



Information Technology Department

Information Technology Graduate Programs

**An introductory guide for the
programs**

**The program's consistency report with the
requirements of the National Qualifications
Framework**

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1 Information Technology Department

The Department of Information Technology (IT) was established as one of three FCIT departments in 2006. It was established to keep pace with the scientific, research and practical developments in the field of information technology, especially in computer networks, databases, human-computer interaction, web-page design and other subfields.

With the multi-disciplinary nature of the work of today's IT Professional, the IT Department promotes multi-disciplinary research and activities, infusing its faculty with expertise coming from various allied and related fields. The IT department supports its faculty members through development programs for professional training and development, and through recognition of their consultancies and project involvements inside and outside of the university.

1.1 Vision

To be a pioneer in the field of Information Technology in the region for scientific research, practical innovations, teaching and learning, and entrepreneurship.

1.2 Mission

To provide high-quality and cutting-edge degree programs, research, and specialized consultations in the field of information technology with highly qualified faculty members to serve the community using up-to-date technology and promote entrepreneurship.

1.3 Objective

- To constantly review and update educational programs to accommodate all the emerging technologies in Information Technology.
- To expand technical cooperation with technical sectors in the society.
- To attract outstanding scientists in the areas of specialization to deliver lectures and conduct joint research with members of the department in order to exchange technical and scientific expertise and be acquainted with all-new in the area of specialization.
- To promote the faculty to conduct outstanding scientific research and publish in distinguished scientific journals along with attending conferences and seminars for various scientific collaborations with other scientific schools.
- To provide laboratories with equipment and software packages required for experiments and scientific research.
- To enable research groups within the department in various fields of specialization.
- To encourage inter-cooperation between the department and other scientific departments inside and outside the faculty for multidisciplinary projects.
- To promote industry collaboration for scientific and practical innovations.
- To create new business opportunities utilizing cutting-edge IT technologies.

2 Degree Programs

The Department of Information Technology offers programs conferring Master of Science (MS) and Doctor of Philosophy (PhD) degrees. These programs consist of completion of focused courses and composition of a thesis, resulting in an in-depth education in computing surrounded by ample research opportunities.

3 Admission

3.1 Requirements of the Information Technology Department

To qualify for admission an applicant must:

1. Hold the requisite degree in Computer Science, Computer Engineering, Information Systems, Information Technology, or another approved field of computing
2. Have a cumulative GPA of at least a "B"
3. Have a General Aptitude Test (GAT) score of at least 65
4. Have a TOEFL score of at least 450 if the applicant is applying to a master's program or 500 if the applicant is applying to a doctoral program, or equivalent

Applicants qualified for admission to a master's program who receive at least 80% consideration per the following criteria qualify for preferential admission based on the number of available spaces:

1. (50% consideration): Cumulative average
2. (40% consideration): General Aptitude Test (GAT) score
3. (10% consideration): Degree of specialization of the applicant

Applicants qualified for admission to a doctoral program who receive at least 70% consideration per the following criteria qualify for preferential admission based on the number of available spaces:

1. (40% consideration): Score on written exam administered by the department
2. (30% consideration): General Aptitude Test (GAT) score
3. (30% consideration): Research potential of the applicant based on:
 - a. Written submission by the applicant of the applicant's objective of study (i.e. statement of purpose)
 - b. Prior research contributions of the applicant in terms of publications, participation in scientific research events, research contributions within a program specialization

3.2 Admission Deadlines

Admission deadlines are determined by the Deanship of Graduate Studies for each academic calendar year and can be found at <https://graduatestudies.kau.edu.sa>.

3.3 Conditional Admission Requiring Completion of Prerequisite Courses

A student granted conditional admission requiring completion of prerequisite courses must complete these courses on the first attempt within the student's first three semesters with a grade of no less than a "C" in each and a cumulative GPA of no less than a "B" across all before commencing registration for a graduate program. With the express approval of the department, a student may register for graduate courses if the student has no more than two uncompleted prerequisite courses, which must be able to be completed on time. Time taken for completing prerequisite courses does not count against any limits for completing a graduate degree. Grades earned for prerequisite courses are not used when determining GPA.

3.4 Postponing Admission

An applicant with reasonable justification may postpone admission for up to two semesters if the applicant submits a request within the timeframe established by the Deanship of Graduate Studies that is approved by the Department Council, the College Dean, and the Deanship of Graduate Studies.

4 Postponing Graduate Studies

A student with reasonable justification who has completed at least one semester or a significant portion of the thesis may postpone graduate studies for up to four semesters with no more than

two of those semesters being consecutive if the student submits a request at least two weeks prior to the beginning of the next semester that is approved by the Department Council, the College Dean, and the Deanship of Graduate Studies. The postponement period does not count against any limits for completing the graduate degree.

5 Postponing Prerequisite Courses

A student with reasonable justification who has completed at least one semester of prerequisite courses may postpone studies for only one semester if the student submits a request at least two weeks prior to the beginning of the next semester that is approved by the Department Council, the College Dean, and the Deanship of Graduate Studies. The postponement period does not count against any limits for completing the prerequisite courses and the graduate studies. The postponing prerequisite courses counts as a postponed semester per Postponing Graduate Studies.

6 Withdrawing from a Semester

A student with reasonable justification who has completed at least one semester and is not under an additional attempt may drop all enrolled courses and withdraw from a semester if the student submits a request within the timeframe established by the Deanship of Graduate Studies before final examinations have commenced that is approved by the Department Council, the College Dean, and the Deanship of Graduate Studies. The withdrawn semester counts as a postponed semester per Postponing Graduate Studies where postponement should not exceed two consecutive semesters.

7 Changing Majors

A student who satisfies all requirements deemed necessary by any associated Departments may change major once with the recommendations of the Department and College Councils and the approval of the Council of the Deanship of Graduate Studies. The transferring of any credit hours previously-earned at the University is subject to the approval of the new Department. Such transferred credits are used when determining GPA. Time spent in the previous major counts against any limits for completing prerequisite courses or a graduate degree. Only one change of major is allowed per degree.

A student wishing to change majors should:

- Apply to the Head of the Department if the student wishes to transfer from one field or program to another within the same department.

- Apply to the Dean of the College if the student wishes to transfer from one department to another within the same college
- Apply to the Deanship of Graduate Studies if the student wishes to transfer from one college to another within the university

8 Dismissal

The Council of the Deanship of Graduate Studies may decide to dismiss a student who **fails to**:

1. Fulfill all expected academic duties
2. Comply with the rules and regulations of the university
3. Register during the allowed registration period
4. Fulfill the conditions of Conditional Admission Requiring Completion of Prerequisite Courses
5. Fulfill the conditions of Postponing Admission
6. Fulfill the conditions of Postponing Graduate Studies
7. Fulfill the conditions of Postponing Prerequisite Courses
8. Fulfill the conditions of Withdrawing from a Semester FORM [AAG-15]
9. Demonstrate consistent scientific honesty
10. Have a GPA of at least a “B” for any two consecutive semesters
11. Pass the comprehensive examination, if required, within two attempts
12. Maintain qualification of a thesis per the committee
13. Successfully defend a thesis per the committee
14. Complete the degree on time

If a student fails to fulfill the 10th requirement in the Dismissal, the student may be granted an additional attempt for up to two semesters with the recommendations of both the Department and College Councils and the approval of the Council of the Deanship of Graduate Studies.

If a student fails to fulfill the 14th requirement in the Dismissal, the student may be granted an additional attempt for up to two semesters with the support of the student’s academic advisor’s report, the recommendations of the Councils of the Department, College, and Deanship of Graduate Studies, and the approval of the University Council. FORM [AAG-1]

9 Readmission

Under certain circumstances, when supported by the Department and College Councils, recommended by the Council of the Deanship of Graduate Studies, and approved by the University Board, A student formerly enrolled in a graduate program may be granted readmission. If no more than six semesters have passed since the student’s dismissal, the student may be required to repeat certain courses per a list produced by the Department and College Councils and approved by the Council of the Deanship of Graduate Studies with any semesters completed or postponed prior to readmission counting against the applicable limits. If more than six

semesters have passed since the student's dismissal, the student is treated as a new applicant, regardless of the number of credit hours earned previously.

10 Facilities

FCIT provides students with access to computing labs and centers. Students may obtain access to these facilities by contacting the academic advisor. Our main facilities are outlined below.

10.1 Data Center

Equipped with state-of-the-art servers and networking equipment for high-performance and cloud computing, the FCIT Data Center provides the intense computing resources necessary for the grid and cluster approaches that are key to graduate research projects and publications. Additional resources can be obtained on a case-by-case basis per research requirements. The FCIT Data Center has been utilized for civil improvement projects, including several projects under the auspices of the King Abdullah City for Science and Technology (KACST) Fund.

10.2 High Performance Computing (HPC) Lab

Providing aggregated computing power far-exceeding average workstations, the High-Performance Computing (HPC) Laboratory delivers the resources necessary to address large-scale research problems in an array of fields, including science, engineering, and business. Examples of applications that benefit significantly from such resources include visualization, distributed databases, numerical modeling, simulations, scientific predictions (e.g. earthquakes), gaming, web servers, and search engines.

