LONDON CAPITAL COMPUTER COLLEGE

# Advanced Diploma in Programming (602) – Advanced Operating System Principles

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| **Prerequisites:** Programming skills and Operating System knowledge. | **Corequisites:** A pass or higher in Diploma in Programming or equivalence. |
| **Aim:** This course will cover both basic and some 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 course is to provide candidates 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 course 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:** Student study materials | **Supplementary Materials:** Recommended textbooks and lecture notes. |
| **Special Requirements:** The course has a lot of abstract information; hence extra reading out of class-time is necessary | |

| **Intended Learning Outcomes:** | **Assessment Criteria:** |
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| 1. Explore how the components of an operating system are all created to enable various parts of computer to work concurrently and demonstrate the main components of modern operating system. | 1.1 Define the functions of an operating system<br>1.2 Outline the operating system architecture |
| 2. Outline Hardware Components including mainboards, processors, clocks, memory hierarchy, registers and describe the difference between computer hardware and system software concepts. | 2.1 Analyse computer hardware components<br>2.2 Analyse computer programming languages generations<br>2.3 Identify high-level language features |
| 3. Demonstrate how the implementation of threads and processes differs from one operating system to another. | 3.1 Distinguish process vs thread<br>3.2 Identify the process/thread states<br>3.3 Analyse the operating system process/thread operations<br>3.4 Outline challenges of synchronising concurrent processes and threads<br>3.5 Describe mutual exclusion<br>3.6 Describe concurrent programming |
| 4. Describe how deadlocks can be prevented by constraining requests for resources. | 4.1 Identify causes of deadlocks<br>4.2 Be able to prevent, detect and recover deadlocks<br>4.3 Analyse deadlock algorithms |
| 5. Describe the main purposes of | 5.1 Describe goals of processor scheduling |

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| scheduling algorithms and the rules that determine how and when processes are run. | 5.2 Distinguish pre-emptive and nonpre-emptive scheduling<br>5.3 Describe different scheduling methods<br>5.4 Analyse memory organisation, management and placement |
| 6. Demonstrate how multitasking operating systems extend their virtual memory management schemes to compensate for this scarcity of physical memory. | 6.1 Identify the purpose of virtual memory<br>6.2 Describe paging<br>6.3 Describe segmentation<br>6.4 Analyse paging replacement strategies<br>6.5 Outline the impact of page size |
| 7. Outline how Disk Space Management tools provide data that system administrators need to track disk space availability. | 7.1 Analyse hard disk characteristics<br>7.2 Define disk scheduling<br>7.3 Explore disk scheduling strategies<br>7.4 Distinguish caching and buffering<br>7.5 Outline Redundant Arrays of Independent Disks technology |
| 8. Demonstrate how to design and apply database file system technologies. | 8.1 Describe file hierarchical and organisational structure<br>8.2 Describe file allocation and space management<br>8.3 Describe data integrity and access techniques<br>8.4 Describe database logical structure<br>8.5 Analyse relational database model |
| 9. Describe monitoring utilities and tuning tools for the Operating System, principles of performance tuning and demonstrate the performance tuning process. | 9.1 Define system performance<br>9.2 Analyse system performance evaluation techniques<br>9.3 Distinguish benchmarks vs simulation<br>9.4 Analyse processor design techniques<br>9.5 Discuss multiprocessor architecture<br>9.6 Explore multiprocessor scheduling algorithms<br>9.7 Discuss load balancing<br>9.8 Describe read/write lock operations |
| 10. Describe issues pertaining to distributed environments and demonstrate the basics of distributed systems design. | 10.1 Define networking topologies<br>10.2 Explore networking protocols<br>10.3 Analyse client/server model<br>10.4 Identify attributes of a distributed system<br>10.5 Analyse communication process in distributed systems<br>10.6 Outline characteristics of distributed file system<br>10.7 Define clustering<br>10.8 Distinguish Java and .Net platforms<br>10.9 Outline distributed system security<br>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

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| **Text Books** | • Operations & Process Management: Principles and Practice for Strategic Impact by Nigel Slack, Stuart Chambers and Alan Betts Robert Johnston ISBN-10: 0273684264<br>• Operating Systems Principles by Lubomir F. Bic and Alan C. Shaw ISBN-10: 0130266116<br>• 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 |