

Ministry of Education  
King Saud University  
Deanship of Graduate Studies



College of Computer and  
Information Sciences  
Department of Information Systems

# PhD Program in Information Systems

## (Thesis and Courses Option)

**Dhu Al-Qidah 1443**

**June 2022**

- **INTRODUCTION**

The college of Computer and Information Sciences (CCIS) was created under the issued Royal Order No. 7/1558/m in the year 1404 H. The Department of Information Systems was one of main departments of the CCIS. The Information Systems Department has been serving students for more than thirty-five years, during which a large proportion of Saudis cadres and leaders of information systems in the Kingdom of Saudi Arabia have graduated to meet the growing needs in the information technology sector. Fast and continuous developments and changes in information systems require a review of this program every few years to cope with rapid changes.

The department of Information Systems contributes strongly in many research activities of the CCIS. Its members participate on a regular basis in scientific seminars and conferences held within and outside of the Kingdom in addition to publishing in many journals and edited books. The research areas of the department includes: systems engineering, database systems, enterprise systems, decision support systems (DSS), knowledge management, data mining, geographic information systems (GIS), e-business, information technology and project management. Members of the department are present in the research venues worldwide where they publish regularly excellent quality research papers, a good number of them are ISI indexed.

- **DEGREE NAME**

- ❖ PhD in Information Systems.

- **PROGRAM LANGUAGE**

- ❖ English

- **IMPORTANCE OF THE PHD PROGRAM IN INFORMATION SYSTEMS**

1. Need of qualified academic staff to work in Saudi universities
2. Need of researchers in university and corporate research centers
3. Need of information systems specializations in the job market
4. Provide research opportunities in information systems for Master students

- **PROGRAM VISION**

Develop excellence in higher education and research in the field of information systems to address scientific and technical challenges in today's world.

- **PROGRAM MISSION**

Provide students with the necessary knowledge and the most advanced research skills enabling them to carry out innovative research in information systems for the development and prosperity of Saudi Arabia and the world.

- **PROGRAM OBJECTIVES**

1. Promote advanced research and scientific publication and contribute to the future scientific and technical world advancement in Information Systems.
2. Prepare highly specialized scholars, professionals and Saudis research personnel, manpower and expertise that meet the Saudi society development needs, and jobs demand; and support the successful transfer of advanced information technologies in industry, academic and scientific sectors.
3. Create solutions for the persistent Information Systems problems in the public and private sectors through a higher level of applied research and technology transfer.
4. Provide graduate students and researchers with skills, means, methodology, innovation and scientific approaches necessary for distinguished professionals in Information Systems sectors.

- **PROGRAM OUTPUTS**

1. **Knowledge and Understanding:**

- Apply knowledge of mathematics, computing, and engineering to solve research problems
- Carry out innovative and original research

2. **Mental Skills:**

- Identify, formulate, and solve computing problems.
- Design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
- Design and conduct experiments, and analyze and interpret data

3. **Professional and practical skills:**

- Work in a multidisciplinary research team.
- Show high commitment to professional and ethical responsibility
- Demonstrate oral and written communication skills in publishing scientific papers and presenting technical work to a range of audiences

4. **General and transferred skills:**

- Develop independent thinking
- Engage in continuous learning and professional development

- **BENEFICIARIES OF THE PROGRAM**

- MSc graduates (male and female) from Saudi Universities in the various fields of computing, engineering, and information technology
- Distinguished graduates from within and outside Saudi Arabia.

- **EMPLOYMENT OPPORTUNITIES**

- Teaching faculty and researcher in Saudi Universities
- Researchers in Saudi research centers
- Information systems consultants in government and private sectors
- Information technology project leaders

- **ADMISSION REQUIREMENTS**

- ❖ In addition to admission requirements enumerated in the Unified Law Organizing Graduate Studies at Saudi Universities, the following admission requirements stipulated by the information systems department:

1. MSc in Information Systems or related disciplines.
2. Having a GPA of at least 4 (out 5) in MSc and BSc degrees.
3. Obtain a score of at least 61 in TOFEL-IBT or its equivalent.
4. Obtain a score of at least 148 in GRE quantitative part.
5. Pass an interview to be announced by the department council.

- **DEGREE REQUIREMENTS**

- ❖ Thesis and Courses Option

- a. Successful completion of 26 credit hours of graduate courses in the PhD program.
- b. To pass a comprehensive exam.
- c. To publish or obtain an acceptance for at least one publication in a specialized referred venue in the Information Systems various areas of specialization.
- d. Completion and successful defense of an original thesis.

