



**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**SCHOOL OF SCIENCE AND TECHNOLOGY**

**COURSE CODE: CIT 211**

**COURSE TITLE: INTRODUCTION TO OPERATING SYSTEMS**



**CIT211**  
**INTRODUCTION TO OPERATING SYSTEMS**

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## **Introduction**

*CIT211 – Introduction to Operating Systems* is a 3 -credit unit course of 22 units. It deals with the various operating system design concepts and techniques.

It also gives an insight into evolution of operating systems. Since operating systems is the most important software in the computer system, this course takes you through the various types of operating system depending on the environment, the design considerations, the functions performed by the operating system and how these are achieved/implemented either through hardware or software.

This course is divided into six modules. The first module deals with the basic introduction to the concept of Operating Systems such as definition and functions of operating system, history and evolution of operating system.

The second module treats, extensively, the various types of operating system.

The third module deals with concept of process management and discusses the concepts of Co-operating Processes, Threads, and CPU Scheduling.

The fourth module discusses process synchronisation issues such as Race Condition, Mutual Exclusion and Critical Section Problem.

The fifth module treats deadlock issues such as deadlock Characterisation and methods for dealing with deadlocks.

The last i.e. the sixth module discusses memory management functions of the operating system and issues such as memory management algorithms like paging, segmentation, contiguous memory allocation with their peculiar features were discussed.

This Course Guide gives you a brief overview of the course contents, course duration, and course materials.

## **What You Will Learn in This Course**

The main purpose of this course is to provide the necessary tools for designing and Operating system. It makes available the steps and tools that will enable you to make proper and accurate decision on designs issues and the necessary algorithms for a particular computing environment. Thus, we intend to achieve this through the following:

## Course Aims

- i. Introduce the concepts associated with Operating systems
- ii. Provide necessary tools for analysing a computing environment and choosing/designing appropriate operating system
- iii. Provide you with the necessary foundation in operating system designs.

## Course Objectives

Certain objectives have been set out to ensure that the course achieves its aims. Apart from the course objectives, every unit of this course has set objectives. In the course of the study, you will need to confirm, at the end of each unit, if you have met the objectives set at the beginning of each unit. By the end of this course you should be able to:

1. Define an OS
2. State the major functions of the OS
3. State the importance of the OS in the computer system
4. Enumerate the various services rendered the user by the OS
5. Discuss the history and evolution of operating system
6. Describe the functions/responsibilities of the kernel
7. Distinguish a process from a programme
8. List the possible states of a process
9. Describe a process control block (PCB)
10. Describe process creation and process termination
11. Describe the concept of co-operating processes
12. State reasons for allowing process co-operation
13. Explain inter-process communication
14. Distinguish between a thread and a process
15. Enumerate the advantages of threads over processes
16. Distinguish between preemptive and non-preemptive scheduling
17. State the goals for CPU scheduling
18. Give comparative analysis of the various CPU scheduling algorithms
19. Describe the various CPU scheduling evaluation algorithms.
20. Define Race condition
21. Describe some real life examples of race condition
22. Define process synchronisation
23. Describe ways to enforce mutual exclusion
24. Explain the critical section problem
25. Define deadlock
26. State the necessary conditions for deadlock to occur

27. Describe some of the methods for handling deadlocks.
28. Describe address binding
29. Define logical and physical address space
30. Distinguish between dynamic loading and dynamic linking
31. Describe contiguous memory allocation and its various variants
32. Distinguish between internal and external fragmentation
33. Describe methods of solving external fragmentation
34. Describe the principle of overlays and its uses
35. Explain the differences between paging and segmentation
36. Describe a method for solving the problems of both paging and segmentation.

### **Working through This Course**

In order to have a thorough understanding of the course units, you will need to read and understand the contents, practise the steps by designing an Information system of your own, and be committed to learning and implementing your knowledge.

This course is designed to cover approximately seventeen weeks, and it will require your devoted attention. You should do the exercises in the Tutor-Marked Assignments and submit to your tutors.

### **Course Materials**

These include:

1. Course Guide
2. Study Units
3. Recommended Texts
4. A file for your assignments and for records to monitor your progress.