10.3 Data Communication and Networks (DCN) Lab

The Data Communication and Networks (DCN) Laboratory facilitates research in such areas as advanced data communications, next-generation multimedia communication networks, telecommunication network management, mobile and wireless networks, and communication network security. The DCN Laboratory is presently being updated with state-of-the-art equipment and software to meet the needs of innovative research, which will allow FCIT researchers to conduct theoretical, experimental, and applied research in areas involving network programming and simulation, including cloud computing, data center security, routing protocols for wireless sensor and mesh networks, applied cryptography, distributed storage systems for managing structured data, the Internet of Things (IoT), advanced networking topics, communication network evaluation, information security, and network security.

10.4 Intelligent System (IS) Lab

Equipped with the latest state-of-the-art equipment, including LABNIRS, Biosemi Active-Two EEG, and Tobii Eye Tracker systems, the Intelligent Systems (IS) Laboratory was established to promote excellence in research and education in multidisciplinary fields such as human language technology, speech processing, machine learning, data mining, machine vision, brain-computer interfacing, and assistive technologies. The IS Laboratory provides tools for researchers conducting theoretical, experimental, and applied research that leads to the development of intelligent systems. Such research includes rehabilitation (e.g. movement, work, language, hearing), cognitive computation involving brain-computer interfacing and olfactory nerve testing, informatics involving analyses of emotions and big data, and measurements taken of newborn babies involving the senses of touch, sight, and hearing.

10.5 Data Engineering (DE) Lab

Enabling research and development of data and knowledge engineering applications, the Data Engineering (DE) Laboratory supports multidisciplinary research and development efforts that utilize visualization, data analysis, and knowledge-engineering with current themes including data mining, prediction, and data warehousing.

10.6 Software Engineering (SE) Lab

The Software Engineering (SE) Laboratory supports graduate and postgraduate researchers working on static and dynamic testing of exascale software systems, which requires the utilization of network clusters, map reduction, and NOSQL databases. A wide variety of research efforts spanning many different topics are currently underway in the SE Laboratory.

11 Graduate Program Structure

11.1 Courses

11.1.1 Master Degree

The master program in Information Technology is a two-year degree program. To obtain a master's degree, a student must complete 33 credit hours according to the following tables:

| Requirements | Credits |
|--|-----------|
| 6 Obligatory Courses (General Courses) | 13 |
| One Obligatory course for each track | 3 |
| 3 Elective courses for each track | 9 |
| Thesis | 8 |
| Total Credit Hours | 33 |

| Obligatory Courses (General Courses) for all Tracks | | |
|---|---------------------------------|--------------|
| CODE | COURSE NAME | CREDIT HOURS |
| CPIT 600 | INTERNETWORKING | 3 |
| CPIT 601 | OBJECT ORIENTED SOFTWARE ENG. | 3 |
| CPIT 602 | DATABASE SYSTEMS ADMINISTRATION | 3 |
| CPIT 603 | QUANTITATIVE ANALYSIS | 2 |
| CPIT 694 | RESEARCH METHODS | 1 |
| CPIT 695 | SEMINAR | 1 |
| CPIT 699 | THESIS | 8 |
| | TOTAL CREDIT HOURS | 21 |

| First Track: Internet Technologies | | |
|------------------------------------|---------------------------|--------------|
| CODE | COURSE NAME | CREDIT HOURS |
| CPIT 630 | TCP/IP PROGRAMING | 3 |
| | TOTAL CREDIT HOURS | 3 |

| First Track: Elective for Internet Technologies (Select 3) | | |
|--|-----------------------------------|--------------|
| CODE | COURSE NAME | CREDIT HOURS |
| CPIT 631 | WEB ENGINEERING | 3 |
| CPIT 632 | CLOUD COMPUTING ARCHITECTURE | 3 |
| CPIT 633 | E-COMMERCE | 3 |
| CPIT 634 | INTERNET COMPUTING | 3 |
| CPIT 645 | E-SECURITY | 3 |
| CPIT 697 | SELECTED TOPICS ON INTERNET TECH. | 3 |
| | TOTAL CREDIT HOURS | 9 |

| Second Track: Network Security | | |
|--------------------------------|-------------|--------------|
| CODE | COURSE NAME | CREDIT HOURS |

| CPIT 640 | ADVANCED INFORMATION SECURITY | 3 |
|--|-------------------------------------|--------------|
| | TOTAL CREDIT HOURS | 3 |
| Second Track: Elective for Network Security (Select 3) | | |
| CODE | COURSE NAME | CREDIT HOURS |
| CPIT 631 | INTERNET AND NETWORK SECURITY | 3 |
| CPIT 632 | ENCRYPTION ALGORITHM | 3 |
| CPIT 633 | COMPUTER FORENSICS | 3 |
| CPIT 634 | NETWORK SECURITY | 3 |
| CPIT 645 | ELECTRONIC SECURITY | 3 |
| CPIT 697 | SELECTED TOPICS ON NETWORK SECURITY | 3 |
| | TOTAL CREDIT HOURS | 9 |

| Thesis | | |
|------------------------|-------------|--------------|
| CODE | COURSE NAME | CREDIT HOURS |
| CPIT 699 | THESIS | 8 |

11.1.2 Common Degree Plan

All students admitted to information technology department take the following courses in their planning

| CODE | COURSE NAME | CREDIT HOURS | UNITS | SEMESTER |
|--------------------|---------------------------------|----------------|----------|----------|
| CPIT 600 | INTERNETWORKING | 3 | 11 | FIRST |
| CPIT 601 | OBJECT ORIENTED SOFTWARE ENG. | 3 | | |
| CPIT 602 | DATABASE SYSTEMS ADMINISTRATION | 3 | | |
| CPIT 603 | QUANTITATIVE ANALYSIS | 2 | | |
| CPIT 6XX | OBLIGATORY TRACK | 3 | 11 | SECOND |
| CPIT 694 | RESEARCH METHODS | 1 | | |
| CPIT 695 | SEMINAR | 1 | | |
| CPIT 6XX | -- | ELECTIVE TRACK | | |
| CPIT 6XX | -- | | | |
| CPIT 699 | THESIS | 4 | 7 | THIRD |
| CPIT 6XX | ELECTIVE TRACK | 3 | | |
| CPIT 699 | THESIS | 4 | 7 | FOURTH |
| TOTAL CREDIT HOURS | | | 33 UNITS | |

