



# Study Guide for Apprentice System Operator Step 1 Test

Test Number: 9851

Human Resources  
Performance Assessment Services  
Southern California Edison  
An Edison International Company

REV102110

## Introduction

The **9851 Apprentice System Operator Step 1 Test** is a job knowledge test designed to cover the major knowledge areas necessary to perform the job. This Guide contains strategies to use for taking tests and a study outline, which includes knowledge categories, major job activities, and study references.

### Test Session

It is important that you follow the directions of the Test Administrator exactly. If you have any questions about the testing session, be sure to ask the Test Administrator before the testing begins. During testing, you may **NOT** leave the room, talk, smoke, eat, or drink. Since some tests take several hours, you should consider these factors before the test begins.

**All cellular/mobile phones, pagers or other electronic equipment will NOT be allowed in the testing area.**

All questions on this test are multiple-choice or hot spot questions. Multiple choice questions have four possible answers. Hot spot questions have a picture, and you must click the correct spot on the picture to answer the question. All knowledge tests will be taken on the computer. For more information on this, please see the next section of this study guide on *Computer Based Testing*.

- **The test has a three hour time limit. A basic calculator will be provided for you to use during the test.**

**You will NOT be able to bring or use your own calculator during testing.**

You will receive a Test Comment form so that you can make comments about test questions. Write any comments you have and turn it in with your test when you are done.

### Study Guide Feedback

At the end of this Guide you have been provided with a Study Guide Feedback page. If a procedure or policy has changed, making any part of this Guide incorrect, your feedback would be appreciated so that corrections can be made.

## Computer Based Testing

Taking an SCE knowledge test on the computer is simple. You do not need any computer experience or typing skills. You will only use the keyboard to enter your candidate ID and password. You'll answer all questions by pressing a single button on the mouse.

### Log in Screen

You will be seated at a testing station. When you are seated, the computer will prompt you to enter the candidate ID and password you received in your invitation e-mail. You **MUST** have your candidate ID and password or you will be unable to take the test. Once you have confirmed your identity by entering this information, you will see a list of tests available to you.

### Sample/Tutorial

Before you start your actual test, a Sample/Tutorial Test is provided to help you become familiar with the computer and the mouse. From the list of exams that appear when you complete the log in, you will select Sample/Tutorial. You will have up to 10 minutes to take the Sample/Tutorial Test. The time you spend on this Sample Test does **NOT** count toward your examination time. Sample questions are included so that you may practice answering questions. In the Sample/Tutorial Test, you will get feedback on your answers. You will not receive feedback on your actual test.

### Example

During the test, you may see several different types of items. Many of the questions will be multiple choice items. A few items will be pictures, where you'll have to click the spot on the picture that answers the question. Those picture questions are known as "Hot Spot" questions. More information on each type is below.

### Overall Test Information

- When you begin the test, you can see the total time allowed for completion displayed at the top of the screen. You can scroll up to see that information at any time during the test.
- You can change your answers at any time during the test until the time runs out, or you click the "Submit" button. Once you click Submit, you can not change your answers.



## Multiple Choice Questions

To answer each multiple choice question, you should move the mouse pointer over the circle (radio button) next to the answer of your choice, and click the left mouse button.

A sample is shown below:

1. In order to answer each question, first read the question and determine the response that best answers the question. Put the mouse pointer directly over the circle corresponding to that response.



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Time remaining: 29:54

**Sample**

Please select the best answer for each question below. If you have any comments, please record them on the Test Comments form given to you by the Test Administrator. Good luck!

1 of 13

Two resistors of 20 ohms each are connected in series. The total resistance of the circuit is \_\_\_\_ ohms.

a. 10

b. 20

c. 30

d. 40

2. While the pointer is over the circle corresponding to the best answer, click the left mouse button.



**Click the left button when the pointer icon is over your answer choice.**

3. The answer you selected should now have a green dot in the circle. If you need to select an alternate answer, simply move the pointer over that circle, and click again.



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Time remaining: 28:59

**Sample**

Please select the best answer for each question below. If you have any comments, please record them on the Test Comments form given to you by the Test Administrator. Good luck!

