رابعا: المحتوى العلمي لمقررات قسم تكنولوجيا المعلومات

IT100: Digital Logic Design

This course provides a modern introduction to logic design and the basic building blocks used in digital systems, digital computers. It starts with a discussion of combinational logic: logic gates, minimization techniques, arithmetic circuits, and modern logic devices such as field programmable logic gates. The second part of the course deals with sequential circuits: flip-flops, synthesis of sequential circuits, and case studies, including counters, registers, and random-access memories. State machines will then be discussed and illustrated through case studies of more complex systems using programmable logic devices. Different representations including truth table, logic gate, timing diagram, switch representation, and state diagram will be discussed. The course has an accompanying lab component that integrates hands-on experience with modern computer-aided design software including logic simulation, minimization and an introduction of the use of hardware description language (VHDL).

IT201: Computer Graphics

Computer Graphics is a study of the hardware and software principles of interactive raster graphics. Topics include an introduction to the basic concepts, 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques, graphical software packages and graphics systems. Students will use a standard computer graphics API to reinforce concepts and study fundamental computer graphics algorithms. This course examines one or more selected current issues in the area of image synthesis. Specific topics covered are dependent on the instructor. Potential topics include scientific visualization, computational geometry, photo-realistic image rendering and computer animation.

IT200: Computer Organization and Architecture

An introduction to computer architecture. Includes a survey of computer architecture fundamentals exemplified in commercially available computer systems, including classical CPU and control unit design, register organization, primary memory organization and access, internal and external bus structures, and virtual memory schemes. Alternatives to classical machine architecture, such as the stack machine and the associative processor, are defined and compared. Parallel processors and distributed systems are also presented, along with an analysis of their performance relative to nonparallel machines.

IT203: Multimedia

This course Applies basic knowledge of mathematics and science in multimedia system computing introduce students to the different media types and design issues related to multimedia systems; The course examines types of multimedia information: voice, data video facsimile, graphics, and their characterization; modeling techniques to represent multimedia information; introduce students to the advances in multimedia compression technology; Provide an opportunity for students to apply design, implementation and evaluation concepts and techniques to the development of a small but realistic multimedia system. Define criteria and

specifications appropriate to multimedia compression systems problems, and plan strategies for their solution. Identify the current and underlying technologies that support multimedia compression processing.

IT202: Computer Networks

The principles and practice of computer networking, with emphasis on the Internet. The structure and components of computer networks, packet switching, layered architectures, OSI 7-layer model, TCP/IP, physical layer, error control, window flow control, local area networks (Ethernet, Token Ring; FDDI), network layer, congestion control, quality of service, multicast.

IT301: Web and Network Programming

This course aims to give a broad knowledge of modern networking technologies and network-based applications, computing systems, and software. The course will cover the background and history, basic concepts and components, mechanisms and protocols of computer networks and Internet. The scope will extend to the World Wide Web computing and information exchange framework built on top of Internet and introduce key technologies that enable the client–server web application modes. You are expected to finish the course with necessary knowledge and understanding of the rationale in modern computer networking and network centric system and application design.

IT302: Introduction to Internet of Things (IoT)

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

IT303: Introduction to Cloud Computing

This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Business Process as a Service (BPaaS). IaaS topics start with a detailed study the evolution of infrastructure migration approaches from VMWare/Xen/KVM virtualization, to adaptive virtualization, and Cloud Computing / on-demand resources provisioning. Mainstream Cloud infrastructure services and related vendor solutions are also covered in detail. PaaS topics cover a broad range of Cloud vendor platforms including AWS, Google App Engine, Microsoft Azure, Eucalyptus, OpenStack and others as well as a detailed study of related platform services such as storage services that leverage Google Storage, Amazon S3, Amazon Dynamo, or other services meant to provide Cloud resources management and monitoring capabilities. The SaaS and PaaS topics covered in the course will familiarize students with the use of vendor-maintained applications and processes available on the Cloud on a metered on-demand basis in multi-tenant environments. The course also covers the Cloud security model and associated challenges and delves into the implementation and

support of High-Performance Computing and Big Data support capabilities on the Cloud. Through hands-on assignments and projects, students will learn how to configure and program IaaS services. They will also learn how to develop Cloud-based software applications on top of various Cloud platforms, how to integrate application-level services built on heterogeneous Cloud platforms, and how to leverage SaaS and BPaaS solutions to build comprehensive end-to-end business solutions on the Cloud.

IT300: Digital Signal Processing

This course will cover : Digital processing of signals, sampling, difference equations, discrete-time Fourier transforms, discrete and fast Fourier transforms, digital filter design, LTI systems, Z-transform, Multirate signal processing, Filter Banks, Wavelets and Applications to mp3 and JPEG , Overview of FIR and IIR filter design techniques, DFT, FFT, and role of DCT in MPEG and JPEG, and Spectral Analysis.