11.1.3 Course Description

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 600 | Internetworking | 3 Units | |
| COURSE DESCRIPTION | <p>This course covers advanced topics on internetworking, Internet architecture and protocols. Topics include internetworking concept, Internet architectural model, IP protocol, classfull and classless addresses, and transport and application layers protocols. This course also includes routing algorithms, routing between peers, routing within an autonomous system, mobile IP, private network interconnection, bootstrap and auto-configuration, domain name system, and network management.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 601 | OBJECT ORIENTED SOFTWARE ENGINEERING | 3 UNITS | |
| COURSE DESCRIPTION | <p>Building on large-scale and complex software systems from available parts with the goal of increasing return on investment, decreasing time to market, and assuring quality and reliability. The course covers the basic software component concepts, overview of advanced topics on software components and component-based software engineering from research and practice.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 602 | DATABASE SYSTEMS ADMINISTRATION | 3 UNITS | |
| COURSE DESCRIPTION | <p>This course is intended for students who wish to specialize in database management systems or wish to practice the advanced techniques involved in optimization of data storage, database design and queries. This course covers advanced topics like physical storage and access methods, query optimization, transaction processing, concurrency control, distributed databases and object oriented databases. Designing and Creating Database, Optimal Flexible Architecture and other advanced topics in Database administration.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 603 | QUANTITATIVE ANALYSIS | 2 UNITS | |
| COURSE DESCRIPTION | <p>This course introduces the graduate student to basic methods of empirical inquiry in the social sciences. The overwhelming majorities of studies that test hypotheses, empirically fit models, produce predictions, or estimate policy impacts are based upon some form of quantitative or statistical analysis. This course will provide a basic introduction to statistical methods for political scientists and policy analysts. The course will provide a solid foundation in statistical inference, enabling the student to become a competent producer of basic statistical research.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 620 | ENTERPRISE IT ARCHITECTURE | 3 UNITS | CPIT 601 |
| COURSE DESCRIPTION | <p>Planning for business transformation using IT, strategy analysis for business plans and balanced scorecard, identifying strategic opportunities for business transformation, real-world case studies for business transformation, managing and sustaining enterprise architecture, The course is a practical extension of Enterprise Architecture Concepts, analyzing various existing and new business models and master plans through case studies, explaining how to achieve a balanced relationship between business, technology and organization. Significant problems of EA practice and trends of the area are also covered.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 630 | TCP/IP PROGRAMMING | 3 UNITS | CPIT 600 |
| COURSE DESCRIPTION | <p>TCP/IP is a very large protocol suite for internet computing and web computing. This course emphasizes on thorough high-level understanding of this protocol suite and other practical issues concerning TCP/IP today. TCP/IP Protocols and standards that are commonly used in developing such distributed systems will be covered. The course covers networking applications and their specific application protocols, and also the management protocol (SNMP). Selected advanced topics on current and evolving Internet protocols, in particular IP multicasting, differentiated services and quality of service, virtual private networks, and IPv6, will also be studied.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 631 | WEB ENGINEERING | 3 UNITS | CPIT 630 |
| COURSE DESCRIPTION | <p>Web applications are complex systems that deliver a plethora of functionality to a large number of users, and also exhibit unique behaviors and demands in terms of performance, scalability, usability, and security. Web engineering is an emerging and multidisciplinary process that is used to create quality web applications. Web Engineering introduces a structured methodology utilized in software engineering to Web development projects. This course will discuss the limits of current web technologies, the similarities and differences between web and software engineering, design, information and service architectures, content management, and testing disciplines.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 632 | CLOUD COMPUTING ARCHITECTURE | 3 UNITS | CPIT 630 |
| COURSE DESCRIPTION | <p>The course examines basic APIs used in the Cloud, including the techniques for building, deploying, and maintaining applications. We learn how to weave existing SaaS offerings into new services and how to use Hadoop, the open source implementation of MapReduce framework and RestFul Web services, to build very powerful and efficient applications. We also learn how to deal with not trivial issues in the Cloud: load balancing, caching, distributed transactions, and identity and authorization management.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 633 | E-COMMERCE | 3 UNITS | CPIT 630 |
| COURSE DESCRIPTION | <p>This course is designed to provide in-depth coverage of electronic commerce concepts. The learner will participate in a variety of activities designed to provide familiarity with the tools and issues associated with a web-delivered commercial enterprise. The learner will plan, design, develop and test web environments designed to meet secure retail and organizational needs.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 634 | INTERNET COMPUTING | 3 UNITS | CPIT 630 |
| COURSE DESCRIPTION | <p>This course covers the basic principles and practices of distributed computing over the Internet. It focuses on the Internet as a domain for sharing resources with Grids, distributed computing with Web services, and service-oriented computing. The Internet is increasingly used as a large interconnection network for deploying distributed applications to solve challenging problems in diverse areas. Application areas include Finance and E-business, Government Services, Scientific Computing and Grids, Bioinformatics, Physics, Remote Visualization, Remote Collaboration, Multimedia applications, and File Sharing. The Internet is pandemic to modern uses of technology.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 640 | ADVANCED INFORMATION SECURITY | 3 UNITS | CPIT 600 |
| COURSE DESCRIPTION | <p>This course investigates advanced topics in cryptography. Topics include private and public key cryptosystems, cryptographic hash functions, message authentication codes, basic digital signature schemes, and user authentication. Additional topics include digital watermarking, fingerprinting, and steganography. Students will write a term paper, either theoretical based on literature or reporting a student's own implementation or experiments with a chosen cryptographic scheme. Depending on the size of the group, some or all students will give a presentation to the class.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 641 | INTERNET SECURITY | 3 UNITS | CPIT 640 |
| COURSE DESCRIPTION | <p>The course is devoted to investigate the security of networks at various protocol levels. Topics include network level security and the IPsec protocol, virtual private networks, key management and distribution, transport level security: SSL, TLS, and SSH protocols. Additional topics include wireless network security, application-specific protocols for e-mail security: PGP and S/MIME, malicious software and antivirus, intrusion detection, and firewalls: types, locations, and configurations.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 642 | CRYPTOGRAPHIC ALGORITHMS | 3 UNITS | CPIT 640 |
| COURSE DESCRIPTION | <p>The course is devoted to the review of basic cryptographic algorithms, their implementation and usage. Classical encryption techniques and those of Rivest-Shamir-Adleman and EL Gamal will be seen in depth, and an overview of several others will be presented. This course also presents authentication schemes and interactive proof protocols. Students will write a term paper, either theoretical based on literature or reporting a student's own implementation or experiments with a chosen cryptographic scheme. Depending on the size of the group, some or all students will give a presentation to the class.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 643 | COMPUTER FORENSICS | 3 UNITS | CPIT 640 |
| COURSE DESCRIPTION | <p>This course provides students with knowledge and understanding of computer forensics to know different aspects of computer crime and ways in which to uncover, protect and exploit digital evidence. It will provide a theoretical foundation for the techniques and methods needed for the extraction of information from digital devices. Students will gain exposure to the spectrum of available computer forensics tools, both hardware and software, and be able to use them to perform rudimentary investigations along with developing their own tools for special needs situations.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 644 | SECURE NETWORKS | 3 UNITS | CPIT 640 |
| COURSE DESCRIPTION | <p>This course provides students with knowledge to understand the basics of security in a networked world. It will provide students with the foundation needed to understand the problems of wired and wireless network security, perform a risk analysis to ascertain the threats and cost of an attack, and design and implement security strategies to effectively build a defense to minimize the effects of these attacks.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 645 | E-SECURITY | 3 UNITS | CPIT 640 |
| COURSE DESCRIPTION | <p>The course will focus on the technology, concepts, issues and principles that are important in the design and implementation of secure e- system. The course will examine technology for protecting such systems. It provides an in depth review of the theoretical and applied topics in e- security. Students satisfactorily completing the course will be able to formulate a security model for web environment and be able to evaluate the security models and risks of e-system. It focuses on concepts and methods associated with planning, designing, implementing, managing, and auditing security at all levels in an e-system.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 697 | SELECTED ADVANCE TOPICS ON INTERNET TECHNOLOGIES | 3 UNITS | CPIT 630 |
| COURSE DESCRIPTION | <p>Topics on current research and professional issues in internet technologies.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|--|---------|--------------|
| CPIT 692 | SELECTED ADVANCE TOPICS ON NETWORKS SECURITY | 3 UNITS | CPIT 640 |
| COURSE DESCRIPTION | <p>Topics on current research and professional issues in network security.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 694 | RESEARCH METHODS | 1 UNITS | CPIT 601 |
| COURSE DESCRIPTION | <p>In this course, students are introduced to: the Definition and Value of Research, Scientific Methods of Research and its Special Features, Classification of Research, How to select a topic for research? Theory and Research, Concepts, Variables and types of variables, Hypothesis Testing and Characteristics, Review of literature, Conducting a Systematic Literature Review, Theoretical Framework, Problem Definition and research Proposal, The Research Process, Ethical Issues in Research, Measurement of Concepts, Criteria for Good Measurement, Research Design, Survey research, Personal interviewing, Telephone interviewing, Intercept and interviews in malls and other high traffic areas.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 695 | SEMINAR | 2 UNITS | CPIT 694 |
| COURSE DESCRIPTION | <p>In this course, student will prepare the proposal of his/her M.Sc. thesis. The student will produce and defend their thesis outlines. The proposal will contain a more detailed description of intended research points, a detailed literature review and project plan. The student will be evaluated on their report, and viva.</p> | | |

| CODE | COURSE TITLE | CREDITS | PREREQUISITE |
|--------------------|---|---------|--------------|
| CPIT 699 | THESIS | 3 UNITS | CPIT 695 |
| COURSE DESCRIPTION | <p>The Thesis is the culmination of the Masters course by applying the knowledge gained and the study methods used, to make a detailed analysis of a particular topic in an IT related field. This will involve a survey of recent developments in the field, a critical analysis of these developments and a prognosis of future developments. As part of the thesis work student will also need to produce original contribution that has been verified using scientific reasoning such as prototyping or simulation.</p> | | |

11.1.4 Advising

Upon acceptance into a graduate program, each student is assigned to a Graduate Program Advisor (GPA) and an academic advisor within the department. The GPA is responsible for helping students with the technical processes of graduate students, such as deadlines, forms, and formal procedures. The GPA is responsible for ensuring that graduate programs and students adhere to the graduate studies policies and requirements. The academic advisor is responsible for monitoring students' progress while they are taking courses. The role of academic advisor transfers to a student's thesis advisor once the student and thesis advisor have signed form [AAG-12].

11.1.5 Plan of Study

In each student's first semester in consultation with the student's academic advisor, the student must complete and submit a plan of study containing all of the courses necessary to complete the student's degree. The plan of study must then be approved by the student's academic advisor and the Department Chairman. A student may alter this plan of study at any time with the approval of the student's academic advisor and the Department.

11.1.6 Course Registration Requirements

Saudi students are required to take at least 6 credit hours of courses per semester.

International students are required to take at least 9 credit hours of courses per semester.

No student may take more than 12 credit hours of courses per semester.

11.1.7 Seminar Attendance

Regularly throughout each semester various seminars are presented that expose graduate students to ideas and projects that might be in their interest. Some of these seminars, which are part of the FCIT Research Seminar Series, are presented by faculty from the university or visitors. Other seminars are presented by graduate students regarding their ongoing works, offering opportunities for research, collaboration, enhanced learning, and providing valuable feedback along with improvement of writing, analysis, and presentation skills. A week before each seminar, an announcement is sent to all faculty and students providing details regarding attendance of the seminar. A day before each seminar, a follow-up reminder is sent. Students are required to attend at least six seminars per semester.

