Level 6 Advanced Diploma in Programming (602) 163 Credits

Unit: Advanced Operating System Principles **Exam Paper No.**: 1	**Guided Learning Hours:** 300 **Number of Credits:** 30
Prerequisites: Programming skills and Operating System knowledge.	**Corequisites:** A pass or higher in Diploma in Programming or equivalence.
Aim: This unit will cover both intermediate and advanced operating systems concepts, focusing primarily on processors. The emphasis will be on understanding general concepts that are applicable to a wide range of operating systems, rather than a discussion of the features of any one specific system, including Process Management, Storage Management, I/O Systems, Protection and Security, Encryption, Extensible Operating Systems, and Fault Tolerance, and two case studies: Linux and Windows. The aim of the unit is to provide learners with knowledge of modern operating system abstractions, implementation technique issues. An operating system consists of programs and data that manage computer hardware and allow efficient execution of application software. The unit provides understanding of operating systems concepts and knowledge about various aspects of operating system design and implementation. A special emphasis is laid on distributed operating systems and services provided by them. Topics covered include: structure and organization of operating systems; distributed operating systems concepts; processes and scheduling; communication; virtual memory and distributed shared memory; file systems and input/output systems; protection and security; distributed operating system services; multiprogramming, multitasking, and multithreading.	
Required Materials: Recommended learning resources.	**Supplementary Materials:** Lecture notes and tutor extra reading recommendations.
Special Requirements: The unit has a lot of abstract information; hence extra reading out of class-time is necessary	
Intended Learning Outcomes:	**Assessment Criteria:**
1. How the components of an operating system are all created to enable various parts of computer to work concurrently.	1.1 Define the functions of an operating system 1.2 Explain the operating system architecture 1.3 Describe the main components of modern operating system 1.4 Describe different operating systems.
2. Hardware components including mainboards, processors, clocks, memory hierarchy, registers.	2.1 Explain computer hardware components 2.2 Describe computer programming languages generations 2.3 Identify high-level language features 2.4 Describe the difference between computer hardware and system software concepts
3. The implementation of threads and processes and difference from one operating system to another.	3.1 Distinguish process vs thread 3.2 Identify the process/thread states 3.3 Explain the operating system process/thread operations 3.4 Explain challenges of synchronising concurrent processes and threads 3.5 Describe mutual exclusion 3.6 Describe concurrent programming
4. Locking strategies and techniques for preventing deadlocks; how deadlocks can be prevented by constraining requests for resources.	4.1 Identify causes of deadlocks 4.2 Describe how to prevent, detect and recover deadlocks 4.3 Analyse and describe deadlock

	algorithms
5. The main purposes of scheduling algorithms and the rules that determine how and when processes are run.	5.1 Describe goals of processor scheduling 5.2 Distinguish pre-emptive and nonpre-emptive scheduling 5.3 Describe different scheduling methods 5.4 Explain memory organisation, management and placement
6. Understand how multitasking operating systems extend their virtual memory management schemes to compensate for this scarcity of physical memory.	6.1 Explain the purpose of virtual memory 6.2 Describe paging 6.3 Describe segmentation 6.4 Describe paging replacement strategies 6.5 Outline the impact of page size
7. Understand how Disk Space Management tools provide data that system administrators need to track disk space availability.	7.1 Explain hard disk characteristics 7.2 Define disk scheduling 7.3 Describe disk scheduling strategies 7.4 Distinguish caching and buffering 7.5 Describe Redundant Arrays of Independent Disks (RAID) technology
8. Designing and applying database file system technologies; file storage in database system vs file system; clustered database management systems.	8.1 Describe file hierarchical and organisational structure 8.2 Describe file allocation and space management 8.3 Describe data integrity and access techniques 8.4 Describe database logical structure 8.5 Describe relational database model
9. Monitoring utilities and tuning tools for the Operating System, principles of performance tuning and the performance tuning process.	9.1 Define system performance 9.2 Explain system performance evaluation techniques 9.3 Distinguish benchmarks vs simulation 9.4 Analyse processor design techniques 9.5 Describe multiprocessor architecture 9.6 Describe multiprocessor scheduling algorithms 9.7 Define and describe load balancing 9.8 Describe read/write lock operations
10. Problems unique to distributed systems; implementation issues; issues pertaining to distributed environments and the basics of distributed systems design.	10.1 Define networking topologies 10.2 Explain networking protocols 10.3 Explain client/server model 10.4 Identify attributes of a distributed system 10.5 Analyse communication process in distributed systems 10.6 Outline characteristics of distributed file system 10.7 Define clustering 10.8 Distinguish Java and .Net platforms 10.9 Outline distributed system security 10.10 Analyse security and authentication protocols
Methods of Evaluation: A 3-hour written examination paper with five essay questions, each carrying 20 marks. Candidates are required to answer all questions. Candidates also undertake project/coursework in Advanced Operating System Principles with a weighting of 100%.	

Recommended Learning Resources:
Advanced Operating System Principles

Text Books	• Operations & Process Management: Principles and Practice for Strategic Impact by Nigel Slack, Stuart Chambers and Alan Betts Robert Johnston ISBN-10: 0273684264 • Operating Systems Principles by Lubomir F. Bic and Alan C. Shaw ISBN-10: 0130266116 • Advanced Operating Systems: Distributed Data Bases and Multiprocessor Systems by Mukesh Singhal and Niranjan G. Shivaratri
Study Manuals 	BCE produced study packs
CD ROM 	Power-point slides
Software 	Windows Operating System, Linux and Java Programming Languages