IT304: Introduction to Cybersecurity

This is an introductory course designed to familiarize students with the concepts of cybersecurity. The course will prepare students for succeeding courses in cybersecurity and forensics. Course Topics: Introduction to Information Security, The Need for Security, Legal, Ethical, and Professional Issues in Information Security, Risk Management, Planning for Security, Security Technology: Firewalls, VPNs, and Wireless, Security Technology: Intrusion Detection and Prevention Systems and Other Security Tools, Cryptography, Physical Security, Implementing Information Security, Security and Personnel, Information Security Maintenance and eDiscovery.

IT305: Mobile Application Development

There are more mobile devices on the planet than people. Mobile app development helps to unleash the full power of mobile devices and push their usage into every corner of modern society. This course introduces students to important concepts and aspects in mobile application development on Java based Android phones, including UI design, data persistence, multimedia support, sensor management, multithreading, debug and test, and application publishing. Although the course is centered on Android, general principles of mobile app development discussed here can also be applied to other contexts.

IT306: Wireless and Mobile Networks

This course provides a comprehensive treatment of wireless data and telecommunication networks. Topics include recent trends in wireless and mobile networking, wireless coding and modulation, wireless signal propagation, IEEE 802.11a/b/g/n/ac wireless local area networks, 60 GHz millimeter wave gigabit wireless networks, vehicular wireless networks, white spaces, IEEE 802.22 regional area networks, Bluetooth and Bluetooth Smart, wireless personal area networks, wireless protocols for Internet of Things, ZigBee, cellular networks: 1G/2G/3G, LTE, LTE-Advanced, and 5G.

IT307: Embedded Systems Design

Embedded systems are the systems of future with cellular phones, smart-phones, tablets becoming the dominant platforms for computing and communication. This course introduces fundamental knowledge of Embedded systems. The ubiquity of information and the associated need for the computation that accompanies it is driving this revolution only to be accelerated by the new paradigms such as the Internet-of-Things (IoT). These platforms are clearly very different in terms of their processing requirements which are unique: real-time needs, high performance but at low energy, compact-code and data segments, and most importantly ever-changing software stack. Such unique requirements have led to a complete redesign and reinvention of the both hardware and the software stack from ground up, for example, brand new processors such as ARM, DSPs, network processors were invented all the way up to new virtual machines such as Dalvik.

IT308: Microcontrollers

This course provides the main principles of microprocessors and microcontrollers and their peripherals. Various related topics are covered including introduction to computing system; microcontroller architecture; instruction set; assembly language programming; hardware interfaces; memory management.

IT401: Image Processing

This course will provide students with a preliminary understanding of the theory and practice of image processing. Basic concepts and fundamentals of image processing and analysis will be described in the course. The spatial frequency domain (The sampling theorem, template matching and the convolution theorem, spatial filtering). Enhancement and restoration, image segmentation. Image representation: (Spatial differentiation and smoothing, template matching، region analysis, contour following).

IT402: Network Security

Discussion of the need for network security, describe various threats, attack types and hackers. Explain authentication, encryption & encryption standard. Secret-Key, public key algorithm authentication protocols, digital certificate. Virtual private network, (VPN), secure sockets layer (SSL). Firewalls, and firewalls topology, packet filters and proxy servers. Threats and couther measures in centralized and distributed systems; communication security techniques based on encryption; symmetric and asymmetric encryption; encryption modes, including stream and block encryption, and cipher-block chaining; message origin and mutual authentication; third-party and inter-realm authentication; authentication of mobile users; data confidentiality and integrity protocols; formal analysis of authentication protocols and message integrity; access control in distributed systems and networks; firewall design.

IT403: Computer Vision

This course introduces computer vision, including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image

classification, scene understanding, and deep learning with neural networks. We will develop basic methods for applications that include finding known models in images, depth recovery from stereo, camera calibration, image stabilization, automated alignment, tracking, boundary detection, and recognition.

IT404: Robotics

Introduction to Robotics; Co-ordinate systems(Cartesian, cylindrical ; Polar and Revolute systems); Robot Arms(Axes, ranges , Off-set and In-line Wrist, Roll, Pitch and Yaw); End Effectors; Sensors (Micro-switches, Resistance Transducers, Peizo-electric, infrared , Laser and Vidicon Tubes); Application of sensors (Reed Switches, Ultra Sonic, Bar Code Readers) ; Hydraulic system units (pumps, valves, solenoids, cylinders) ; Electrical system units (stepper motors, encoders and AC motors); programming of Robots ; Safety considerations.

IT405: Computer Animation and 3D Modeling

Kinematics and techniques for character animation. Topics include physical modeling and simulation, motion planning, control and learning algorithms, locomotion, motion trajectory optimization, scripting languages, motion capture and motion editing. Students will implement algorithms and interactive animation tools.

IT406: Information Theory and Data Compression

This course is about how to measure, represent, and communicate information effectively. Why bits have become the universal currency for information exchange. How information theory bears on the design and operation of modern-day systems such as smartphones and the Internet. What are entropy and mutual information, and why are they so fundamental to data representation, communication, and inference. Practical compression and error correction. Relations and applications to probability, statistics, machine learning, biological and artificial neural networks, genomics, quantum information, and blockchains.