11.1.8 End of Semester Report

At the end of each semester, each student's academic advisor prepares a report detailing the student's progress. Based on this report, the Department Council may issue an academic warning to the student indicating that the student has demonstrated a lack of commitment towards the student's studies and other academic duties. If improvement is not evident after two warnings have been issued, the Department Council may recommend that the Council of the Deanship of Graduate Studies dismiss the student. The best way to avoid these consequences is for the student to maintain regular contact with the student's academic advisor and uphold the student's GPA. It should be noted that the Department Council has the authority to dismiss any student failing to make sufficient progress towards a degree. FORM [AAG-11], FORM [AAG-15]

11.2 Thesis

11.2.1 Thesis Concept

After completing at least 50% of the required graduate courses with a cumulative GPA of at least a "B", each student should submit a thesis proposal concept to the department. If this proposal is approved, the Department Council will assign an advisor and possibly co-advisors. FORM [AAG-2]

11.2.2 Advisory Committee

Each student is guided by an Advisory Committee that provides guidance and oversight for the student's thesis work. While the purpose of this committee is fundamentally the same for master's students and doctoral students, the membership requirements differ. Once a student's Advisory Committee has been formed and approved by the Department, per the recommendation of the College Council these proceedings will be reported for approval by the Council of the Deanship of Graduate Studies.

For master's students:

- By the end of each student's second semester of graduate studies, the student must select a professor, associate professor, or assistant professor from the department to be the student's advisor and chair of the student's advisory committee. An assistant professor may only act as an advisor if the assistant professor has at least two years of experience within the university as an assistant professor and at least two journal papers published or accepted for publication within the assistant professor's field. FORM [AAG-12]
- A student may have a co-advisor. Under certain circumstances, a student may have a second co-advisor who may be from outside of the department. An assistant professor may only act as a co-advisor if the assistant professor has at least one year of experience within the

university as an assistant professor and at least one journal paper published or accepted for publication within the assistant professor's field.

- The advisor chooses additional committee members according to the student's thesis topic while ensuring adherence of the committee to the requirements that follow. FORM [AAG-6]
- The committee must have an odd number of members, not less than three, with the advisor and any co-advisors not constituting a majority.
- At least one committee member must be a professor or associate professor.
- At least one committee member must be from the department.
- At least one committee member must be from outside of the department. Retired faculty members are considered to be members of their former departments for this purpose.
- Decisions of the committee require a two-thirds majority.

For doctoral students:

- By the end of each student's second semester of graduate studies, the student must select a professor or associate professor from the department to be the student's advisor and chair of the student's advisory committee. FORM [AAG-12]
- A student may have a co-advisor. Under certain circumstances, a student may have a second co-advisor who may be from outside of the department.
- The advisor chooses additional committee members according to the student's thesis topic while ensuring adherence of the committee to the requirements that follow. FORM [AAG-6]
- The committee must have an odd number of members, not less than three, with the advisor and any co-advisors not constituting a majority.
- Every committee member must be a professor or associate professor.
- At least one committee member must be from the department.
- At least one committee member must be from outside of the university. Retired faculty members are considered to be members of their former departments for this purpose.
- Decisions of the committee require a two-thirds majority.

If at any time a student's advisor is unable to continue acting as the student's advisor, the Department shall suggest a replacement for approval by the College Council and the Council of the Deanship of Graduate Studies. A student with convincing reason(s) has the right to apply in writing for a replacement advisor to the head of his/her department for approval by the Department Council. A student's advisor with convincing reason(s) has the right to apply in writing to discontinue acting as the student's advisor to the head of his/her department for approval by the Department Council, but must continue service until a new advisor has been appointed. FORM [AAG-4] or FORM [AAG-7]

11.2.3 End of Semester Report

At the end of each semester, each student's advisor prepares a report detailing the student's progress. Based on this report, the Department Council may issue an academic warning to the student indicating that the student has demonstrated a lack of commitment towards the student's

studies and other academic duties. If improvement is not evident after two warnings have been issued, the Department Council may recommend that the Council of the Deanship of Graduate Studies dismiss the student. The best way to avoid these consequences is for the student to maintain regular contact with the student's advisor and make diligent progress towards completing the thesis. It should be noted that the Department Council has the authority to dismiss any student failing to make sufficient progress towards a degree. FORM [AAG-11], FORM [AAG-13], FORM [AAG-15]

11.2.4 Thesis Registration

Each student works with the student's advisor to submit a title for the thesis. Once this thesis title has been approved, the student will receive approval from the Deanship of Graduate Studies to register for thesis credit hours.

11.2.5 Thesis Proposal

Each student works with the student's advisor and Advisory Committee to prepare the formal thesis proposal. The purpose of this proposal is to ensure that the thesis has firm direction and the best chance of successfully being defended. The student's written and oral presentation should convince the Advisory Committee that the thesis is valid and progressing.

11.2.6 Thesis Seminar

Before a student can defend the thesis to the Department Council, the student must present a seminar to the department detailing the thesis with emphases on purpose, usefulness, importance, method of implementation, and contributions as they relate to the existing body of research.

11.2.7 Thesis Defense

Once a student's Advisory Committee has determined that the thesis is ready to be defended, the student's advisor reports the completed thesis to the Department for review. The reviewed thesis is then sent by the College to the Council of the Deanship of Graduate Studies for approval of the defense. The student must then fill out the appropriate Thesis Defense Form, providing the title of the thesis in Arabic and English, the names of the members of the Advisory Committee, and the intended date of the defense, which must be at least two weeks from the date of submission. The student should submit the completed and approved thesis to the advisory committee at least two weeks before the intended date of the defense. FORM [AAG-17]

After a student has attempted to defend the thesis, the members of the advisory committee prepare and sign a report that is submitted to the Department Chairman within one week of the defense attempt containing one of these four recommendations:

- Award degree upon approval of the thesis by the Deanship of Graduate Studies
- Award degree upon approval of the thesis by the Deanship of Graduate Studies once minor modifications have been approved by a delegated member of the advisory committee within three months with any extension of this time requiring approval by the University Board
- Thesis needs major modifications and another defense attempt within a period of time not to exceed a year to be recommended by the Department Council and approved by the Council of the Deanship of Graduate studies
- Reject thesis

Each advisory committee member has the right to submit a separate report with the member's own comments to the Department Chairman and the Dean of Graduate Studies within two weeks of the defense attempt.

11.3 PhD Courses

| List of Courses | | | | | | | |
|-----------------|----------------|------------|---------|-------|-------------|--|-------------|
|)Prerequisite(|)No. of Hours(| | | | Course type | Course Title | Course Code |
| | (Credits) |)Clinical(| English | (Th.) | | English | English |
| | 3 | | 2 | 2 | Core | Advanced Probability and Statistics | CPIT 701 |
| | 3 | | 2 | 2 | Core | Modeling and Simulation | CPIT 702 |
| | 3 | | 0 | 3 | Elective | Advanced Concepts and Structures in Internet Computing | CPIT 720 |
| | 3 | | 0 | 3 | Elective | Mobile Computing | CPIT 721 |
| | 3 | | 0 | 3 | Elective | Advanced Topics in Wireless Networks | CPIT 722 |
| | 3 | | 0 | 3 | Elective | Recent Advances in Cloud Computing | CPIT 723 |
| | 3 | | 2 | 2 | Elective | Wireless Sensor Networks | CPIT 724 |
| | 3 | | 0 | 3 | Elective | Recent Advances in Networking | CPIT 725 |
| | 3 | | 0 | 3 | Elective | Advanced Software Modeling and Development | CPIT 730 |
| | 3 | | 0 | 3 | Elective | Software Engineering for Distributed Systems | CPIT 731 |
| | 3 | | 0 | 3 | Elective | Verification and Testing | CPIT 732 |
| | 3 | | 0 | 3 | Elective | Software Engineering and Economic Theory | CPIT 733 |
| | 3 | | 0 | 3 | Elective | Recent Advances in Software Engineering | CPIT 734 |
| | 3 | | 2 | 2 | Elective | Advanced Database Management | CPIT 740 |
| | 3 | | 0 | 3 | Elective | Database Programming for the World Wide Web | CPIT 741 |
| | 3 | | 2 | 2 | Elective | Advanced Big Data Analytics | CPIT 742 |
| | 3 | | 2 | 2 | Elective | Advanced Data Mining and Data Warehousing | CPIT 743 |
| | 3 | | 2 | 2 | Elective | Web Search Engines and Recommender Systems | CPIT 744 |
| | 3 | | 0 | 3 | Elective | Recent Advances in Database Systems | CPIT 745 |
| | 3 | | 2 | 2 | Elective | Cryptography and Computer Network Security | CPIT 750 |

| | | | | | | | |
|--|----|--|---|----|-----------------|---|----------|
| | 3 | | 0 | 3 | Elective | Cloud Computing Security | CPIT 751 |
| | 3 | | 2 | 2 | Elective | Intrusion Detection | CPIT 752 |
| | 3 | | 0 | 3 | Elective | Mobile Forensics | CPIT 753 |
| | 3 | | 0 | 3 | Elective | Recent Advances in Information Security | CPIT 754 |
| | 3 | | 0 | 3 | Elective | Innovative Interactive Devices in HCI | CPIT 760 |
| | 3 | | 2 | 2 | Elective | Mixed Reality | CPIT 761 |
| | 3 | | 2 | 2 | Elective | Image Processing and Computer Vision | CPIT 762 |
| | 3 | | 0 | 3 | Elective | Usable Privacy and Security | CPIT 763 |
| | 3 | | 0 | 3 | Elective | Recent Advances in HCI | CPIT 764 |
| | 3 | | 2 | 2 | Elective | Artificial Intelligence Methods for IT | CPIT 770 |
| | 3 | | 2 | 2 | Elective | Advanced Computer Architecture | CPIT 771 |
| | 3 | | 2 | 2 | Elective | Advanced Embedded Systems | CPIT 772 |
| | 3 | | 0 | 3 | Elective | Selected Topics on Information Technology | CPIT 791 |
| | 21 | | 0 | 21 | Core | Thesis | CPIT 799 |

