Title (Units): **COMP 7050 Advanced Topics in Distributed Systems and Networking (3,2,1)**

Course Aims: To learn the mathematical modeling and simulation techniques and apply them to solve problems in distributed systems and networking.

Prerequisite: Research Postgraduate Student Standing

Course Intended Learning Outcomes (CILOs):
Upon successful completion of this course, students should be able to:

No.	Course Intended Learning Outcomes (CILOs)
	Knowledge
1	Explain the basic concepts and methodologies of mathematical modeling for distributed systems and networking
2	Describe the procedures of computer simulations and explain simulation results
3	Describe the problems in the selected topics and explain the solutions to these problems
4	Describe advanced technologies in distributed systems and networking
	Skill
5	Develop mathematical models for problems in distributed systems and networking
6	Perform evaluation of distributed systems and networking

Calendar Description: The course offers a study of the mathematical modeling and simulation techniques for distributed systems and networking. It also provides case studies on one or more of the advanced topics in distributed systems, cloud computing, edge computing, computer networks, wireless networks, and mobile networks.

Teaching and Learning Activities (TLAs):

CILOs	TLAs will include the following:
1, 2, 3, 4	Students will learn the concepts and techniques via lectures, in-class discussions, assignments, and tests.
5, 6	Students will work on a project which involves problem formulation, proposal of solution, and performance evaluation.

Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous assessment	50%	1-6	Continuous assessments will be used to evaluate how well students have learned the concepts in computer networking and distributed systems. A project will be used to assess the students' skills in applying mathematic modeling, simulation techniques to solve problems in distributed systems and networking.
2	Examination	50%	1-6	Examination will be used to evaluate the students' overall understanding on the modeling and simulation techniques, fundamental design principles of distributed systems and computer networking, and designing solutions to the problems of selected topics in distributed systems and networking.

Assessment Rubrics:

Excellent (A)	• Achieve all six CILOs, demonstrating a thorough understanding and solid knowledge of the selected topics • Able to apply a variety of techniques for solving problems in distributed systems and networking
Good (B)	• Achieve most of the six CILOs, demonstrating a good understanding and competent knowledge of the selected topics • Able to apply an appropriate technique for solving problems in distributed systems and networking
Satisfactory (C)	• Achieve some of the six CILOs, demonstrating a basic level of understanding and knowledge of the selected topics • Able to provide solutions for familiar problems in distributed systems and networking
Fail (F)	• Achieve few of the six CILOs, with little understanding of the selected topics • Unable to provide solutions for simple problems in distributed systems and networking

Course Content and CILOs Mapping:

Content	**CILO No.**
I. Mathematical modeling and simulation	1, 2, 3, 5, 6
II. Advanced Topics in Distributed Systems and Network Softwarization	3, 4, 6
III. Advanced Topics in Ubiquitous Computing and Networking	3, 4, 6

References:

van Steen and A.S. Tanenbaum, Distributed Systems, 4th edition, 2023, (ISBN 978-9081540636)

James Kurose and Keith Ross, Computer Networking: A Top-Down Approach, Pearson, 8th Edition, 2021. (ISBN 978-9356061316)

Larry L. Peterson, Carmelo Cascone, Brian O'Connor, Thomas Vachuska, and Bruce Davie, Software-Defined Networks: A Systems Approach, Systems Approach LLC, 2021. (ISBN 978-1736472101)

F. John Dian, Fundamentals of Internet of Things: For Students and Professionals, Wiley-IEEE Press, 1st Edition, 2022. (ISBN 978-1119847298)

William Stallings, 5G Wireless: A Comprehensive Introduction, Addison-Wesley Professional, 1st Edition, 2021. (ISBN 978-0136767145)

Sunilkumar S. Manvi and Mahabaleshwar S. Kakkasageri, Wireless and Mobile Networks, Concepts and Protocols, Wiley India, 2nd Edition, 2016. (ISBN 978-8126558551)

G.F. Coulourism, J. Dollimore, T. Kindberg, and G. Blair, Distributed Systems: Concepts and Design, 5th Edition, Pearson, 2011. (ISBN 978-0132143011)

Anurag Kumar, D. Manjunath, and Joy Kuri, Communication Networking: An Analytical Approach, Morgan Kaufmann, 2004. (ISBN 978-0124287518)

Raj Jain, The Art of Computer Systems Performance Analysis, Wiley, 1991. (ISBN 978-0471503361)

Additional reading materials such as research papers and book chapters will be provided.

Course Content in Outline:

Topic

I. Mathematical modeling and simulation for distributed systems and networking
   A. Overview of mathematical modeling
   B. Mathematical optimization techniques
   C. Queueing theory
   D. Game theory
   E. Simulation for distributed systems and networking

II. Advanced Topics in Distributed Systems and Network Softwarization:

A. Cloud Computing and Edge Computing
B. Blockchain Technologies
C. Software Defined Networking
D. Network Functions Virtualization and Network Slicing

III. Advanced Topics in Ubiquitous Computing and Networking:
A. Edge Artificial Intelligence
B. Internet of Things
C. Mobile Sensing
D. 5G/6G Wireless Networks