DEREE COLLEGE SYLLABUS FOR:

ITC 4226 DISTRIBUTED SYSTEMS **3/0/3**
(Updated Fall 2025) **UK LEVEL: 6**
UK CREDITS: 15

PREREQUISITES:	ITC 2093 Operating Systems Concepts ITC 2024 Computer Networks and Cybersecurity Fundamentals ***or*** ITC 3175 Introduction to Computer Networks
COREQUISITES:	None.
CATALOG DESCRIPTION:	Distributed systems principles; communication; processes; naming; synchronization; fault tolerance; security; consistency and replication; object-based systems; document-based systems; distributed file systems; coordination-based systems; payment systems; Internet and web protocols; scalability.
RATIONALE:	Principles and concepts of distributed systems underpin development of real-world applications. Students will get a deeper understanding of these principles as well as the design and the complexity of a distributed system, with the use of up to date paradigms. Students will be exposed to the concepts of distributed system's inter-operability, transparency and autonomy and to the difficulties of concurrency, lack of a global clock and independent failure of components.
LEARNING OUTCOMES:	As a result of taking this course, the student should be able to: 1. Determine and explain the needs to design a distributed system. 2. Analyze distributed system models. 3. Perform field research on communication approaches of distributed systems and processes to assess their effectiveness. 4. Evaluate distributed system architectures, consistency, security, process synchronization and data replication needs.
METHOD OF TEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Lectures, class discussions, and review of real-world cases based on specific theoretical concepts. Laboratory practical sessions. • Office hours: Students are encouraged to make full use of the office hours of their instructor, where they can ask questions and go over lecture material. • Use of the Blackboard Learning platform, where instructors post lecture notes, assignment instructions, timely announcements, as well as additional resources.
ASSESSMENT:	**Summative:**

1st assessment: Midterm exam short essay questions and case problems	**30%**
2nd assessment: Portfolio of student work and oral assessment	**10%**
Final assessment: Individual research project Literature review/methodology/interpretation	**60%**

Formative:

Individual and group case problems	**0%**

The formative assessments aim to prepare students for the summative assessments and expose them to teamwork.
The 1st summative assessment tests the LOs 1 and 2.
The 2nd summative assessment tests the LOs 1-4.
The final summative assessment tests the LOs 1-4.

*The final grade for this module will be determined by averaging all summative assessment grades, based on predetermined weights for each assessment. If students pass the **final summative assessment,** which tests all Learning Outcomes for this module, and the average grade for the module is 40 or above, students are not required to resit any failed assessments.*

INDICATIVE READING:

REQUIRED READING:

1. Steen M. & Tanenbaum, A., (2023). *Distributed systems: Principles and paradigms*. 4th Ed.
2. Instructor's notes.

RECOMMENDED READING:

1. Unmesh, J.(2023). Patterns of Distributed Systems. Addison-Wesley Signature Series.
2. Vitillo, R. (2022). Understanding Distributed Systems: What every developer should know about large distributed applications. 2nd Ed.
3. Burns, B. (2024). Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services. 2nd Ed. O'Reilly.
4. Gorton, I. (2022). Foundations of Scalable Systems: Designing Distributed Architectures. O'Reilly.
5. Ross, A. (2021). Security Engineering: A Guide to Building Dependable Distributed Systems. 3rd Ed. Wiley.
6. Jeffery, T. (2020). Distributed Services with Go: Your Guide to Reliable, Scalable, and Maintainable Systems. O'Reilly.
7. Hunter II, T. (2020). Distributed Systems with Node.js: Building Enterprise-Ready Backend Services. O'Reilly.
8. Petrov, A. (2019). Database Internals: A Deep-Dive Into How Distributed Data Systems Work. O'Reilly.
9. Fokkink. W., (2018). *Distributed Algorithms: An Intuitive Approach*. 2nd Ed. PHI Learning.
10. Coulouris, G. (2012). *Distributed systems: Concepts and design* (5th ed.). Pearson Education.
11. Journals / Magazines:
    - International Journal of Distributed Systems and Technologies (IJDST)
    - International Journal of Grid and High Performance Computing (IJGHPC)
    - Journal of Parallel and Distributed Computing (ELSEVIER)
    - International Journal of Communication Networks and Distributed Systems (Inderscience)

INDICATIVE MATERIAL:

REQUIRED MATERIAL: N/A

(e.g. audiovisual, digital material, etc.)	**RECOMMENDED MATERIAL**: N/A
COMMUNICATION REQUIREMENTS:	Daily access to the course's site on the College's Blackboard CMS. Communication using proper written and oral English. Use of word processor, spreadsheet, and presentation SW for documentation and presentation of assignments.
SOFTWARE REQUIREMENTS:	MS-Office Distributed systems middleware C, Python
WWW RESOURCES:	• IEEE Xplore: Distributed Systems Online, IEEE (http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?reload=true&punumber=8968) •) • CORBA Middleware (http://www.corba.org/) • Fusion Middleware (http://docs.oracle.com/cd/E21764_01/core.1111/e10103/intro.htm#ASCON109) • Object Management Group (OMG) Interface Definition Language (IDL) (http://www.omg.org/gettingstarted/omg_idl.htm) • Distributed Systems Articles: ○ https://www.freecodecamp.org/news/a-thorough-introduction-to-distributed-systems-3b91562c9b3c?ref=refind ○ https://martinfowler.com/articles/data-monolith-to-mesh.html?ref=refind ○ https://systemdesign.one/consistency-patterns?ref=refind ○ https://www.allthingsdistributed.com/2022/11/amazon-1998-distributed-computing-manifesto.html?ref=refind ○ https://martinfowler.com/articles/patterns-of-distributed-systems/?ref=refind
INDICATIVE CONTENT:	1. Characterization of Distributed Systems 2. System Models 3. Inter-Process Communication 4. Remote Invocation 5. Indirect Communication 6. Operating System Support 7. Security 8. Name Services 9. Time and Global States 10. Transactions and Concurrency Control 11. Replication