Courses Description

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 701 | Advanced Probability and Statistics | 3 | - |
| Description | <p>The course is intended to provide students with probability and statistics knowledge for research. Topics covered include: Probability theory, Probability Distributions (Discrete and Continuous), Convergence and limits, Kolmogorov Theorem, Central Limit Theorem, Martingales, Parametric theory and Nonparametric theory (Regression, Classification, Clustering), CART (Classification and Regression Trees), Correlation, Autocorrelation, Confidence Intervals, Graphical Models, Minimax Theory, Jackknife, Collinearity, Bootstrap, Time Series Methods, Markov Chains and Queueing theory.</p> <p>Lab/Practical Coverage: Standard datasets available online will be used and evaluated using parametric and nonparametric tests. Further, the data will be analyzed for correlation and other aspects.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 702 | Modeling and Simulation | 3 | - |
| Description | <p>The course is intended to provide student with a reasonable grounding in how to make use of modelling techniques in order to evaluate the dynamic behavior of real systems. Topics include: Discrete and Continuous Modelling, Sources and Propagation of Error, Graph or Network Transitions Based Simulations, Mesh Based Simulations, Performance evaluation methods, Markovian queueing models, Model verification and validation; Model output analysis, design of simulation experiments; Validation of Model Results.</p> <p>Lab/Practical Coverage: Implement simulation studies like Markovian models, queueing systems along with verification and validation of the proposed model.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 720 | Advanced Concepts and Structures in Internet Computing | 3 | - |
| Description | <p>In this course, students will be exposed to the latest and most exciting developments in the areas of Internet computing and advanced topics that have direct influences of its future structure such as Internet of Things (IoT) framework, Big Data concepts, future Social media architectures, Intelligent Agents, and Internet Computing with Distributed Components.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 721 | Mobile Computing | 3 | - |
| Description | <p>This course provides students with a deep understanding of techniques, mechanisms, protocols and overall network architectures for future Internet design. Special emphasis is given to mobility aspects of future Internet and current research trends and their case studies in the mobile internet computing area. It will focus on the underlying concepts and standards of mobile computing and current technologies for mobile and distributed systems. It discusses cellular networks, wireless networks and their standards and technologies, context-aware computing, location-awareness, wireless sensor networks, internet mobility, web services and service-oriented technology.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 722 | Advanced Topics in Wireless Networks | 3 | - |
| Description | <p>This course is an advanced research-oriented course designed for graduate students with computer wireless networks background. It will cover various topics relevant to a cutting-edge technology, namely, Wireless Ad Hoc Networks, which include Mobile Ad Hoc Networks (MANET), Wireless Sensor Networks (WSN) and Wireless Mesh Networks (WMN). Through this course, students can learn the state of art of wireless ad hoc networks research, and enhance their potential to do research in this exciting area. The material covered in the lectures is mainly derived from research papers published in top journals and conferences.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 723 | Recent Advances in Cloud Computing | 3 | - |
| Description | <p>This course will evaluate the recent achievements having fundamental importance in the field of cloud computing. The course will be divided into two phases. In the first phase, introductory discussions and recent research topics regarding cloud computing will be introduced to the students. In the second phase, every student should give research paper presentations after going through a thorough literature review, actively contribute to the overall discussions and finally ends up a term paper.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 724 | Wireless Sensor Networks | 3 | - |
| Description | <p>This course will cover a broad range of topics in the emerging field of wireless sensor networks. Topics include radio communication; networking protocols: transport layer protocols, routing protocols, medium access control protocols; energy management and applications: multimedia wireless sensor networks, underwater acoustic sensor networks and underground sensor networks.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 725 | Recent Advances in Networking | 3 | - |
| Description | <p>This course will familiarize the students with the most recent developments in computer networks. Major topic areas include data center networking, virtualization, VPN, software defined networking, cloud computing, advanced LAN/WLAN technologies (power over Ethernet, link aggregation, etc.), storage area network technologies, optical networking, IPv6 implementation and operation, multipath TCP, networks for mobile and wireless devices including different network types: ad hoc, cell phone, access point, sensor networks, etc.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 730 | Advanced Software Modeling and Development | 3 | - |
| Description | <p>In-depth study of modern software development concepts for requirements and software modelling and software development that promote reuse of software development artefacts. Such concepts include, Domain Specific Languages (DSL), Model Driven Development (MDD), Meta Object Facility (MOF), Object Constrain Language (OCL), Action Language for Foundational UML (ALF), Architecture patterns and Design Patterns and automated software testing.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 731 | Software Engineering for Distributed Systems | 3 | - |
| Description | <p>This course presents the state of art techniques and programming interfaces for distributed software engineering and its application on the World Wide Web. The course will present a detailed study of the methods and technologies for the production of web-based applications that excels in all areas of software quality and especially in the areas of security, reliability, usability, scalability and maintainability.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 732 | Verification and Testing | 3 | - |
| Description | <p>This course presents various research areas and its leading representatives, for verification and testing. The course is divided into two parts; the first part covers Empirical Software Engineering, model-based testing and search-based testing. The second part is focusing on verification and algorithms, and it covers modeling and verification, state-based refinement, concurrent refinement, Non-Turing computation and evolutionary algorithms.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 733 | Software Engineering and Economic Theory | 3 | - |
| Description | <p>Software Engineering Economics are about making decisions related to software engineering in a business context. Success of any software engineering project is partly dependent on effective business management. Software engineering economics provides a way to examine the attributes of software and software processes in a systematic way that relates them to economic measures. These can be weighted and analyzed when making decisions within the scope of a software engineering project and its organization. The essence of software engineering economics is aligning software technical decisions with the business goals of the organization. This course examines the key aspects of software engineering economics, including life cycle economics; risk and uncertainty; economic analysis methods and practical considerations, which tie concept and theory to contemporary software economic realities.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 734 | Recent Advances in Software Engineering | 3 | - |
| Description | <p>The course covers the current methods and practices for good design of software systems. Software design patterns, frameworks, architectures, and designing systems to apply these multi-level abstractions. Advanced topics in systems analysis and design; alternative methodologies such as agile development, extreme programming, Rational Unified Process; Unified Modeling Language; bench marking and best practices for systems development; cost/benefit analysis, estimation and budgeting for software systems; testing; patterns, domain-driven design; process modeling; service-oriented architecture and cloud computing.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 740 | Advanced Database Management | 3 | - |
| Description | <p>Studying advanced database languages and models, theory and design of databases, transaction processing, database recovery, concurrency control, distributed databases, database security and integrity. Discussion of recent developments in databases and research directions.</p> <p>Practical/Lab Coverage: The practical part will cover a number of advanced topics in big data, databases, and modern data-intensive systems and projects. The specific topics lab activities include:</p> <ul style="list-style-type: none"> • Applying and implementing the concurrency control techniques. • Implement the query processing and optimization strategies for relational database systems in different OS environments such as Linux, UNIX, Solaris 2, and Mac OS X. • Implementing the indexing methods, parallel and distributed database systems, map-reduce/hadoop, NoSQL, database-as-a-service (DB clouds). • Building the data mining models on large databases, data on the web. • Implementing an advance topics and strategies of database security and access control such as DAC, MAC, RBAC, and LBAC. | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 741 | Database Programming for the World Wide Web | 3 | - |
| Description | <p>Information systems accessible through web and Internet are becoming prevalent. This course focuses on technologies and industry standards for accessing and manipulating persistent data that are suitable for web applications. Topics include data storage; XML data specification, parsing and validation; data and language translation; networking and Web technology overview; software framework technology for controlling software system complexity; and a roadmap for the enterprise computing technologies.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 742 | Advanced Big Data Analytics | 3 | - |
| Description | <p>The course will introduce different ways of handling analytics algorithms on different platforms. Subsequently visualization issues and mobile issues on Big Data Analytics will be covered. Students will then have fundamental knowledge on Big Data Analytics to handle various real-world challenges. The course will zoom in to discuss large-scale machine learning methods that are foundations for artificial intelligence and cognitive networks. The course will discuss several methods to optimize the analytics based on different hardware platforms, such as Intel & Power chips, GPU, FPGA, etc. The lectures will conclude with introduction of the future challenges of Big Data, especially on the ongoing Linked Big Data issues that involves graphs, graphical models, spatio-temporal analysis, cognitive analytics, etc. Students will choose the topics of their own for a final project to apply what they learned in the class for their needs, either for the future work requirements or for the research problems at hand.</p> <p>Lab/Practical Coverage: Practical coverage will start with fundamental tools such as Hadoop, Spark and/or related tools. Further data management will be based on HDFS, HBase, KV stores, document database and graph database.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 743 | Advanced Data Mining and Data Warehousing | 3 | - |
| Description | <p>This course emphasizes advanced concepts and techniques for data mining and their application to large-scale data warehouse. This course covers advanced topics on data mining; mining patterns from temporal data, semi-supervised learning, active learning and boosting. In addition to computational aspects of algorithm implementation, the course will also cover architecture and implementation of data warehouse, data pre-processing (including data cleansing), and the choice of mining algorithms for applications.</p> <p>Lab/Practical Coverage:</p> <ol style="list-style-type: none"> 1. Design and implement a data warehouse database (4 weeks) 2. Explore Extraction, Transformation, Loading tasks in data warehousing (1 week) 3. Explore data mining algorithms implementation (3 weeks) 4. Design and implement data mining application (3 weeks) <p>Use data mining tools (4 weeks).</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 744 | Web Search Engines and Recommender Systems | 3 | - |
