

# ELEC-C7310 Course Material Guide

Course topics:

- The UNIX environment – Background
- Filesystem – Background
- Processes and signals – Important
- I/O multiplexing – Important
- Interprocess communication – Important
- Threads – Important
- Additional topics – Useful

Background is something that you should mostly already know. Course covers the standardized APIs and conventions/semantics. Needless to say, Background materials are often a prerequisite to understand the other material.

Important is something that you must learn and understand to pass this course. Assignments will cover the Important parts. Exam questions will mostly cover the Important topics.

Additional topics are at the end of the course. Not required for assignments, since they are lectured late in the course.

Examination will focus on Important, but may have part Background and Additional.

## Course Book Coverage

All UNIX/Linux programming books cover the same subjects, but as we go through many advanced topics some books may not cover them completely. This is not necessarily catastrophic, as you can find information elsewhere. (Manual pages, the Internet, etc.)

### **Stevens, Rago: Advanced Programming in the UNIX Environment**

APitUE is gargantuan book that covers just about every facet of UNIX programming interfaces. Covers the whole course, except for some additional topics. Also, Stevens has another book, UNIX Network Programming, that covers network programming (for S-38.3610).

- Ch1 UNIX System Overview – Good overview of basics, if you’re not familiar with UNIX.
- Ch2 UNIX Standardization and Implementations – Background data, little practical value.
- Ch3 File I/O – Basic, you should know this from prior programming experience.
- Ch4 Files and Directories – Basic, you should know this from prior programming experience. – Only new and UNIXish part is understanding additional UNIX specific features, such as additional file types and permissions.
- Ch5 Standard I/O Library – Basic, you should already know this.
- Ch6 System Data Files and Information – Good background data.
- Ch7 Process Environment – Essential for achieving deeper understanding.
- Ch8 Process Control – Important.
- Ch9 Process Relationships – Good additional material.
- Ch10 Signals – Important.
- Ch11 Threads – Important.
- Ch12 Thread Control – Important.
- Ch13 Daemon Processes – Good additional material for processes.
- Ch14 Advanced I/O – Important.
- Ch15 Interprocess Communication – Important.
- Ch16 Network IPC: Sockets – Material for S-38.3610, with the exception of UNIX Domain Sockets which are covered as part of IPC.
- Ch17 Advanced IPC – Advanced material for IPC.
- Ch18 Terminal I/O – Useful for specialized purposes, but too complex with little gain.
- Ch19 Pseudo Terminals – Useful for specialized purposes, but too complex with little gain.
- Ch20 A Database Library – Non-essential. There are other implementations also.
- Ch21 Communicating with a Network Printer – Not covered. Additional material for S-38.3610?

## **Kerrisk: The Linux Programming Interface**

LPI is another gargantuan book. LPI covers just about every UNIX programming interface. Covers the whole course, and has additional material pertinent to modern Linux programming (advanced APIs) and also covers network programming (for S-38.3610). Goes often into more detail than required for this course.

- Ch1 History and Standards – Nice background, non-essential.
- Ch2 Fundamental Concepts – Very useful overview of UNIX fundamentals.
- Ch3 System Programming concepts – Nice background.

