this chapter the way I wish someone had written it for me when I was starting this process.

I came from Ghana. I had an engineering degree, real work experience, and the motivation to get licensed. What I did not have was a clear map of how the international pathway actually worked, what documents I needed, which state to apply to first, how to present international experience in a way that U.S. state boards could evaluate, and what the NCEES credentials evaluation actually involved.

I figured it out. This chapter is the map I built. It is for every engineer reading this from outside the United States — whether you are in Nigeria, India, the UK, Pakistan, South Africa, the Philippines, or any of the other 150+ countries where ShaiLearning reaches engineers. It's even more feasible once you are in the United States at the time of thinking about getting licensed.

The U.S. PE license is entirely achievable for internationally educated engineers. The pathway has more steps — but every step is well-defined.

Step 1 — Check Whether Your Degree Requires Evaluation

If your engineering degree is from an ABET EAC-accredited program — including programs at international universities that carry ABET accreditation — you may be able to proceed without the NCEES Credentials Evaluation. Check your program's accreditation status at abet.org.

If your degree is from a Washington Accord signatory country (Australia, Canada, China, Hong Kong, India, Ireland, Japan, Malaysia, Mexico, New Zealand, Pakistan, Peru, Republic of Korea, Russia, Singapore, South Africa, Sri Lanka, Taiwan, Turkey, UK, Peru, Costa Rica, and others), your four-year engineering degree may be considered substantially equivalent to a U.S. ABET degree. However, most U.S. state boards will still require the NCEES Credentials Evaluation for formal documentation purposes. Always reach out to the state board if you are not sure. Avoid or reduce assumptions, as they can only lead to delays and frustration.

Step 2 — NCEES Credentials Evaluation

Item	Details
Fee	$400 (paid through your MyNCEES account)
Processing Time	Approximately 15 business days from receipt of complete documentation
Documents Required	Official transcripts (native language + certified English translation), official course descriptions for all engineering courses, and degree certificates
Standard Applied	NCEES Engineering Education Standard — 128 credit-hour baseline aligned to ABET EAC criteria
Possible Outcomes	Meets standard / Does not meet standard / Deficiency noted (partial credit for work experience may apply, depending on state board)

A deficiency finding in the credential's evaluation does not automatically disqualify you. State boards make independent determinations, and many will consider your graduate education, professional certifications, or extensive relevant work experience in evaluating your overall qualifications.

Step 3 — Choose Your Starting State Strategically

This is the step where most international engineers make a costly mistake: choosing their starting state based on where they live rather than on where the process is most efficient or convenient for international applicants. ***Since each state board has special requirements, it is important to know ahead of time whether any of them will hinder or slow your application.***

Direct application states — where you can register for the NCEES exam without waiting for a full board credential review — typically include Texas, Illinois, New Jersey, Florida, and Ohio. These states generally offer faster processing for straightforward international applications. Pre-approval states — where the full board reviews your credentials before you are authorized to register — include New York and California. These pre-approval processes can add three to six months to your timeline for international applicants.

Once you hold a license in one state, applying to additional states through comity (reciprocal licensure) is significantly simpler. Choose your first state for processing efficiency, not necessarily where you currently reside.

Step 4 — Documenting International Engineering Experience

Engineering experience earned outside the United States counts toward PE licensure in most states, provided it is thoroughly documented. U.S. state boards need to verify that your experience involved progressive, responsible engineering work under qualified supervision — the same standard applied to domestic applicants.

What you need: employment verification letters on company letterhead with dates and titles, detailed descriptions of your specific engineering responsibilities and technical contributions, and references who can be contacted by a U.S. state board. If your documentation is in a language other than English, certified English translations are required.

However, be aware that some states may not consider your foreign work experience **"professional engineering experience."** For instance, you may have worked 5 years before arriving in the U.S. Even though most state boards require 4 years of engineering experience, that will not automatically qualify you to earn the license, despite passing both the FE and PE exams. You should always reach out to your state board licensing website or contact them for clarification on this matter. I was a victim of such an assumption and had to wait for additional.

Step 5 — International Exam Center Locations

You do not need to travel to the United States to sit for the PE Power exam. Pearson VUE test centers that administer NCEES exams are currently available outside the United States in:

- Canada — multiple test centers across provinces
- Japan — Tokyo area Pearson VUE centers
- Saudi Arabia
- United Arab Emirates (Sharjah)
- Egypt
- Turkey

Confirm current availability and specific location options through your MyNCEES account when you are ready to schedule. International candidates approved through a foreign entity pay a nonrefundable $25 international scheduling fee.