1 of 13

Two resistors of 20 ohms each are connected in series. The total resistance of the circuit is \_\_\_\_ ohms.

a. 10

b. 20

c. 30

d. 40

## Hot Spot Questions

To answer each Hot Spot question, you should move the mouse pointer over the part of the image that best answers the question, and click the left mouse button. You will see a pointer appear in that spot. If you want to change your answer, simply move the mouse pointer to a new area on the picture and click again. The pointer will move to the new spot.

A sample is shown below:

1. In order to answer each question, first read the question and determine the place on the image that best answers the question. The pointer that will indicate your answer can always be seen in the bottom left of the image. It looks like this:



Put the mouse pointer directly over the spot on the image you want to select, and click the left mouse button.


The screenshot shows a web application interface. At the top left, it says "1 of 8". Below that is the question: "On the screen below, where would you click to find out how much vacation time you have left?". The main content area is titled "About Me" and features a photo of a woman. Below the photo is a "Welcome to the 'About Me' section" message. A text box below the photo says: "'About Me' has information about your benefits, programs that help you in your work and/or home life and more. Click on the links below to access the various areas." Below this is an "About Me Map" section with four tiles: "Overview", "Career & Jobs", "Pay", and "Time & Attendance". A red arrow points from a text box "Pointer starts out at the bottom left of the image." to a small black dot in the bottom left corner of the map. Another red arrow points from a text box "Place the mouse pointer on the spot you want to select, then click on the left button." to a mouse cursor hovering over the "Time & Attendance" tile.

2. The pointer will move from the bottom left of the image and appear over the spot you selected.

**1 of 8**

**On the screen below, where would you click to find out how much vacation time you have left?**





### About Me



*Welcome to the "About Me" section*

"About Me" has information about your benefits, programs that help you in your work and/or home life and more. Click on the links below to access the various areas.

#### About Me Map

 <b>Overview</b> An Overview of what's contained in this section of the Portal	 <b>Career &amp; Jobs</b> Find out about career information and opportunities at Edison International.
 <b>Pay</b> Find information about base pay, job descriptions, Results Sharing, and recognition awards here.	 <b>Time &amp; Attendance</b> Use this section to complete and submit your timesheet for approval, or to view your time-off balances and time

The pointer now appears over the correct answer.

3. To change your answer, simply move the mouse pointer to the new spot, and click again. The pointer graphic will move to the new spot you've selected. In order for your answer to be considered correct, the center of the pointer (•) must be over the correct spot on the graphic.

## Test Taking Strategies

### Introduction

The **9851 Apprentice System Operator Step 1 Test** contains multiple-choice questions and may also contain hot spot questions. The purpose of this section is to help you to identify some special features of a multiple-choice test and to suggest techniques for you to use when taking one.

Your emotional and physical state during the test may determine whether you are prepared to do your best. The following list provides common sense techniques you can use before the test begins.

<b>Technique</b>	<b>Remarks</b>
<i>Be confident</i>	<ul style="list-style-type: none"> <li>- If you feel confident about passing the test, you may lose some of your anxiety.</li> <li>- Think of the test as a way of demonstrating how much you know, the skills you can apply, the problems you can solve, and your good judgment capabilities.</li> </ul>
<i>Be punctual</i>	<ul style="list-style-type: none"> <li>- Arrive early enough to feel relaxed and comfortable before the test begins.</li> </ul>
<i>Concentrate</i>	<ul style="list-style-type: none"> <li>- Try to block out all distractions and concentrate only on the test. You will not only finish faster but you will reduce your chances of making careless mistakes.</li> <li>- If possible, select a seat away from others who might be distracting.</li> <li>- If lighting in the room is poor, sit under a light fixture.</li> <li>- If the test room becomes noisy or there are other distractions or irregularities, mention them to the Test Administrator immediately.</li> </ul>
<i>Budget your times</i>	<ul style="list-style-type: none"> <li>- Pace yourself carefully to ensure that you will have enough time to complete all items and review your answers.</li> </ul>
<i>Read critically</i>	<ul style="list-style-type: none"> <li>- Read all directions and questions carefully.</li> <li>- Even though the first or second answer choice looks good, be sure to read all the choices before selecting your answer.</li> </ul>
<i>Make educated guesses</i>	<ul style="list-style-type: none"> <li>- Make an educated guess if you do not know the answer or if you are unsure of it.</li> </ul>