- **PROGRAM TRACKS: NONE**

- **PROGRAM STRUCTURE**

- ❖ Thesis and Courses Option

- (26) credit hours and (24) credit hours for the thesis are required:

Type of Courses	No. of Courses	Credit Hours
General Course from the list (1)	1	(3) credit hours
Two courses from the list (2) for PhD programs in Computer Science and Computer Engineering	2	(6) credit hours
Core Courses	4	(8) credit hours
Elective Courses from the list (3)	3	(9) credit hours
Comprehensive Exam	1	0
Thesis	1	(24) credit hours
<b>Total</b>	<b>12</b>	<b>(26) credit hours and (24) credit hours for the thesis</b>

● **PROGRAM STUDY PLAN**

❖ **First Level:**

#	Course Code	Course Name	Credit Hours
1	----	General Course from the list (1)	3(3+0)
2	----	Course from the list (2) for PhD programs in Computer Science and Computer Engineering	3(3+0)
<b>Total</b>			<b>(6) Credit Hours</b>

❖ **Second Level:**

#	Course Code	Course Name	Credit Hours
1	IS 611	Information and Knowledge Management	3(3+0)
2	----	Course from the list (2) for PhD programs in Computer Science and Computer Engineering	3(3+0)
<b>Total</b>			<b>(6) Credit Hours</b>

❖ **Third Level:**

#	Course Code	Course Name	Credit Hours
1	-----	Elective Course (1) from the list (3)	3(3+0)
2	-----	Elective Course (2) from the list (3)	3(3+0)
<b>Total</b>			<b>(6) Credit Hours</b>

❖ **Fourth Level:**

#	Course Code	Course Name	Credit Hours
1	IS 696	Independent Research Study (1)	2(2+0)
2	-----	Elective Course (3) from the list (3)	3(3+0)
<b>Total</b>			<b>(5) Credit Hours</b>

❖ **Fifth Level:**

#	Course Code	Name	Credit Hours
1	IS 697	Independent Research Study (2)	2(2+0)
<b>Total</b>			<b>(2) Credit Hours</b>

❖ **Sixth Level:**

#	Course Code	Name	Credit Hours
1	COM 700	Comprehensive Exam	0
<b>Total</b>			<b>(0) Credit Hours</b>

❖ **Seventh Level:**

#	Course Code	Name	Credit Hours
1	IS 699	Thesis Proposal Preparation	1
<b>Total</b>			<b>(1) Credit Hours</b>

❖ Eighth Level:

#	Course Code	Name	Credit Hours
1	IS 700	Thesis	(24) Credit Hours
<b>Total</b>			(26) credit hours + (24) credit hours for the thesis

❖ List (1): General Courses

#	Course Code	Course Name	Credit Hours	Prerequisite
1	Math 505	Numerical Linear Algebra	3(3+0)	Math242, Math244, Math253, Math254
2	Stat 503	Probability and Mathematical Statistics for Engineers	3(3+0)	
3	Math 507	Advanced operations Research	3(3+0)	Math253, Math254

❖ List (2): Courses from PhD programs in Computer Science and Computer Engineering

#	Course Code	Course Name	Credit Hours
1	CSC 612	Analysis and Design of Algorithms	3(3+0)
2	CEN 621	Advanced Computer Architecture	3(3+0)
3	CEN 631	Advanced Computer Networks	3(3+0)
4	CSC 642	Advanced Software Engineering	3(3+0)
5	CEN 643	Digital Signal Processing	3(3+0)
6	CSC 662	Artificial Intelligence	3(3+0)

❖ List (3): Elective Courses

#	Course Code	Course Name	Credit Hours
	IS 621	Web Content Management	3
	IS 622	Advanced Topics in Information Security	3
	IS 623	Data Warehouses and Knowledge Discovery	3
	IS 624	Enterprise Systems	3
	IS 625	Spatial Information Systems	3
	IS 626	Artificial Intelligence Techniques and Applications	3
	IS 627	Advanced Simulation Techniques	3
	IS 628	E-Business Strategies	3
	IS 629	Advanced Systems Analysis and Design	3
	IS 698	Advanced Topics in Information Systems	3