### **Study Units**

There are twenty-two study units in this course:

#### **Module 1    Operating System Fundamentals**

- |        |   |
|--------|---|
| Unit 1 | Definition and Functions of Operating System (OS) |
| Unit 2 | History and Evolution of Operating System         |

Unit 3	The Kernel
Unit 4	Types of Operating Systems
<b>Module 2</b>	<b>Types of Operating Systems</b>
Unit 1	Disk Operating System
Unit 2	Real-time Operating System
Unit 3	Time-Sharing and Object-oriented Operating System
<b>Module 3</b>	<b>Process Management</b>
Unit 1	Processes
Unit 2	Co-operating Processes
Unit 3	Threads
Unit 4	CPU Scheduling
Unit 5	Algorithm Evaluation
<b>Module 4</b>	<b>Process Synchronisation</b>
Unit 1	Race Condition
Unit 2	Synchronisation
Unit 3	Mutual Exclusion
Unit 4	Critical Section Problem
<b>Module 5</b>	<b>Deadlocks</b>
Unit 1	Deadlock Characterisation
Unit 2	Methods for Dealing with Deadlocks
<b>Module 6</b>	<b>Memory Management</b>
Unit 1	Memory Management Fundamentals
Unit 2	Memory Management Algorithms I
Unit 3	Memory Management Algorithms II

Make use of the course materials, do the exercises to enhance your learning.

### **Textbooks and References**

Andrew Tanenbaum, *Operating Systems - Design and Implementation* (Third edition).

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- Allen B. Downey The Little Book of Semaphores, <http://greenteapress.com/semaphores>
- Lehmann, D. J., Rabin M. O, (1981). On the Advantages of Free Choice: A Symmetric and Fully Distributed Solution to the Dining Philosophers Problem. Principles of Programming Languages 1981 ([POPL](#)'81), pages 133-138.
- Stallings, William (2005). Operating Systems: Internals and Design Principles (5th edition). Prentice Hall. [ISBN 0-13-127837-1](#).

## Assignments File

These are of two types: the self-assessment exercises and the Tutor-Marked Assignments. The self-assessment exercises will enable you monitor your performance by yourself, while the Tutor-Marked Assignment is a supervised assignment. The assignments take a certain

percentage of your total score in this course. The Tutor-Marked Assignments will be assessed by your tutor within a specified period. The examination at the end of this course will aim at determining the level of mastery of the subject matter. This course includes twelve Tutor-Marked Assignments and each must be done and submitted accordingly. Your best scores however, will be recorded for you. Be sure to send these assignments to your tutor before the deadline to avoid loss of marks.

## **Presentation Schedule**

The Presentation Schedule included in your course materials gives you the important dates for the completion of tutor marked assignments and attending tutorials. Remember, you are required to submit all your assignments by the due date. You should guard against lagging behind in your work.

## **Assessment**

There are two aspects to the assessment of the course. First are the tutor-marked assignments; second, is a written examination.

In tackling the assignments, you are expected to apply information and knowledge acquired during this course. The assignments must be submitted to your tutor for formal assessment in accordance with the deadlines stated in the Assignment File. The work you submit to your tutor for assessment will count for 30% of your total course mark.

At the end of the course, you will need to sit for a final three-hour examination. This will also count for 70% of your total course mark.

## **Tutor-Marked Assignments (TMAs)**

There are twenty-two tutor- marked assignments in this course. You need to submit all the assignments. The total marks for the best three (3) assignments will be 30% of your total course mark.

Assignment questions for the units in this course are contained in the Assignment File. You should be able to complete your assignments from the information and materials contained in your set textbooks, reading and study units. However, you may wish to use other references to broaden your viewpoint and provide a deeper understanding of the subject.

When you have completed each assignment, send it together with form to your tutor. Make sure that each assignment reaches your tutor on or

before the deadline given. If, however, you cannot complete your work on time, contact your tutor before the assignment is done to discuss the possibility of an extension.

### **Final Examination and Grading**

The final examination for the course will carry 70% percentage of the total marks available for this course. The examination will cover every aspect of the course, so you are advised to revise all your corrected assignments before the examination.

This course endows you with the status of a teacher and that of a learner. This means that you teach yourself and that you learn, as your learning capabilities would allow. It also means that you are in a better position to determine and to ascertain the what, the how, and the when of your language learning. No teacher imposes any method of learning on you.

The course units are similarly designed with the introduction following the table of contents, then a set of objectives and then the dialogue and so on.

The objectives guide you as you go through the units to ascertain your knowledge of the required terms and expressions.

### **Course Marking Scheme**

This table shows how the actual course marking is broken down.

