

INFORMATION COMM & TECH (ICT)

ICT 601 Research Methods and Ethics 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

This course is a foundational course for graduate students who will be engaged in research. It provides students with an introduction to ethics and ethical misconduct, intellectual property and environmental health and safety as well as scientific thought and design of experiments. A focus of the course is to transition students from textbooks to primary literature as their main source of information.

ICT 615 AI for Social Media and Multimedia Applications 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

This course covers fundamental and novel artificial intelligence (AI) technologies for social media and multimedia applications. The students will read and present selected references about AI for social and multimedia computing, and learn the hands-on skills to implement or modify existing AI algorithms. Beside these technical understanding of involved AI technologies, the students will propose and implement creative social media or multimedia applications using AI technologies. The student will complete assignments, class-activities and projects individually or in groups

ICT 620 Computer Graphics 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

This course is at the core of visual computing. It provides an overview over the fundamentals of computer graphics such as digital representations for 3D models, GPU-accelerated OpenGL, rasterization, ray-tracing, shading, lighting, texturing, etc. Selected advanced and hot topics will also be covered. The course will be complemented by practical assignments using WebGL, running in any modern web browser and providing students with immediate visual feedback.

ICT 621 Visual Computing 3 Credits

Grade Mode: Standard Letter

This course introduces students to the field of visual computing, including visualization, computer vision, virtual reality, and 3D deep learning. It emphasizes practical skills in creating visual applications and analyzing visual data, with hands-on projects using WebGL, Python, and AI-based toolkits. The course is ideal for students in data science and ICT-related fields who want to gain fluency in modern visual intelligence technologies.

ICT 632 Advanced Applications of the Web and Internet 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

This course covers advanced techniques for building and maintaining practical applications of the Web and Internet. Main topics include web services, search engines, mobile web, practical aspects of the backbone techniques of the web, solutions for dealing with the rapidly growing and evolving web, and algorithms for handling the uncertainties in web data. The course will also cover selected topics of the state-of-the-art applications of the web techniques. The course is interdisciplinary in nature and has a wide breadth.

ICT 660 Principles of Health Informatics 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

The objective of this graduate level course is to provide data science students with an overview of the Health Informatics domain and introduce them to major concepts, areas, and ideas evolving within the discipline of Health Informatics. Key challenges and opportunities for the health data scientist will be highlighted. Students will gain insights and develop a solid base in understanding, analyzing and evaluating health information systems to support data science research and projects.

ICT 665 Artificial Intelligence and Machine Learning in Healthcare 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

This course covers both mathematical concepts and tools related to artificial intelligence (AI), with their application in real-world healthcare problems. Topics will cover concepts on uncertainty, searching algorithms, classification techniques, clustering techniques and application of AI in solving different healthcare related problems. This course will concentrate on building machine learning models to solve different open research problems in the field of genomics, bioinformatics, cheminformatics, drug discovery, healthcare etc.

ICT 666 Computational Bioinformatics 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

The aim of this course is to introduce the fundamental of bioinformatics algorithms and different bioinformatics methods for health management and life science students and researchers. It aims to give an overview of genomic and epidemiologic questions and to communicate the statistical and computational ideas behind the key analysis methods in these fields. This course does not assume that the student has a background in molecular biology, but rather introduces both the biological and mathematical concepts.

ICT 668 Medical Image Processing 3 Credits

Grade Mode: Standard Letter, Audit/Non Audit

The first part of this course introduces medical imaging, with a focus on magnetic resonance imaging, x-ray computer tomography, ultrasound, and nuclear medicine. The second half of the course introduces students to basic concepts in digital image and signal processing. After an introduction to the area of image processing and a brief mathematical review, we will cover the fundamental techniques of image processing, including image enhancement in spatial and frequency domains, image restoration, image segmentation, image description, and mathematical morphology.

ICT 670 Information Technology Project Management 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

The course addresses the growing need for better management of information technology projects. It covers the key elements of the project management framework, including project stakeholders, the project management knowledge areas, common tools and techniques, and project success. It covers planning methods and techniques required for defining, planning, integrating and implementing information technology projects consistent with the organizational strategic plan and mission. On successful completion of the course, students will have a good understand of the relationship between project, program, and portfolio management and the contributions they each make to enterprise success. They should be able to explain what a project is, provide examples of information technology projects, list various attributes of projects, and describe the triple constraint of projects.

ICT 671 Information Systems Management 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

The course focuses on issues managers face in the selection, procurement, use, and management of information technology assets. It presents a detailed study of the issues, principles, techniques and best practices in managing information systems and enterprise knowledge as organizational resources. Topics include IT operations, information technology and strategy, information technology and organization, assets management, performance evaluation and benchmarking, hardware and software acquisition, physical environments and security issues, outsourcing and partnerships.

ICT 675 Healthcare Information Systems 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

The course provides the basic foundations and tools needed to understand, manage, and evaluate information systems effectively within a healthcare environment. The course will review health information system related regulations and standards and explore relevant issues pertaining to middle and senior level management working within the health care information system domain.