- Ch4 File I/O: The Universal I/O Model – Basics, important.
- Ch5 File I/O: Further details – Some important, other good additional material. Explains advanced concepts.
- Ch6 Processes – Important
- Ch7 Memory Allocation – Important
- Ch8 Users and Groups – Concepts important, exact mechanisms good to know.
- Ch9 Process credentials – Good to know.
- Ch10 Time – Good to know.
- Ch11 System limits and options – Good to know.
- Ch12 System and Process information – Good to know
- Ch13 File I/O buffering – Important
- Ch14 Filesystems – Important
- Ch15 File attributes – Good to know
- Ch16 Extended Attributes – Non-essential
- Ch17 Access controll lists – Non-essential
- Ch18 Directories and links – Basics, good to know.
- Ch19 Monitoring file events – Advanced material, not covered.
- Ch20 Signals: Fundamental concepts – Important
- Ch21 Signals: Signal Handlers – Important
- Ch22 Signals: Advanced features – Important
- Ch23 Timers and sleeping – Good to know
- Ch24 Process creation – Important
- Ch25 Process termination – Important
- Ch26 Monitoring child process – Important
- Ch27 Program execution – Important
- Ch28 Process creation and execution in more detail – Important
- Ch29 Threads: Introduction – Important
- Ch30 Threads: Thread synchronization – Important
- Ch32 Threads: Thread safety and per-thread storage – Important
- Ch33 Threads: Further details – Important
- Ch34 Process Groups, Sessions, and Job Control – Good to know
- Ch35 Process Priorities and Scheduling – Good to know
- Ch36 Process Resources – Good to know
- Ch37 Daemons – Good to know, this has changed due to recent developments
- Ch38 Writing Secure Privileged Programs – Good to know
- Ch39 Capabilities – Not covered
- Ch40 Login Accounting – Not covered
- Ch41 Fundamentals of Shared Libraries – Advanced, not covered
- Ch42 Advanced Features of Shared Libraries – Advanced, not covered
- Ch43 Interprocess Communication Overview – Important

- Ch44 Pipes and FIFOs – Important
- Ch45 Introduction to System V IPC – Important, IPC
- Ch46 System V Message Queues – Important, IPC
- Ch47 System V Semaphores – Important, IPC
- Ch48 System V Shared Memory – Important, IPC
- Ch49 Memory Mappings – Important, behind-the-scenes
- Ch50 Virtual Memory Operations – Important, behind-the-scenes
- Ch51 Introduction to POSIX IPC – Important, IPC
- Ch52 POSIX Message Queues – Important, IPC
- Ch53 POSIX Semaphores – Important, IPC
- Ch54 POSIX Shared Memory – Important, IPC
- Ch55 File Locking – Important
- Ch56 Sockets: Introduction – Important, IPC
- Ch57 Sockets: Unix Domain – Important, IPC
- Ch58 Sockets: Fundamentals of TCP/IP Networks – Not covered, ref S-38.3610
- Ch59 Sockets: Internet Domains – Not covered, ref S-38.3610
- Ch60 Sockets: Server Design – Design principles are useful for exercises and exam design question!
- Ch61 Sockets: Advanced Topics – Not covered, ref S-38.3610
- Ch62 Terminals – Not important, good if you know what these are.
- Ch63 Alternative I/O Models – Important
- Ch64 Pseudoterminals – Not important

## **Johnson, Troan: Linux Application Development**

LAD is a good basic book on practical UNIX application programming. Some topics are covered very briefly, and parts of IPC are not covered at all (message queues and semaphores.) Instead there is focus on practical tools and libraries, and the parts that are commonly used.

- Part 1, ch1-3 Getting Started – Background, little practical value.
- Part 2, ch2-9 Development Tools and Environment – Background, useful for programming.
- Part 3, ch10 The Process Model – Important.
- Part 3, ch11 Simple File Handling – Basic, you should already know most of this.
- Part 3, ch12 Signal Processing – Important.
- Part 3, ch13 Advanced File Handling – Important
- Part 3, ch14 Directory Operations – Basic, you should already know most of this.
- Part 3, ch15 Job Control – Nice additional material.

- Part 3, ch16 Terminals and Pseudo Terminals – Useful for specialized purposes, but too complex with little gain.
- Part 3, ch17 Networking with Sockets – Material for S-38.3610, with the exception of UNIX Domain Sockets (ch17.4) which are covered as part of IPC.
- Part 3, ch18 Time – Basic.
- Part 3, ch19 Random Numbers – Non-essential additional material.
- Part 3, Ch20-21 Consoles – Useful for specialized purposes, but too complex with little gain.
- Part 3, ch22 Writing Secure Programs – Additional material.
- Part 4 Development Libraries – Non-essential additional material.

### **Rochkind: Advanced UNIX Programming**

Classic book, but I haven't had the opportunity to review it. Table of contents seems to cover the whole course, but I/O multiplexing might be covered lightly.

### **Your Book Here**

If you already have a book, please tell me of it. I'll review if it covers the material required for this course.