• **COURSES DESCRIPTION**

<b>IS 611</b>	<b>Information and Knowledge Management</b>	<b>3(3+0)</b>
Knowledge as a manageable asset. Organizations classes, adaptive systems, information and knowledge environment. Information handling. Organizational setting and technologies used for handling information and knowledge.		
<b>IS 621</b>	<b>Web Content Management</b>	<b>3(3+0)</b>
Concepts and techniques in website content representation, organization, presentation, and development with the eXtensible Markup Language (XML). Basic XML syntax, XML vocabulary specification, data modeling, XML style sheets and transformation, and Document Object Model (DOM). Design the Document Type Definitions (DTDs) and XML schemas. Creation and manipulating of XML documents. Advanced topics in manipulating XML data, including standards, namespaces and schemas, XML Transformation Language, and databases in relation to XML.		
<b>IS 622</b>	<b>Advanced Topics in Information Security</b>	<b>3(3+0)</b>
Policies, models, and mechanisms for secrecy, integrity, and availability. Operating system models and mechanisms for mandatory and discretionary controls, data models, concepts and mechanisms for database security, basic cryptography and its applications, security in computer networks and distributed systems, controlling and preventing viruses and other rogue programs. Authentication, access control, non-repudiation; and their integration in network protocols. Key management, cryptographic protocols and their analysis. Access control, delegation and revocation in distributed systems. Security architectures, multilevel systems, and security management and monitoring.		
<b>IS 623</b>	<b>Data Warehouses and Knowledge Discovery</b>	<b>3(3+0)</b>
Advanced topics in deductive, active, temporal and OR DBs, extensible databases, spatial queries and storage structures, time series, data warehouses and knowledge discovery, and databases and the Web (queries on semi-structured data). Modern Trends in Intelligent Information Systems and DBMSs, Deductive Databases and knowledge bases, Temporal Queries and Reasoning, Active Databases, Object-Relational DBMSs.		
<b>IS 624</b>	<b>Enterprise Systems</b>	<b>3(3+0)</b>
Enterprise resource planning (ERP) client/server systems and e-business. The marketplace for ERP, CRM, SCM, and e-procurement; and management issues, strategy, business value, risks, usability and outsourcing. Future and predicted enterprise system trends.		
<b>IS 625</b>	<b>Spatial Information Systems</b>	<b>3(3+0)</b>
Principles in representing and organizing spatial data in geographic databases, and procedures of spatial analysis utilizing geospatial data. Concepts of the nature of spatial problems, the properties of spatial data, the entity and field approaches, Euclidean and fractal geometries, topology and graphs, regular and irregular tessellations, hierarchical data structures, spatial addressing, spatial data operations, and computational geometry. Representation for hydrological modeling and land use analyses; map overlay modeling, using grid and vector data; and geocoding and network analyses for transportation analyses.		

<b>IS 626</b>	<b>Artificial Intelligence Techniques and Applications</b>	<b>3(3+0)</b>
<p>Foundational techniques in Artificial Intelligence: history, symbol system hypothesis, intelligent modeling and modeling intelligence, critique of classic AI problems. Problem spaces and search: State space, search, heuristics, graph methods. Knowledge representation and inference: Inference, inheritance, slot and filler structures, sets and attributes, frames and frame languages. Knowledge representation and logic: Predicate logic, Non-classical logics: fuzzy logic, non-monotonic reasoning. AI Applications including Planning and Scheduling, Computer-based Vision, Neural Networks, Natural language Understanding, Generation and Translation, Intelligent Agents.</p>		
<b>IS 627</b>	<b>Advanced Simulation Techniques</b>	<b>3(3+0)</b>
<p>Dynamical systems theory. Simulation systems and their classification. Principles of simulation system design and implementation. Using general programming languages for simulation. Algorithms for control of simulation. Continuous simulation; numerical methods, spatial models. Discrete simulation; events, processes, quasi-parallel execution. Combined simulation; state events. Advanced and special simulation methods. Basics of sensitivity analysis. Digital system models. Qualitative simulation. Models of uncertainty, using fuzzy logic in simulation. Knowledge-based simulation. Model optimization. Parallel and distributed simulation. Modern visualization methods. User interfaces of simulation systems and models. Simulation for virtual reality. Theoretical foundations of model validation and verification. Simulation results analysis. Application of artificial intelligence principles to system modeling and simulation.</p>		
<b>IS 628</b>	<b>E-Business Strategies</b>	<b>3(3+0)</b>
<p>Different aspects of conducting business over the Internet. Business-to-business and business-to consumer e-Business models. The history and future of the Internet, Internet infrastructure, website design, Internet security, web server platforms, the components that comprise an e-Business strategy and demonstrate methods strategy. Software tools and protocols for web-based applications, identify the components of e-Business strategies and methods. Integration of e-business applications to back-office.</p>		
<b>IS 629</b>	<b>Advanced System Analysis and Design</b>	<b>3(3+0)</b>
<p>Advanced tools and techniques that the programmer or analyst uses to develop information systems. Object-oriented tools and the Unified Modeling Language (UML), objects, use cases, actors, structured scenarios, hierarchies, dependencies, message flows, state transition, and user interfaces. object-oriented CASE tool.</p>		
<b>IS 696</b>	<b>Independent Research Study1</b>	<b>2(2+0)</b>
<p>The student selects a research topic and conducts a literature review in relation to the topic.</p>		
<b>IS 697</b>	<b>Independent Research Study2</b>	<b>2(2+0)</b>
<p>The student selects a research topic and conducts a literature review in relation to the topic.</p>		
<b>IS 698</b>	<b>Advanced Topics in Information Systems</b>	<b>3(3+0)</b>
<p>In this course, students are able to study advanced topics in Information Systems. The content and syllabi of this course is designed by a member of staff and approved by the department council.</p>		