ICT 676 Information Systems Analysis and Design 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

The course develops comprehensive theoretical knowledge as well as practical skills related to the development process of information systems. This course deals with the concepts, skills, methodologies, techniques, tools, and perspectives essential for systems analysts. Upon successful completion of the course, students should be able to gather data, analyze and specify the requirements of a system, design system components and environments, build general and detailed models that assist in implementation and validation of the system and its compliance to the requirements, preferences and constraints of its social and organizational environment.

ICT 690 Special Topics 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

Special topics in ICT allow students to examine a variety of timely, cutting-edge areas in ICT. Taught by our faculty research scientists from our research institutes or industrials, this course allows students to keep up with critical trends and topics in the field.

ICT 695 Master's Thesis Hours 1-6 Credits
Grade Mode: Pass/Non Pass

ICT 698 Industrial/ Project 1-6 Credits
Grade Mode: Standard Letter, Pass/Non Pass

ICT 701 Graduate Research Seminars 0 Credits
Grade Mode: Standard Letter, Pass/Non Pass

Research seminar to be presented by invited speakers as well as students. Satisfactory attendance and presentations lead to the grade Pass.

ICT 705 Applied Data Analytics 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

This course covers cutting-edge algorithms and software tools for data analysis, including the analysis of various types of data such as time series, texts and images. Main topics include data visualization, advanced regression and classification solutions, advanced data reduction techniques such as dimensionality reduction and kernel PCA, as well as application-specific tools and methods. In addition, the course also introduces common software tools and libraries which can be used as building blocks for designing and developing novel data analysis applications.

ICT 706 Independent Studies 3 Credits
Grade Mode: Standard Letter

Independent studies offers an opportunity for students to perform independent research work in any area related to Computer Science and Engineering under the supervision of a faculty member.

ICT 716 Data Science Tools and Applications 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

The course objectives are to equip the graduate students with intermediate-level concepts and tools of data science, their properties, and their applications to practical problems. Furthermore, knowledge of how to apply these data science concepts and tools to solve real-world problems in health, engineering, finance, transportation and energy will be important objectives.

ICT 717 Computer Vision 3 Credits
Grade Mode: Standard Letter

This course introduces students to the fundamental concepts, algorithms, and applications of computer vision. Students will learn how computers can be trained to interpret and understand visual data from the world. The course covers classic vision topics such as image filtering, feature detection, and stereo vision, as well as modern topics including deep learning for vision tasks. Emphasis will be placed on practical implementation, algorithmic understanding, and the design of end-to-end vision systems.

ICT 718 GenAI - Generative AI Foundations 3 Credits
Grade Mode: Standard Letter, Audit/Non Audit

This course provides a comprehensive exploration of Generative AI (GenAI) models, focusing on their mathematical and computational foundations. It covers Deep Learning, Autoregressive Models, Flow Models, Latent Variable Models, Generative Adversarial Networks, Diffusion Models, and Large Language Models (LLMs) such as Transformers. Emphasis is placed on alignment, safety, adversarial robustness, and ethical considerations. Through project-based learning and research-driven assignments, students will gain hands-on experience in implementing, evaluating, and deploying state-of-the-art GenAI models in practical scenarios.

ICT 720 Cloud Computing **3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

The course focuses on the technologies associated with the cloud computing infrastructure and the usage of the cloud in different application domains. The first part of this course introduces core cloud computing architectures and basic concepts. The second part of the course delves into systems aspects such as fault tolerance, consistency, resource allocation, and quality of service in the context of particular cloud applications, such as distributed machine learning algorithms, real-time multimedia, or cloud-enabled Internet of Medical Things.

ICT 725 Quantum Computing **3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course aims to provide a solid understanding of the fundamentals of Quantum Computing. In the first half, we give an overview of Quantum Mechanics and its mathematical treatment. We then introduce the building blocks of Quantum Computing and discuss how they work, how to build them, and their physical realization. In the second half, we introduce Quantum Cryptography and Quantum Machine Learning, as examples of Quantum Computing applications. Finally, we conclude with discussion on Quantum Information theory.

ICT 726 Quantum Machine Learning **3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

Quantum computing revolutionizes computation by efficiently solving classically intractable problems, disrupting and advancing countless applications. The course will focus on Quantum Machine Learning (QML). It introduces QML and explains how it advances Machine Learning. It will introduce basic QML topics, such as quantum support vector machine, quantum kernel methods, and quantum neural networks. It will then explore advanced QML topics, including Fault-Tolerant QML and Quantum Generative Adversarial Network. The course concludes with other applications of quantum computing beyond QML

ICT 730 System Performance Modelling and Analysis **3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

During their graduate studies, graduate students often aim to develop new concepts and techniques to enhance certain performance metrics of the system they are investigating, but often lack the right methods they need to use to evaluate and assess the effectiveness of such developed concepts and techniques. This course covers various methods that graduate students can use to model, characterize and analyze the performances of their designed techniques and concepts.

ICT 736 Interactive Design for Health care **3 Credits**

Grade Mode: Standard Letter, Audit/Non Audit

This course exposes students to the healthcare domain at large, including being involved in existing project work within medical institutes in Qatar. The students will study a variety of cutting-edge user-centered interactive technologies that are currently being used and can potentially be used in the near future to support healthcare. The students will pair up in groups of 2 and explore the introduction of new interactive technology in one of the domains discussed in class.

ICT 890 Dissertation Hours **1-9 Credits**

Grade Mode: Pass/Non Pass