*Table 1:* Course Marking Scheme

<b>Assessment</b>	<b>Marks</b>
Assignment 1- 4	Four assignments, best three marks of the four count at 30% of course marks
Final Examination	70% of overall course marks
Total	100% of course marks

## Course Overview

Unit	Title of Work	Weeks Activity	Assessment (End of Unit)
	Course Guide	Week 1	
<b>Module 1 Operating System Fundamentals</b>			
1	Definition and Functions of Operating System (OS)	Week 1	Assignment 1
2	History and Evolution of Operating System	Week 1	Assignment 2
3	The Kernel	Week 2	Assignment 3
4	Types of Operating Systems	Week 2	Assignment 4
<b>Module 2 Types of Operating System</b>			
1	Disk Operating System	Week 3	Assignment 5
2	Real-Time Operating System	Week 3	Assignment 6
3	Time-Sharing and Object-Oriented Operating System	Week 3	Assignment 7
<b>Module 3 Process Management</b>			
1	Processes	Week 4	Assignment 8
2	Co-operating Processes	Week 4	Assignment 9
3	Threads	Week 5	Assignment 10
4	CPU Scheduling	Week 6-7	Assignment 11
5	Algorithm Evaluation	Week 7	Assignment 12
<b>Module 4 Process Synchronisation</b>			
1	Race Condition	Week 8	Assignment 13
2	Synchronisation	Week 8	Assignment 14
3	Mutual Exclusion	Week 9	Assignment 15
4	Critical Section Problem	Week 9	Assignment 16
5	Classic Problems of Synchronisation	Week 10	Assignment 17
<b>Module 5 Deadlocks</b>			
1	Deadlock Characterisation	Week 11	Assignment 18
2	Methods for Dealing with Deadlocks	Week 12	Assignment 19
<b>Module 6 Memory Management</b>			
1	Memory Management Fundamentals	Week 13	Assignment 20
2	Memory Management Algorithms I	Week 14	Assignment 21
3	Memory Management Algorithms II	Week 15	Assignment 22
	Revision	Week 16	
	Examination	Week 17	
	<b>Total</b>	<b>17 weeks</b>	

## How to Get the Best from This Course

In distance learning the study units replace the university lecturer. This is one of the great advantages of distance learning; you can read and work through specially designed study materials at your own pace, and at a time and place that suit you best. Think of it as reading the lecture instead of listening to a lecturer. In the same way that a lecturer might set you some reading to do, the study units tell you when to read your set books or other material. Just as a lecturer might give you an in-class exercise, your study units provide exercises for you to do at appropriate points.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next is a set of learning objectives. These objectives enable you know what you should be able to do by the time you have completed the unit. You should use these objectives to guide your study. When you have finished the units you must go back and check whether you have achieved the objectives. If you make a habit of doing this you will significantly improve your chances of passing the course.

Remember that your tutor's job is to assist you. When you need help, don't hesitate to call and ask your tutor to provide it.

1. Read this Course Guide thoroughly.
2. Organise a study schedule. Refer to the 'Course Overview' for more details. Note the time you are expected to spend on each unit and how the assignments relate to the units. Whatever method you chose to use, you should decide on it and write in your own dates for working on each unit.
3. Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they lag behind in their course work.
4. Turn to Unit 1 and read the introduction and the objectives for the unit.
5. Assemble the study materials. Information about what you need for a unit is given in the 'Overview' at the beginning of each unit. You will almost always need both the study unit you are working on and one of your set of books on your desk at the same time.
6. Work through the unit. The content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit you will be instructed to read sections from your set books or other articles. Use the unit to guide your reading.

7. Review the objectives for each study unit to confirm that you have achieved them. If you feel unsure about any of the objectives, review the study material or consult your tutor.
8. When you are confident that you have achieved a unit's objectives, you can then start on the next unit. Proceed unit by unit through the course and try to pace your study so that you keep yourself on schedule.
9. When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your tutor's comments, both on the tutor-marked assignment form and also written on the assignment. Consult your tutor as soon as possible if you have any questions or problems.
10. After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this Course Guide).

## **Facilitators/Tutors and Tutorials**

There are 12 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of these tutorials, together with the name and phone number of your tutor, as soon as you are allocated a tutorial group.

Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter and provide assistance to you during the course. You must mail or submit your tutor-marked assignments to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone, or e-mail if you need help. The following might be circumstances in which you would find help necessary. Contact your tutor if:

- you do not understand any part of the study units or the assigned readings,
- you have difficulty with the self-tests or exercises,
- you have a question or problem with an assignment, with your tutor's comments on an assignment or with the grading of an assignment.

You should try your best to attend the tutorials. This is the only chance to have face to face contact with your tutor and to ask questions which

are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from course tutorials, prepare a question list before attending them. You will learn a lot from participating in discussions actively.

## **Summary**

Introduction to Operating systems introduces you to the concepts associated with operating system development and function which is critical in understanding the various computing environments/hardware platforms. The content of the course material was planned and written to ensure that you acquire the proper knowledge and skills for the appropriate situations. Real-life situations have been created to enable you identify with and create some of your own. The essence is to help you in acquiring the necessary knowledge and competence by equipping you with the necessary tools to accomplish this.

We hope that by the end of this course you would have acquired the required knowledge to view operating systems and the computing environments in a new way.

We wish you success with the course and hope that you will find it both interesting and useful.

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