| Description | <p>Study of Web-based search engines and recommender systems. Topics include traditional information retrieval methods, Boolean retrieval systems, ranking-based retrieval systems, search engine performance metrics, Web crawling/bots, link analysis, anatomy of a search engine, fundamentals of classification-based recommender systems, learning user information interests, object properties, and case studies.</p> <p>Lab/Practical Coverage: Standard data collections will be used to analyze for various aspects discussed in the lecture. Retrievals obtained using various techniques will be tested for precision, recall, etc.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 745 | Recent Advances in Database Systems | 3 | - |
| Description | <p>Identification of the association between traditional relational databases and other query languages and/or data models. Formal handling of de-normalization and normalization, advanced query processing techniques and optimization, advanced data modeling, physical database design and indexing, XML databases and query engines, and object-oriented database systems. Management of spatiotemporal data, including index structures and continuously streaming and sensor-based data.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 750 | Cryptography and Computer Network Security | 3 | - |
| Description | <p>Topics include need for security services in computer networks, basic concepts of cryptology, modern symmetric ciphers, public key cryptography (RSA, ElGamal, Elliptic Curve Cryptosystems), efficient hardware and software implementations of cryptographic primitives, requirements for implementation of cryptographic modules, side-channel attacks, data integrity and authentication, digital signature schemes, key exchange and key management, quantum key distribution, the web and electronic payments, security aspects of mobile communications, zero-knowledge identification schemes, and smart cards.</p> <p>Lab/Practical Coverage: This lab includes programming assignments to implement and test several cryptographic algorithms. The suggested algorithms are AES for symmetric encryption, and either RSA or ECC for asymmetric encryption. SHA-2 is suggested for implementing a digital signature scheme. The asymmetric algorithms should use large numbers to provide an acceptable security level.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 751 | Cloud Computing Security | 3 | - |
| Description | <p>This course provides students with the state-of-the-art on cloud security issues, the common threats and associated risks to clouds and the known attacks and their countermeasures. Challenges on privacy and reliability in cloud computing security will be presented. This includes personal data privacy and security, trust properties of cloud computing, reliability of the cloud computing network, service delivery models (IaaS, PaaS, and SaaS), and the key factors affecting the security risks. The latest research in cloud computing security will be reviewed, and students will discuss open research problems related to the security in the cloud.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 752 | Intrusion Detection | 3 | - |
| Description | <p>The course explores the use of intrusion detection systems (IDS) as a security tool. It presents different intrusions affecting availability, confidentiality and integrity of computing resources. A variety of methodologies will be presented including signature-based and anomaly-based intrusion detection systems. Additionally, many detection approaches are reviewed and compared including Statistics-based, Pattern-based, Rule-based, State-based and Heuristic-based IDS. The course examines existing types of IDS technologies such as Host-based IDS, Network-based IDS, Wireless-based IDS, and cloud-based IDS. Students will do IDS projects using a popular and open source tool (Snort).</p> <p>Lab/Practical coverage: Students should select a tool that facilitates using several classification algorithms to implement an anomaly-based IDS prototype. Standard datasets are available for training and testing the developed prototype. For real-time testing, students should use attacking tools against isolated systems such as personal computers and/or local area networks to evaluate the effectiveness of the developed prototype.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 753 | Mobile Forensics | 3 | - |
| Description | <p>This course provides students with solid understanding on how the popular Mobile OSs is hardened to defend against common attacks and exploits. It covers advanced topics of today's Mobile Forensics that experts require such as file system structure and recovery procedure, data carving techniques on data in physical memory, the intricacies of manual acquisition (physical vs. logical) and advanced analysis using reverse engineering.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 754 | Recent Advances in Information Security | 3 | - |
| Description | <p>This course will familiarize the students with the most recent developments in information security. Major topic areas include biometrics security, big data security, network security, data center security and software security. This includes looking at issues of physical security, Internet of Things security and management. Additionally, the course covers recent advances of today's penetration testing, formal verification of systems, distributed system authentication, continuous authentication, protocol design and attack, computer viruses and malware.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 760 | Innovative Interactive Devices in HCI | 3 | - |
| Description | <p>This course will cover new techniques and technologies for creating high quality user interfaces. It will consider current work in this area, emphasizing readings from the research literature as well as practical projects involving the implementation of new concepts in user interface software or other technology. Typical topics to be covered might include: advanced interaction techniques, ubiquitous computing, tangible interfaces, mobile and wearable computing, web-based interaction, information visualization, virtual and augmented reality, new input devices, audio, speech, and other new interaction modalities.</p> <p>Students should create multiple concepts of integrated technologies to produce innovative service and assess their technical feasibility, financial viability, and desirability. Then they choose a single service idea and produce a plan with a business model and a video sketch suitable for posting on a crowd funding site.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 761 | Mixed Reality | 3 | - |
| Description | <p>This course covers the recent and future trends in the areas of Virtual and Augmented Reality including the developments at both theoretical and practical levels. The course is divided into three parts. The first part focuses on the elements of design and development of mixed reality virtual worlds as well as introducing the latest tools used in this area. The second part focuses on the human interaction with the virtual worlds including sensors and feedback devices. The last part covers case studies and cutting edge research work in the area.</p> <p>Lab/Practical Coverage: During the lab sessions, students will be introduced to the latest technologies used in the area of mixed reality including the latest input devices (such as controllers and other sensors) and output devices (helmets, haptics feedback, etc.). The students will develop applications that utilize these technologies using the most popular game engines and design software/hardware solutions that enhance the experience of mixed reality.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 762 | Image Processing and Computer Vision | 3 | - |
| Description | <p>This course is intended to provide to the students the capability of analyzing images of different types (medical, fingerprint, satellite image, compressed images, encrypted/watermarked images, etc.) apply some transformations, extract needed information, locate objects of interest in an image and analyze the objects motions in a video. Students will deal with some concrete examples such as detecting a pathological region in a medical image, recognize a fingerprint, identify some objects of interest in satellite images, use of some techniques allowing the compression of an image, encrypt an image using cryptographic algorithms and use some techniques for image watermarking. Students will be familiar with different problems in the image processing field that facilitate them their contribution in this area during their research projects.</p> <p>Lab/Practical Coverage: For the purpose of a good assimilation of the theoretical notions and a concrete exploration of the image processing problems, lab activities using the MATLAB language will be conducted and will cover the content seen during the course: filtering and image enhancement techniques, segmentation and image processing in the frequency domain.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 763 | Usable Privacy and Security | 3 | - |
| Description | <p>There is growing recognition that technology alone will not provide all of the solutions to security and privacy problems. Human factors play an important role in these areas, and it is important for security and privacy experts to have an understanding of how people will interact with the systems they develop. This course will introduce the students to secure interaction design, trust and semantic attacks, privacy design, making the privacy visible, web browser privacy and security, authentication and alternatives to text passwords, and usable security. Additionally, students will be exposed to a variety of usability and user interface problems related to privacy and security to give them experience in designing and enhancing the security and privacy in the interactive models.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 764 | Recent Advances in HCI | 3 | - |
| Description | <p>This course presents the advanced topics and practices of Human Computer Interaction (HCI), which include: Conceptualizing and modeling interaction; Cognitive aspects of interaction; Interaction design opportunities and weaknesses, Prototyping, and construction; and Evaluation frameworks.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 770 | Artificial Intelligence Methods for IT | 3 | - |
| Description | <p>This course is meant to teach the practical side of machine learning for applications, such as mining newsgroup data or building adaptive user interfaces. The emphasis will be on learning the process of applying machine learning effectively to a variety of problems rather than emphasizing an understanding of the theory behind what makes machine learning work.</p> <p>Lab/Practical Coverage: The course is intended to be lab intensive in the sense that each of the techniques considered will be followed by exercises and labs using appropriate software tools. Topics include decision trees, decision rules, Bayesian learning and related topics, clustering, association rules and instance based learning, rough set techniques, reinforcement learning, data mining techniques, WEKA and ROSETTA machine learning tools, plus more.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 771 | Advanced Computer Architecture | 3 | - |
| Description | <p>The course presents the essence of computer design and instruction set architecture. Presents techniques for pipeline and vector processors. It demonstrates memory hierarchy and I/O subsystem and explores the hardware and software associated with high-performance computing. The course will allow students to practice programming for HPC using parallel and vector algorithms.</p> <p>Lab/Practical coverage The lab of the course will explore parallel programming and synchronization of the multicore system; also, multicomputer programming to explore the basics of the message-passing programming paradigm. Vector computer programming and understanding of pipelining using WinDLX simulator.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|---|----------------|----------------------|
| CPIT 772 | Advanced Embedded Systems | 3 | - |
| Description | <p>The course aims to provide the concept of embedded system programming. In addition, it provides embedded systems developers the necessary skills to develop complex embedded systems and enables them to improve their designs by using the tools available. Interfacing to external memory and sensors as well as keyboard and LCD. Introducing the interrupt based programming. The course will present the cutting edge of the hardware technology in the field and available tools.</p> <p>Lab/Practical coverage: Exploring one of microcontroller and practice its programming and interfacing with peripheral devices and sensors, and embed it in building applications. Programming PLD and PLA for different purposes. Learning FPGA and Verilog, and embed FPGA in implementing solution for different applications. Exploring the new trends of technologies for embedded system devices.</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 791 | Selected Topics on Information Technology | 3 | - |
| Description | <p>This course provides the required background to important theoretical and applied issues in information technology. It aims to deepen the candidate's grasp of the theories, techniques and methods commonly employed in a certain emerging area of information technology. It is possible that we have many sections with different titles and contents and may have one single student (if situation mandates).</p> | | |

