

CS4274: DISTRIBUTED COMPUTING TECHNOLOGIES

Effective Term

Semester A 2022/23

Part I Course Overview

Course Title

Distributed Computing Technologies

Subject Code

CS - Computer Science

Course Number

4274

Academic Unit

Computer Science (CS)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

EE3009 Data Communication Protocols or
EE3015 Computer Networks or equivalent

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course aims to provide introduction to advanced distributed system technologies and programming for mainframe servers and workstations. Students will gain the knowledge about fundamental concepts of distributed systems, particularly client-server models, and inter-process communications (IPC). Students will also learn the programming skill and train their problem solving ability about development of distributed systems for mainframe servers and workstations. We will explore the state of art of distributed systems, such as remote procedure calls (RPC), fault tolerance, data replications and distributed database systems. Specifically, we will discuss the programming of client-server system, middleware systems, and RPC applications in great details.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Make critique and assessment on the fundamental concepts of distributed systems and design principles.	25	x		
2	Design and analyse client-server based systems by using communication protocols or by using RPCs.	25	x	x	
3	Describe the concepts of distributed file systems, database systems, and transaction processing systems.	25	x	x	x
4	Design and analyse fault tolerance transaction processing systems on top of the file systems.	25	x	x	x

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain concepts of distributed systems and programming	1, 2, 3, 4	3 hours/week
2	Tutorial	Require students participate in problem solving of distributed system design	1, 2, 3, 4	8 hours/semester
3	Group Projects	Design, program, and test of distributed systems	1, 2, 3, 4	6 hrs/wk for 6 weeks (2 projects)

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Two projects	1, 2, 3, 4	30

Continuous Assessment (%)

30

Examination (%)

70

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)**Assessment Task**

Projects

Criterion

- 1.1 ability to understand concepts of distributed systems
- 1.2 ability to design, program and test of distributed system
- 1.3 ability to solve problems in design of systems

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Assessment Task

Examination

Criterion

- 2.1 ability to understand and explain concepts of distributed system
- 2.2 ability to design and develop distributed systems in details

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not reaching marginal level

Part III Other Information

Keyword Syllabus

Distributed time, clock synchronization, IPC (Inter-Process Communication), RPC (Remote Procedure Call), NFS (Networked File System), distributed file systems, fault tolerance, distributed database systems, distributed transaction processing system.

Syllabus

- Distributed time and clocks
 - Analyse distributed synchronization protocols for local and physical time
- Fundamental concepts of distributed systems and design principles
 - Make critique and assessment on distributed protocols for global states, coordination, and agreement
- Inter-Process Communication (IPC) in distributed systems
 - Make critique and assessment on IPC protocols and distributed object
 - Analyse client-server based systems by using IPC
- Client-server model and programming using RPCs (remote procedure calls)
 - Analyse client-server based systems by using RPCs
- Distributed file systems and distributed database systems
 - Make critique and assessment on distributed file systems and distributed database management systems
- Distributed Transaction processing and management
 - Make critique and assessment on distributed concurrency protocols
 - Analyse fault tolerance transaction processing systems on top of the file systems
- Data replication

Reading List

Compulsory Readings

Title	
1	Coulouris, G.F, Dollimore, J., and Kindberg, T. (2011). Distributed Systems. Addison-Welsley, 5th edition.
2	Tanenbaum, A. (2010). Computer Networks. Prentice Hall Inc., 5th edition.

Additional Readings

Title	
1	Nil