📌 UK CEng / IntPE Mutual Recognition Route

If you hold Chartered Engineer (CEng) status from a recognized UK engineering institution and also hold International Professional Engineer (IntPE) designation, you may qualify for an expedited PE licensure route in certain U.S. states under mutual recognition agreements between NCEES and the UK Engineering Council. Both the FE and PE exams may be waived under this route. Verify current mutual recognition provisions with your target state board before pursuing this pathway.

💬 From Shai

ShaiLearning reaches engineers in 150+ countries. You are not navigating this alone. Engineers from India, Pakistan, South Africa, Egypt, the UK, Australia, the Philippines, Ghana, Nigeria, and dozens of other countries have used this exact pathway to earn U.S. PE licenses. If you have a question that this chapter has not answered, book a call — we will go through your specific country and situation directly.

Chapter 18: After the PE Exam — Your License, Your Next Steps

You passed. You received your official PE license certificate. Now what?

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This is the part that nobody talks about enough. Getting the PE license is the milestone — but what you do with it in the months and years that follow is what actually changes your career. This final chapter covers the practical steps that new PEs often overlook.

Order Your Official Seal and Stamp

Your state board will notify you of how to obtain your official engineering seal. This is the physical stamp (or electronic equivalent) that you will use to seal engineering documents for public submission. Every state has specific requirements for seal format, size, and content. Order it promptly — you cannot legally seal documents without it.

Understand Your Professional Obligations

Your PE license comes with ongoing legal and ethical obligations. The most important is the Continuing Professional Competency (CPC) or Continuing Professional Education (CPE) requirement — most states require between 30 and 45 professional development hours (PDH) every two years to maintain your license. These must be tracked and documented.

Many states also require ethics courses as part of CPC requirements. Maintaining your license in good standing is not optional. A lapsed PE license cannot be used to seal documents, and practicing engineering with a lapsed license is a legal violation.

Consider Multi-State Licensure Through Comity

Once you hold a PE license in one state, applying for licensure in additional states through comity (reciprocal licensure) is significantly simpler than the initial application. If your work takes you across state lines or if you want to offer consulting services to clients in multiple states, multi-state licensure gives you the legal authority to seal work in each licensed state.

The NCEES Record system is designed specifically to streamline comity applications. Keep your record current and complete.

Engage With the Engineering Community

Licensure opens doors to professional engagement that were not previously available. IEEE technical committees, state engineering society boards, NCEES volunteer positions, and membership on professional licensing boards are all available to licensed PEs. These engagements build both your network and your technical depth in ways that continuing education credits alone cannot.

Consider Sharing with Others

If you benefited from guidance on this journey from ShaiLearning, from a colleague, or from anyone who helped you navigate the process, consider sharing the message with others. The engineering profession advances when licensed engineers actively support the engineers behind them. Doing so is one of the most professionally meaningful things you can offer to the community.

From Shai

Every time I get a message from an engineer who has just passed the PE Power exam, it reminds me why I built ShaiLearning. This work matters. Your license matters. Not just for your career — but for every client, every project, every system that will benefit from having a licensed PE who takes professional responsibility for the engineering seriously.

If you are reading this before you have taken your exam, come back to this chapter when you pass. I will be here. And the ShaiLearning community will celebrate with you.

ShaiLearning Resources for Licensed PEs and Active Candidates

Resource	What It Provides	Where to Find It
PE Power Mentorship Program	1-on-1 coaching, custom study plan, domain review, practice exam analysis	shailearning.com/pe-mentorship
FE Electrical & Computer Guide	Complete FE exam preparation for engineers at the EIT stage	shailearning.com
Book a Free 15-Min Call	Direct 1-on-1 call with Shai, P.E., no scripts, real answers	shailearning.com/book-a-call
International Licensure Guidance	Country-specific pathway guidance and state board strategy	shailearning.com
ShaiLearning Newsletter	PE exam updates, power engineering content, career guidance	shailearning.com (subscribe free)
YouTube Channel	Electrical power engineering explanations, exam tips, and career content	YouTube: ShaiLearning

📌 **Your PE Journey Starts at ShaiLearning.com**

This guide covers every domain of the October 2025 PE Power exam, the full NCEES registration process, and the complete international engineer's pathway to PE licensure.

When you are ready to go from reading to doing — to have a personalized study plan, technical coaching, and direct accountability from a licensed PE who has been through this process — ShaiLearning is ready for you.

Visit shailearning.com | Book a call: shailearning.com/book-a-call