| <i>Course Code</i> | <i>Course Title</i> | <i>Credits</i> | <i>Prerequisites</i> |
|--------------------|--|----------------|----------------------|
| CPIT 799 | Thesis | 3 | - |
| Description | <p>A thesis/dissertation is a requirement for all Doctor of Philosophy (Ph.D.) students. It is considered as primary evidence of the student's capacity for research, independent thought and of his/her ability to write professionally in the language of instruction.</p> | | |

11.4 Master of Science Program Specific Requirements

11.4.1 Time Limits for Degree Completion

Each student must complete the degree in no fewer than four semesters and no more than eight semesters from the time the student first enrolls in graduate courses.

11.3.1 Degree Requirements by Department

In order to be conferred a Master of Science degree by the Department of Information Technology, a student must:

1. Complete 25 course credit hours
2. Complete 8 thesis credit hours
3. Attend at least 6 seminars per semester
4. Maintain a GPA of at least 3.75
5. Publish at least one journal paper
6. Present a thesis seminar
7. Successfully defend a thesis
8. Submit an approved thesis

11.4 Doctor of Philosophy Program Specific Requirements

11.4.1 Time Limits for Degree Completion

Each student must complete the degree in no fewer than six semesters and no more than ten semesters from the time the student first enrolls in graduate courses.

11.4.2 Comprehensive Examinations

Each student must pass comprehensive written and oral examinations after the completion of all required coursework before beginning the thesis. The Department Council establishes the courses required for examination and an examination committee consisting of an odd number of members. The faculty reports examination results to the Deanship of Graduate Studies within two weeks.

Comprehensive Written Examination

Each student should take the written examination during the semester after the student has finished the required courses, but not more than three semesters from the student's first enrollment in graduate courses. A student can postpone taking the written examination for one semester with the approval of the Department Council. A passing score for the written examination is a 70%. If a student fails to pass the written examination, the student may be granted another chance to take the written examination during the next semester. If the student again fails to pass the written examination, the Department Council and College Dean will recommend dismissal of the student for approval by the Council of the Deanship of Graduate Studies.

Comprehensive Oral Examination

After passing the written examination, each student should attend an oral examination at a time decided upon by the examination committee, which shall be no later than the next semester. A passing score for the oral examination is a 70% from each member of the examination committee. If a student fails to pass the oral examination, the student may be granted another chance to take the oral examination no later than the next semester. If the student again fails to pass the oral examination, the Department Council and College Dean will recommend dismissal of the student for approval by the Council of the Deanship of Graduate Studies.

11.4.3 Degree Requirements by Department

In order to be conferred a Doctoral of Philosophy degree by the Department of Information Technology, a student must:

1. Complete 18 course credit hours
2. Complete 21 thesis credit hours
3. Attend at least 6 seminars per semester
4. Maintain a GPA of at least 3.75
5. Pass comprehensive examinations
6. Publish at least two journal papers
7. Present a thesis seminar
8. Successfully defend a thesis
9. Submit an approved thesis

11.4.4 PhD Comprehensive Exam

11.4.5 Part I: Written Exam

- The written exam is an open book exam.
- The written exam consists of two paper exams
- The first exam paper related to core courses (701 & 702)
- The second paper exam related to elective area (Selected by student)
- The first paper exam 50%
- The second paper exam 50%
- The Exam will be conducted in two separate days.
- The Duration of each exam paper is 2 hours
- The exam is scheduled in 2nd week of First semester (Fall Semester).
- The written exam pass mark 70%

The Written Exam Content

- Core Exam Paper: the core exam paper will be prepared based of the following table:

| General Information |
|---|
| Exam Title (Core / Interested Area): Core |
| PhD courses relevant to the exam: <ul style="list-style-type: none">• CPIT-701: Advanced Probability and Statistics (25 Marks)• CPIT-702: Modelling and Simulation (25 Marks) |
| Relevant study materials or resources: <ol style="list-style-type: none">1. Probability and Statistics: The Science of Uncertainty. Michael J. Evans and Jeffrey S. Rosenthal2. Probability and Statistics for Engineering and the Sciences. Jay L. Devore3. Banks, J., Carson, J. S., & Nelson, B. L. (2014). Discrete-event system simulation. 5th Edition. Upper Saddle River, N.J: Prentice Hall.4. R. Jain, "Art of Computer Systems Performance Analysis," Wiley, 1991, ISBN:0471503363 |

| Core Exam Topics with Rubric (Total 50 Marks) | | | | |
|--|---|------------------------------|--------------|--------------------|
| Topic | Sub-topic | Question Type | Marks | Course Name |
| Probability Models | <ul style="list-style-type: none"> • Measure of Uncertainty • Probability Models • Properties of Probability Models • Conditional Probability and Independence • Uniform Probability on Finite Spaces • Continuity of P | Scenario and Technical based | 5 Marks | CPIT-701 |
| Discrete Random Variables and Probability Distribution | <ul style="list-style-type: none"> • Random Variables • Distribution of Random Variables • Discrete Distributions • Cumulative Distribution Function • Joint Distributions • Conditioning and Independence | Scenario and Technical based | 10 Marks | CPIT-701 |
| Continuous Random Variables and Probability Distribution | <ul style="list-style-type: none"> • Continuous Distributions • Cumulative Distribution function • Joint Density functions • Conditioning | Scenario and Technical based | 10 Marks | CPIT-701 |

| | | | | |
|----------------------------------|---|------------------------------|---|--------------------------|
| General Principles of Simulation | <ul style="list-style-type: none"> • Concepts in Discrete Event Simulation • The Event Scheduling/Time Advanced Algorithm • Manual Simulation using Event Scheduling | Technical and Scenario based | 7 | Modelling and Simulation |
| Random Number Generation | <ul style="list-style-type: none"> • Desired Properties of a good generator • Linear-congruential generators | Technical and Scenario based | 9 | |

| | | | | |
|-----------------|---|------------------------------|---|--|
| and Testing | <ul style="list-style-type: none"> • Combined Generators • Seed Selection • Testing Random Number Generators <ul style="list-style-type: none"> ○ Kolmogorov-Smirnov Test ○ Chi-Square Test ○ Test for Auto Correlation | | | |
| Queueing Theory | <ul style="list-style-type: none"> • Characteristics of Queueing Systems <ul style="list-style-type: none"> ○ The Calling Population; System Capacity ○ The Arrival Process ○ Queue Behavior and Queue Discipline ○ Service Times and the Service Mechanism • Queueing Notation • Analysis of a Single Queue <ul style="list-style-type: none"> ○ Birth-Death Processes ○ M/M/1 and M/M/m Queues ○ M/M/m/B with finite buffers • Queueing Networks <ul style="list-style-type: none"> ○ Open and close queueing networks ○ Product form networks • Long-Run Measures of Performance of Queueing Systems <ul style="list-style-type: none"> ○ Time-Average Number in System L ○ Average Time Spent in System Per Customer w ○ The Conservation Equation ○ Server Utilization ○ Costs in Queueing Problems • Steady-State Behavior of Infinite-Population Markovian Models <ul style="list-style-type: none"> ○ Single-Server Queues with Poisson Arrivals and Unlimited Capacity ○ Multi-server Queue | Technical and Scenario based | 9 | |

| | | | | |
|--|---|--|--|--|
| | <ul style="list-style-type: none"> ○ Multi-server Queues with Poisson Arrivals and Limited Capacity ● Steady-State Behavior of Finite-Population Models ● Networks of Queues | | | |
|--|---|--|--|--|