IT407: Virtual and Augmented Reality

Design and implementation of software systems necessary to create virtual environments; techniques for achieving real time, dynamic display of photorealistic, synthetic images; hands-on experience with electromagnetically tracked, head mounted displays. Final project requires the design and construction of a virtual environment.

IT408: Network Simulation

The course is intended to provide the participants knowledge in modeling and simulation of telecommunication networks. The course features software commonly used for telecommunication network simulation. In addition to the basic theory necessary for understanding network simulation, the course aims to give practical skills in using these tools to design and implement simulation models for performance analysis of wired as well as wireless networks. After completing the course, the students should be able to: Describe the main quantitative methods for performance evaluation of telecommunication networks; Explain the

advantages and drawbacks of using simulation as a tool for analyzing telecommunication networks; Describe common assumptions, simplifications, and generalizations made in modeling telecommunication systems; Implement, verify and validate simulation models of telecommunication networks; Design, build, and experiment with simulation models, as well as evaluate the results obtained by simulation

IT409: Computer Forensics

Introduces computer security administrators to computer forensics. Includes setup and use of an investigator's laboratory, computer investigations using digital evidence controls, processing crime and incident scenes, performing data acquisition, computer forensic analysis, e-mail investigations, image file recovery, investigative report writing, and expert witness testimony.

IT410: Cloud Networks

In the cloud networking course, we will see what the network needs to do to enable cloud computing. We will explore current practice by talking to leading industry experts, as well as looking into interesting new research that might shape the cloud network's future. This course will allow us to explore in-depth the challenges for cloud networking—how do we build a network infrastructure that provides the agility to deploy virtual networks on a shared infrastructure, that enables both efficient transfer of big data and low latency communication, and that enables applications to be federated across countries and continents? Examining how these objectives are met will set the stage for the rest of the course. This course places an emphasis on both operations and design rationale.

IT4011: Pattern Recognition

Pattern recognition techniques are used to design automated systems that improve their own performance through experience. This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives. Topics including Bayesian Decision Theory, Estimation Theory, Linear Discrimination Functions, Nonparametric Techniques, Support Vector Machines, Neural Networks, Decision Trees, and Clustering Algorithms etc. will be presented.

IT412: Multimedia Mining

Multimedia mining deals with the extraction of implicit knowledge, multimedia data relationships, or other patterns not explicitly stored in multimedia files. Multimedia mining is more than just an extension of data mining, as it is an interdisciplinary endeavor that draws upon expertise in computer vision, multimedia processing, multimedia retrieval, data mining, machine learning, database and artificial intelligence.

IT413: Optical Networks

Principles and procedures of optical networking with focus on high speed optical signal transmission between network nodes, light path routing and distribution, multilayer network

design, and advanced photonic techniques and devices for optical signal transmission and switching.

IT414: Quantum Computing

Quantum computing exploits the quantum mechanical nature of matter to simultaneously exist in multiple possible states. Building up on the digital binary logic of bits, quantum computing is built based on interacting two-level quantum systems or 'qubits' that follow the laws of quantum mechanics. Addressability of the quantum system and its fragility to fidelity are the major issues of concern, which if addressed appropriately, will enable this new approach to revolutionize the present form of computing. After developing the basics, this course delves on various implementation aspects of quantum computing and quantum information processing.

IT415: Computational Imaging

Computational imaging systems have a wide range of applications in consumer electronics, scientific imaging, HCI, medical imaging, microscopy, and remote sensing. We discuss light fields, time-of-flight cameras, multispectral imaging, thermal IR, computational microscopy, compressive imaging, computed tomography, computational light transport, compressive displays, phase space, and other topics at the convergence of applied mathematics, optics, and high-performance computing related to imaging. Hands-on assignments.

IT416: Game Development

This course furthers the students understanding of programming through the implementation of advanced programming methods employed in video game production. Various data structures used to represent, organize and manage game world information will be explored and implemented in gaming solutions.

IT417: Wireless Sensors Networks

This course deals with the comprehensive knowledge about wireless sensor networks. It provides an insight into different layers and their design considerations. A thorough knowledge of infrastructure establishment and sensor network platform is provided.

IT425: Selected Topics in Information Technology I

Selected Topics provides an opportunity to study a topic which is not included in the existing curriculum. This course examines one or more selected current issues in the area of Information Technology. Topics chosen for study will be by arrangement with the department.

IT426: Selected Topics in Information Technology II

Selected Topics provides an opportunity to study a topic which is not included in the existing curriculum. This course examines one or more selected current issues in the area of Information Technology. Topics chosen for study will be by arrangement with the department.

IT430/IT431: Project

This course will continue for two semesters. In the first semester, a group of students will select one of the projects proposed by the department and analyze the underlying problem. In the second semester, the design and implementation of the project will be conducted. The student will deliver oral presentations, progress reports, and a final report.