- Changing answers*
- If you need to change an answer, be sure to erase your previous answer completely. On the computer, be sure that the new answer is selected instead of the old one.
- Return to difficult questions*
- If particular questions seem difficult to understand, make a note of them, continue with the test and return to them later.
- Double-check math calculations*
- Use scratch paper to double check your mathematical calculations.
- Review*
- If time permits, review your answers.
  - Do the questions you skipped previously.
  - Make sure each answer bubble is completely filled in. Erase any stray marks on your answer sheet. When testing on the computer, make sure each multiple choice question has a green dot next to the correct answer.

Remember the techniques described in this section are only suggestions. You should follow the test taking methods that work best for you.

## **Job Knowledge Categories and Study References**

Below are the major job knowledge areas (topics) covered on the **9851 Apprentice System Operator Step 1 Test** and the associated study references. Listed next to each knowledge category is the number of items on the exam that will measure that topic. You can use this information to guide your studying. Some exams also contain additional pretest items. Pretest items will appear just like all of the other items on your exam, but they will not affect your score. They are an essential part of ensuring the **9851 Apprentice System Operator Step 1 Test** remains relevant to successful performance of the job.

There are a total of 96 items on the **9851 Apprentice System Operator Step 1 Test** and the passing score is 70%. This score was determined during the test validation process.

### **A. Fundamentals (4 items)**

Includes knowledge of AC and DC electrical theory, applied electronic theory, applied physical and mechanical theory and applied math. Knowledge of basic construction and operation of substation equipment. Knowledge of the types, function, and operation of switching center computer equipment and software. Knowledge of the types, operation, and application of communication equipment. Knowledge of how to operate switching center computer equipment and software. Knowledge of how to test and operate communication equipment.

### **B. Prints and Diagrams (10 items)**

Includes knowledge of types of schematics and diagrams. Knowledge of applications and symbology of DC schematics, single line diagrams, SAS menu trees, block and logic flow diagrams, and transmission and distribution of strip maps. Knowledge of procedures and practices for revising prints and diagrams. Ability to read and interpret DC schematics, single line diagrams, SAS menu trees, block and logic flow diagrams, and transmission strip maps. Knowledge of how to maintain schematics and diagrams.

### **C. Switching Devices (5 items)**

Includes knowledge of the function, operation and rating of the types of substation switching devices, field switching devices, and reclosers. Knowledge of the procedures and practices for operating substation devices, field switching devices, and operating reclosers. Knowledge of the procedures and requirements for the Response Time Recorder test and the Circuit Breaker Clearing test. Knowledge of how to inspect: circuit breaker operating mechanism; circuit breaker bushings and terminals; circuit breaker oil level, gas pressure, etc.; disconnects; and District circuit switchers in substations. Knowledge of how to record counters and pressures on circuit breaker hydraulic/pneumatic/gas operating mechanisms. Knowledge of how to operate disconnects, circuit breakers, and District circuit switchers in substations. Knowledge of how to perform routine test of delta breaker and how to drain water from pneumatically operated circuit breaker air systems.

**D. Voltage Control Equipment (4 items)**

Includes knowledge of the function, operation and ratings of: voltage control equipment, synchronous condensers, capacitors, regulators, and reactors. Knowledge of the procedures and requirements for operating: regulators, line reactors and capacitors, synchronous condensers, and inspection of synchronous condensers. Knowledge of how to inspect: synchronous condenser and record details on appropriate form, capacitors, regulators, and reactors. Knowledge of how to bypass regulators and switch line reactors and capacitors.

**E. Auxiliary Substation Equipment (3 items)**

Includes knowledge of various types of auxiliary substation equipment. Knowledge of procedures and requirements pertaining to auxiliary substation equipment. Ability to inspect auxiliary substation equipment.

