

Short Title:	Operating Systems APPROVED
Full Title:	Operating Systems
Module Code:	COMP H2014
ECTS credits:	5
NFQ Level:	6
Module Delivered in	4 programme(s)
Module Contributor:	Kevin Farrell
Module Description:	<p>The aim of this module is to give learners an appreciation and understanding of the internal workings and designs of modern operating systems while also providing learners with the necessary basic knowledge, skills and understanding to install, configure and troubleshoot the Linux operating system. The module is a balance between theoretical and practical aspects of modern operating systems. The module aims to - develop the students' knowledge of operating systems by covering the theory of how modern, multi-user, network operating systems function; in particular the issues of concurrency and deadlock, which arise, in such systems on uni-processor and multi-processor/multicore platforms. - To enhance the students' operating systems administration skills through the advanced configuration and troubleshooting of the Linux operating systems in a multi-user networked environment.</p>
Learning Outcomes:	
<i>On successful completion of this module the learner will be able to</i>	
<ol style="list-style-type: none"> 1. Explain the design principles of operating systems, including OS structures, process and thread management, concurrency and scheduling, memory management, file management, Input/Output management. 2. Compare and contrast single-threaded and multi-threaded processes. 3. Install a modern multi-user Network Operating System, and perform advanced system administration tasks on it, including: installing software from source code and compiling an OS kernel. 4. Analyse and describe software solutions to classic problems of process synchronisation. 	

Module Content & Assessment

Indicative Content

Operating Systems Structures

- System components, OS services, system calls, system programs - OS structures - Virtual machines

Processes

- Process concept, schedulers, operations on processes - Cooperating processes: Producer-Consumer problem - Interprocess Communication - Communication in client-server systems

Processor Scheduling

- Uni-processor scheduling. - High, medium and low level schedulers. - Low level scheduling algorithms. - Thread, multiprocessor and real-time scheduling.

Threads

- Means of supporting threads in an OS - Multithreading models - Threading Issues - Case study: Linux

Memory Management

- Logical vs. physical address space. - Paging and segmentation. - Segmentation with paging. - Virtual Memory Management (demand paging, page-replacement etc.). - Case study: Linux

File Management

- Basic concepts and file management techniques. - Disk partitions and file management utilities. - Journalling. - Case study: Linux.

I/O Management

- I/O Device characteristics and objectives of I/O systems. - Physical and logical organisation of I/O functions. - Categorisation of types of devices. - Buffering.

Process Synchronisation

- The critical-section problem - Synchronisation hardware - Semaphores - Classical problems of synchronisation - Critical regions - Monitors - OS synchronisation - Atomic transactions - Practical Project with ThreadMentor or similar software

Deadlocks

- System Model - Deadlock characterisation - Methods for handling deadlocks - Deadlock prevention, avoidance, detection and recovery

System Administration in Linux

- Installing the Linux OS - Configuring, compiling and installing software from source code - Monitoring processes including measuring CPU- and memory-usage - Configuring and compiling the Linux kernel

Indicative Assessment Breakdown

	%
Course Work Assessment %	50.00%
Final Exam Assessment %	50.00%

Course Work Assessment %

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Project	Practical Project on process synchronisation using concurrency mentoring software; for eg: ThreadMentor package.	2	20.00	n/a
Performance Evaluation	Performance in Practicals.	2	10.00	Every Week
Multiple Choice Questions	Typically, four multiple choice tests, worth equal marks. Each test assesses OS theory from lectures and knowledge from practicals.	2	20.00	n/a

Final Exam Assessment %

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	End-of-Semester Final Examination	2	50.00	End-of-Semester

Indicative Reassessment Requirement
Repeat examination <i>Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.</i>

ITB reserves the right to alter the nature and timings of assessment

Indicative Module Workload & Resources

Indicative Workload: Full Time

Frequency	Indicative Average Weekly Learner Workload
Every Week	2.00
Every Week	2.00
Every Week	4.00

Resources

Recommended Book Resources

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne 2013, *Operating system concepts*, 9th Edition Ed., Wiley [ISBN: 978111809375]

Operating Systems: Internals and Design Principles, 8th Edition Ed., Pearson Ed [ISBN: 9781292061351]

Jose M Garrido, Richard Schlesinger, Kenneth Hoganson 2014, *Principles of Modern Operating Systems*, Second Ed., Jones and Bartlett Learning [ISBN: 978144962634]

Supplementary Book Resources

Nemeth, Snyder, Hein and Whaley 2011, *Unix and Linux System Administration Handbook*, 4th Edition Ed., Pearson Education [ISBN: 978-0-13-148005-6]

Andrew Tanenbaum 2008, *Modern Operating Systems*, 3rd Edition Ed., Pearson Education [ISBN: 9780138134594]

Sobell, *A practical guide to Linux*

Gary Nutt 2004, *Operating systems*, 3rd Edition Ed., Pearson/Addison Wesley Boston [ISBN: 9780201773446]

This module does not have any article/paper resources

Other Resources

Website: *The Linux Documentation Project*
<http://www.tldp.org>

Website: *Multithreaded Programming with ThreadMentor*
<http://www.cs.mtu.edu/~shene/NSF-3/e-Book/index.html>

Module Delivered in

Programme Code	Programme	Semester	Delivery
BN_KISDF_8	Bachelor of Science (Honours) in Computing in Digital Forensics & Cyber Security [240 ECTS credits]	4	Mandatory
BN_KCOMP_8	Bachelor of Science (Honours) in Computing [240 ECTS credits]	4	Mandatory
BN_KCOMP_7	Bachelor of Science in Computing in Information Technology [180 ECTS credits]	4	Mandatory
BN_KCOMP_C	Higher Certificate in Science in Computing in Information Technology [120 ECTS credits]	4	Mandatory