<b>IS 699</b>	<b>Thesis Proposal Preparation</b>	<b>1(1+0)</b>
In this course, students identify an original research topic. Formulate a problem statement. Understand the background of the research. Study related work. Develop or adapt potential research directions. Summarize the state of the research as a thesis proposal (Prerequisite: 13 credit hours).		
<b>IS 700</b>	<b>Thesis</b>	<b>(24) Credit Hours</b>
Complete the research work proposed in the thesis proposal. Publish the results of the research. Write a dissertation that describes the research work and presents the results. Final defense (Prerequisite: IS 699).		
<b>CSC 612</b>	<b>Analysis and Design of Algorithms</b>	<b>3(3+0)</b>
Major data structures design techniques - Divide and conquer - Dynamic programming - Heuristics - Parallel algorithms - Analysis of algorithms - Orders of magnitude - Lower bound theory - Time and space complexity - NP-hard and NP-complete problems - Applications and examples - Correctness of algorithms - Structure of algorithms.		
<b>CEN 621</b>	<b>Advanced Computer Architecture</b>	<b>3(3+0)</b>
Instruction set principles, Pipelining, pipelining hurdles. Instruction level parallelism, Data hazards avoidance, Dynamic Scheduling, Dynamic Hardware prediction. Memory Hierarchy Design, Cache design, Storage systems, Busses, I/O performance measures. Interconnection Networks, Introduction Multiprocessors architectures.		
<b>CEN 631</b>	<b>Advanced Computer Networks</b>	<b>3(3+0)</b>
Review of OSI layered Architecture, TCP/IP Protocols, Data link layer: HDLC, Window flow control, Network layer: Datagram and virtual circuit, Transport protocol: Error-detection and recovery, Presentation layer: Security, Privacy, Text compression, Application layer: Distributed computing, Network operating systems.		
<b>CSC 642</b>	<b>Advanced Software Engineering</b>	<b>3(3+0)</b>
Software methodologies - Software requirements - Software Project Management - Software Cost - Software Quality - Software Testing - Software Measurements - Software Risk Management - Case Study.		
<b>CEN 643</b>	<b>Digital Signal Processing</b>	<b>3(3+0)</b>
Discrete time signals, Z-transforms. Discrete Fourier transform (DFT). Fast Fourier transform (FFT). Design of finite impulse response filter (FIR) and Infinite impulse response filter (IIR), Effects of finite word length		
<b>CSC 662</b>	<b>Artificial Intelligence</b>	<b>3(3+0)</b>
Introduction to AI problem solving - Knowledge representation - Automatic theorem proving - Learning by example - Learning by analogy - Learning by discovery - Self-reference and Self production - Reasoning: causal reasoning - commonsense reasoning - default reasoning - measure-based approaches - reasoning with uncertainty - Confirmation theory - Belief theory - Necessity and possibility theory - Theory of endorsements - Spatial and temporal reasoning.		
<b>505 MATH</b>	<b>Numerical Linear Algebra</b>	<b>3(3+0)</b>
Direct & Iterative methods for solving system of linear equations (including cases with special matrices) along with error convergences analysis. Numerical methods for solving least square problems and approximation of functions). Various methods for computing the eigenvalues and eigenvectors for symmetric and non-symmetric matrices. Applications.		

<b>503 STAT</b>	<b>Probability Mathematical Statistics for Engineering</b>	<b>3(3+0)</b>
Probability, Random Variable, Expectation, Some Distributions Functions of R. V., Sampling distributions, Estimation, Hypothesis, Testing, Correlation and regression, Analysis of Experiments.		
<b>507 MATH</b>	<b>Advanced Operations Research for Engineering</b>	<b>3(3+0)</b>
Linear optimization models. Geometric interpretation. Simplex, two phase, revised simplex and Karmarkar's methods for solving linear programming. Duality and sensitivity analysis. Parametric programming. Applications Introduction to the nonlinear programming.		