**F. System Protection (20 items)**

Includes knowledge of the function, operation and settings of the types of: protective relays, underfrequency relays, load shed relays, transmission line relays, distribution line relays, transformer relays, bus relays, breaker relays, synchronous condenser relays and relay schemes. Knowledge of the procedures and requirements for making solid/automatic protective relays. Knowledge of how to inspect, record and reset protective relays. Knowledge of how to read and perform initial assessment of relay targets and analyze relay target information. Knowledge of how to make solid/automatic protective relays and reclosers.

**G. Normal Operation (17 items)**

Includes knowledge of the responsibilities and authorities of power system control personnel and SCE personnel. Knowledge of the jurisdiction of SCE switching centers and the effects of SCE business goals/priorities on power system operation. Knowledge of the procedures and requirements to sectionalize and isolate sections of power system, for performing substation inspections, for synchronizing and paralleling, and for bypassing regulators and breakers. Knowledge of the procedures and practices for monitoring power system status, of VAR/voltage control, and for scheduling work. Knowledge of the application of planned loading limits and VAR/voltage schedules. Knowledge of how to sectionalize sections of power system, isolate sections of power system, bypass circuit breakers, bypass regulators, interpret historical data, recognize power flow system conditions and correct district's jurisdiction for system operation.

**H. Switching, Tagging, and Clearance (10 items)**

Includes knowledge of the types and applications of switching orders and requests and switching techniques. Knowledge of the procedures and requirements for: clearances, tags, and warning blocks; isolating and grounding substation equipment; creating switching programs; and issuing switching procedures. Knowledge of the procedures and practices for intercompany

switching, processing switching programs and processing outage requests. Knowledge of how to analyze the impact of planned switching on power system and how to recognize incorrect steps when checking switching orders and select more appropriate/correct method. Knowledge of how to identify clearance boundaries and potential hazards and inspect equipment to be operated. Knowledge of how to record MW, amps, and voltage readings of equipment to be operated and tap positions or equipment settings. Knowledge of how to positively identify each device before operating and isolate and ground substation equipment. Knowledge of how to check synchronism and parallel, recognize abnormal situations, issue/release clearance, coordinate switching and confirm operation of equipment as expected. Knowledge of how to perform a final check after completion of switching and tagging activities and verify that equipment has been properly isolated and grounded.

#### **I. Emergency and Abnormal Operation (17 items)**

Includes knowledge of the procedures and practices for: tracking brush fire areas; implementing emergency preparedness procedures; analyzing and responding to alarms; system restoration following islanding or blackout; and DC system emergencies. Knowledge of the procedures and requirements for: responding to natural disaster emergencies; nonsystem emergencies; load shed operation/restoration; and RAS. Knowledge of the application and operation of RAS and techniques and practices for scheduling emergency work. Knowledge of how to recognize abnormal conditions while performing station inspections, identify the reason for an emergency or abnormal condition and operate station entrance gate during loss of power. Knowledge of how to troubleshoot and analyze emergency situations using diagrams, manuals, etc. and how to connect gas bottle to circuit breaker for emergency operation. Knowledge of how to transfer station light and power supply to another source, recognize alarms and take proper response, perform system restoration following blackout/islanding and implement non-system emergency procedures. Knowledge of how to perform load shed operation/restoration, recognize RAS operation, develop emergency switching programs without direction and take station to one-line.

#### **J. Logging and Documentation (4 items)**

Includes knowledge of the procedures and requirements for: recording station inspections, performing SPCC inspection, maintaining interruption reports, and completing month end reports and peak readings. Knowledge of the procedures and practices for: maintaining substation log books, maintaining system status on Harris/OMS, logging switching center readings, maintaining abnormal system status report, and preparing Morning Report. Knowledge of how to record: issue or release of clearances in station log book; station readings; station inspections in station log book; month end bank readings, counters, etc.; switching in station log book; entry/exit times and purpose of visit in station log book and monthly peak readings. Knowledge of how to enter month end reports and peak readings into computer; prepare interruption reports; prepare Morning Report; validate DTOM for outages; and identify and prepare appropriate forms and documents for a job. Knowledge of how to check Response Time Recorder test procedure and update as necessary and Circuit Breaker Clearing test procedure and update as necessary. Knowledge of how to prepare interruption reports and Morning

Report. Knowledge of how to provide adequate information and process paperwork on time. Knowledge of how to perform SPCC inspection and record results on appropriate form and replace log book when necessary.