- Elective Area Exam Paper: One of the following elective area is selected by a student. Each elective area exam content will be based on the following tables:

| Data Science Exam |
|---|
| Exam Title (Core / Interested Area): Elective Area: Data science |
| <p>PhD courses relevant to the exam: the student can select 2 courses from the following</p> <ul style="list-style-type: none"> ● CPIT-742: Advanced Big Data Analytics ● CPIT-743: Advanced Data Mining and Data Warehousing ● CPIT-770: Artificial Intelligence Methods for IT |
| <p>Relevant study materials or resources:</p> <ol style="list-style-type: none"> 3. Tom White: Hadoop: The Definitive Guide, 4th Edition, 2015 4. Sandy Ryza, Uri Laserson, Josh Wills, Sean Owen: Advanced Analytics with Spark Patterns for Learning from Data at Scale (2015) 5. Jiawei, Micheline Kamber, and Jian Pei: Data mining concepts and techniques, 3rd edition (2012) 6. Russell, S. J., & Norvig, P. (2016). Artificial intelligence: a modern approach. Malaysia; Pearson Education Limited. |
| <p>Grade Distribution: 50% in total. Students have the choice to choose ANY TWO out of the below. 25 Marks from CPIT-742 25 Marks from CPIT-743 25 Marks from CPIT-770</p> |

| Data science Exam Topics with Rubric | | | | |
|---|--|------------------------------|--------------|--------------------|
| Topic | Sub-topic | Question Type | Marks | Course Name |
| Big data | <ul style="list-style-type: none"> • Big data challenges and advantages • Big data use cases • Nosql database | Technical and Scenario based | 5 Marks | CPIT-742 |
| Big data infrastructures | <ul style="list-style-type: none"> • Hadoop Architecture • Hadoop MapReduce • Hadoop limitations • Spark Architecture • Spark data structures (RDD, data frame, dataset), advantages and limitations | Technical and Scenario based | 10 Marks | CPIT-742 |
| Prediction and visualization | <ul style="list-style-type: none"> • Big data visualization methods and tools (e.g., python pyplot, tableau, etc.) | Technical and scenario based | 10 Marks | CPIT-742 |
| Artificial intelligence | <ul style="list-style-type: none"> • Intelligent agents • Solving Problems by Searching • Constraint Satisfaction Problems • Knowledge Engineering • Interference Engine • Case Based Reasoning • Artificial Neural Networks | Scenario and Technical based | 25 Marks | CPIT-770 |
| Data mining and data warehousing | <ul style="list-style-type: none"> • Data warehouse architecture • KDD process • Data cube vs 2D tables • Machine learning and deep learning • Association rules • Classification • Recommender systems • Clustering | Scenario and Technical based | 25 Marks | CPIT-743 |

| Security |
|--|
| Exam Title (Interested Area): Security |
| PhD courses relevant to the exam: <ul style="list-style-type: none">• CPIT-750: Cryptography and Computer Network Security• CPIT-751: Cloud Computing Security• CPIT-752: Intrusion Detection• CPIT-754: Recent Advances in Information Security |
| Relevant study materials or resources: <ol style="list-style-type: none">7. Cryptography and Network Security: Principles and Practice, William Stallings, 7th Edition8. Others: Related Books/Internet resources/Relevant research publications |
| Grade Distribution: 50% <ul style="list-style-type: none">• Fundamental challenges in information security (5)• Cryptography and Network Security (30)• Cloud Security (15) |

| Security Exam Topics with Rubric | | | | |
|--|---|------------------------------|--------------|---|
| Topic | Sub-topic | Question Type | Marks | Course Name |
| Fundamental challenges in information security | <ul style="list-style-type: none"> • CIA-confidentiality, integrity, and availability • Authentication and authorization | Technical / direct/ scenario | 5 Marks | Undergraduate level knowledge of security |
| Cryptography | <ul style="list-style-type: none"> • Basic concepts of cryptology • Modern symmetric ciphers (Stream Ciphers, Block Ciphers etc) • Public key cryptography (RSA, ElGamal, Elliptic Curve Cryptosystems etc) • Digital signature schemes • Hash and MAC | Technical / direct/ scenario | 15 Marks | |
| Network Security | <ul style="list-style-type: none"> • Security threats • Key exchange and key management • Zero-knowledge identification schemes • Wireless Network Security: Security aspects of mobile communications • The web and electronic payments | Technical / direct/ scenario | 15 Marks | |
| Cloud Security | <ul style="list-style-type: none"> • Personal data privacy and security • Trust properties of cloud computing • Reliability of the cloud computing network • Service delivery models (IaaS, PaaS, | Technical / direct/ scenario | 15 Marks | |

| | | | | |
|--|--|--|--|--|
| | <p>SaaS), and factors affecting the security risks.</p> <ul style="list-style-type: none"> • Control over security in the cloud model | | | |
|--|--|--|--|--|

| Networks |
|---|
| Exam Title (Core / Interested Area): Networks |
| <p>PhD courses relevant to the exam:</p> <ul style="list-style-type: none"> • CPIT-722: Advanced Topics in Wireless Networks • CPIT-724: Wireless Sensor Networks |
| <p>Relevant study materials or resources:</p> <ol style="list-style-type: none"> 1. A Complete Guide to Wireless Sensor Networks From Inception to Current Trends, Ankur Dumka, Sandip K. Chaurasiya, Arindam Biswas, and Hardwari Lal Mandoria, CRC, ISBN: 978-1-138-57828-9. 2019 2. Wireless Communications and Networks, William Stallings, Second Edition |
| <p>Grade Distribution:</p> <p>Networks:</p> <p>25 Marks from 722</p> <p>25 Marks from 724</p> |

| Networks Exam Topics with Rubric | | | | |
|---|--|----------------------|--------------|--------------------|
| Topic | Sub-topic | Question Type | Marks | Course Name |
| Ch1- An Introduction to Wireless Sensor Networks | | Scenario based | 5 Marks | CPIT-724 |
| Ch3- Quality of Service-Sensitive MAC Protocols in Wireless Sensor Networks | | Technical / direct | 6 Marks | CPIT-724 |
| Ch5- Routing Schemes in Wireless Sensor Networks | | Technical / direct | 7 Marks | CPIT-724 |
| Ch7-Clustering in Wireless Sensor Networks | | Technical / direct | 7 Marks | CPIT-724 |
| Ch2: Transmission Fundamentals | SIGNALS FOR CONVEYING INFORMATION ANALOG AND DIGITAL DATA TRANSMISSION CHANNEL CAPACITY | Technical / direct | 5 Marks | CPIT 722 |
| Ch5: Antennas and Propagation | Antennas Propagation Modes Line-of-Sight Transmission Fading in the Mobile Environment | Technical / direct | 5 Marks | CPIT 722 |
| Ch6: SIGNAL ENCODING TECHNIQUES | Digital Data, Analog Signals Analog Data, Analog Signals Analog Data, Digital Signals | Technical / direct | 5 Marks | CPIT 722 |
| Ch7: Spread Spectrum | The Concept of Spread Spectrum Frequency Hopping Spread Spectrum Direct Sequence Spread Spectrum Code Division Multiple Access | Technical / direct | 5 Marks | CPIT 722 |

| | | | | |
|--|-----------------------------------|--|--|--|
| | Generation of Spreading Sequences | | | |
|--|-----------------------------------|--|--|--|

11.4.6 Part II: Oral Exam

- The oral exam should be related to one of IT topics
- The oral exam consists of two parts (Survey Report & Presentation)
- The survey report consists of at least 20 recent references that are related to the selected topic.
- The report should be with minimum number of 15 pages in IEEE format. IEEE sample format is attached.
- A student should deliver a presentation related to the survey report.
- The evaluation of the of the survey report and the presentation will be done based on evaluation forms attached with this document.

| Form Code | Form Title | اسم النموذج |
|-----------|---|---|
| AAG-1 | Additional Attempt to Graduate | فرصة إضافية للتخرج |
| AAG-2 | Approval of Thesis Concept and Advisor Assignment | إقرار موضوع الرسالة وتعيين مشرف |
| AAG-3 | Changing Majors | تغيير تخصص الطالب |
| AAG-4 | Changing Advisors | تعديل مشرف أو لجنة اشراف |
| AAG-5 | Withdrawing from a Semester | حذف الفصل الدراسي) الاعتذار عن الدراسة) |
| AAG-6 | Forming Advisory Committee | تشكيل لجنة مناقشة |
| AAG-7 | Modifying Advisory Committee | تعديل لجنة مناقشة |
| AAG-8 | Postponing Studies | تأجيل الدراسة |
| AAG-9 | Postponing Admission | تأجيل القبول |
| AAG-10 | Modifying Thesis Title | تعديل عنوان الرسالة العلمية |
| AAG-11 | Student Progress Report | تقرير نهاية الفصل الدراسي |
| AAG-12 | Student Responsibility | مسؤولية الطالب |
| AAG-13 | Student Performance Evaluation | تقييم أداء الطالب في الرسالة |
| AAG-14 | Discrepancy Report | تقرير التناقض |
| AAG-15 | Student Commitment | التزام الطالب |
| AAG-16 | Meeting Minutes | محضر الاجتماع |
| AAG-17 | Student Seminar Schedule | تحديد موعد سيمينار |