**K. Substation Instrumentation and Alarms (2 items)**

Includes knowledge of types of substation instrumentation, function, operation, and ratings. Knowledge of types of potential transformers and current transformers, function and operation. Knowledge of types of capacitor coupled potential devices, function and operation. Knowledge of types of alarms, categories, priorities, and equipment processing. Knowledge of procedures and requirements for testing alarms and annunciators and obtaining monthly peak readings. Knowledge of the effects of PTs and CTs on switching/outages. Ability to test substation alarms and annunciators and inspect instrument transformers.

## Knowledge Test Study References By Knowledge Area

To learn the knowledge that will be assessed in the knowledge test, refer to the list of study references below.

Knowledge Categories	Knowledge Test #9851 References			
	SOB No.	Substation Ops & Mtnc Policy & Proc) Section	Operators Manual Section	APM Section
<b>Fundamentals</b>			1.2 & 4.1	
<b>Prints and Diagrams</b>	84	E-1	2.7	
<b>Switching Devices</b>	84	E-1	3.1 & 5.5	
<b>Voltage Control Equipment</b>	305		3.5	
<b>Substation Instrumentation and Alarms</b>			3.9	
<b>Auxiliary Substation Equipment</b>	26		3.6 & 3.7 DC Hand Out	
<b>System Protection</b>	309, 1003, 1013, 1014, & 1025		4.1, 4.4, 4.5, 4.6, 4.7, 4.9, & 5.6	
<b>Normal Operations</b>	3, 4, 15, 25, 100, 104, 301, 305, & 322	O-8 & O-6	1.7, 1.8, 2.3, 3.4, 4.5, & 6.3	710
<b>Switching Tagging and Clearances</b>	111	O-1 & O-8		405, 408, 412 & 708
<b>Emergency &amp; Abnormal Operations</b>	12, 26, 100, 115, 309, 600, & 611	O-5 & MT-1	3.1, 3.8, 4.1, 4.4 & 7.1	P-6
<b>Logging and Documentation</b>	3 & 6	G-5		705,
<b>Additional Reading for a few categories</b>	<b>Synchronizing</b> 1.8 of the Operators Manual		This is found on the Substation Training web site <a href="http://edna.sce.com/td2/ets/trn/sst/">edna.sce.com/td2/ets/trn/sst/</a> on the Operations Page	

## Sample Questions

The following sample questions should give you some idea of the form the test will take.

1. Which relay type is made solid when clearing its associated line CB?
  - a. KD
  - b. Cey
  - c. HCB
  - d. None of the above
  
2. Corrections made to an unattended station log book are?
  - a. made only in red ink.
  - b. made only in blue ink
  - c. crossed out with a single line and initialed.
  - d. erased thoroughly and corrected.
  
3. Clearances on equipment at an unattended station may only be issued to a qualified person by:
  - a. the Switching Center having jurisdiction
  - b. the Acting Operator
  - c. the System Operator
  - d. the GCC
  
4. What are the two categories that DC load is divided into?
  - a. DC load and Non-DC load
  - b. Critical and non-critical load
  - c. Battery feed and Charger feed
  - d. Station Light and Power and all other station load

### Sample Question Answers

1. D
2. C
3. B
4. B

### Study Guide Feedback

Please use this page to notify us of any changes in policies, procedures, or materials affecting this guide. Once completed, return to:

Southern California Edison  
Human Resources - Performance Assessment Services  
G.O. 4, Ground Floor  
8631 Rush St.  
Rosemead, CA 91770

**Test Name: 9851 Apprentice System Operator Step 1 Test**

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