Computer Science Department

Course Description for Master program

Course No.	Course Name	Course Description
CS 610	Advanced Computer Algorithms	Study and application of techniques and procedures used in the analysis of algorithms including the worst and average cases of both time and space. Algorithms for clarification are chosen from several areas such as: Sorting, Searching, Graph Algorithms, String Matching, and Others, Study of the P and NP classes.
CS 670	Advanced Database Management Systems	This course introduces various principles of database management systems (DBMS) as well as its advanced features. It focuses on terminology and fundamental concepts of relational databases and database management systems. Students will learn SQL and PL/SQL including, triggers and transaction processing. They will understand performance issues and optimization strategies through query rewriting, secondary storage characteristics, and access strategies. This course also exposes student to some of the current challenges facing database professionals (e.g. semi-structured data management, XML databases, information extraction, data integration, Data Warehouse, Data mining) as well as some DBMS design and management issues.
CS 630	Advanced Computer Networks	This course addresses current issues concerning the Internet. Topics cover the fundamentals of Internet technology, routing and congestion control, techniques for supporting quality of service in the Internet, traffic engineering, and future research issues. The course will prepare students for pursuing research is this fast growing area. It will also help in meeting the demands of industry in this important area of expertise.
CS 680	Advanced Software Engineering	The course aims to develop the broad understanding of the discipline of software engineering (gained in the earlier Software Engineering course) by considering the wider systems engineering context in which software

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		plays a role. It aims to examine the concepts and techniques associated with a number of advanced and industrially relevant topics, relating to both the product and processes of software engineering. It seeks to complement this with an account of the associated practical and professional issues in software engineering. The course will also provide an on-going support to the group project work.
CS 620	Advanced Computer Architecture	This course covers the evolution of computer architecture and the factors influencing the design of hardware and software elements of computer systems. Topics include: instruction set design; processor micro-architecture and pipelining; cache and virtual memory organizations; protection and sharing; I/O and interrupts; in-order and out-of-order superscalar architectures; multithreaded architectures; symmetric multiprocessors; and parallel computers
CS 795	Seminar in Research Methods	The course introduces fundamental concepts in the design and implementation of computer communication networks and their protocols. An emphasis will be placed on the protocols used in the Internet. A top-down approach will be followed for the network layers description. Research Methods introduces graduate students to basic ideas about conducting a personal research. Students will learn methods for selecting research topics, devising research questions, planning research, analysing experimental results, modelling and simulating computational phenomena, and synthesizing broader theories. The course will be structured around three activities: lectures on research strategy and tactics, statistical methods, and experimental design; discussions of technical papers; and preparation and review of written assignments. Significant reading, reviewing, and writing will be required, and students will be expected to participate actively in class discussions.
CS 631	Mobile Networks	This course will examine techniques used to support mobility and multiple access methods in wireless networks. Multiple access methods such as FDMA, TDMA, CDMA, OFDMA, and CSMA/CA will be

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		detailed. Mobility Management techniques including handover and roaming will be also covered. Network planning and security issues will be discussed. These different techniques will be illustrated by showing their usage in the most relevant networks, namely Wireless Local Area Networks, Wireless Metropolitan Area Networks, Cellular Networks, and Mobile IP Networks
CS 632	Advanced Network Security	This course focuses on advanced network security issues. It explores the principles of network security and cryptographic algorithms as well as study core security concepts and review existing security architectures and systems. Students will acquire a mental "road map" of network security issues and gain an in-depth understanding of the principle paradigms used in the area. They will learn techniques for thinking about cryptography, analysing primitives and protocols, and synthesizing solutions to make secure a network.
CS 633	Network Modeling & Simulation	This course will cover topics of modeling and simulation of complex distributed systems such as probabilistic modeling, deterministic modeling and parallel simulation. It will reinforce student abilities to design complex systems and evaluate their performance. This task is very important for doing research in several areas.
CS 734	Network Management	This course introduces core as well as advanced concepts in Network Management. The main topics include Layers of network management; infrastructure for network management; the key areas of network management (accounting, security, configuration, performance, and fault tolerance); the Internet management framework and protocols (SNMP, MIBs, and so on); practical limitations and case studies; and so on.
CS 735	Advanced Cryptography	This course focuses on advanced network security issues. It explores the principles of network security and cryptographic algorithms as well as study core security concepts and review existing security architectures and systems. Students will acquire a mental "road map" of network

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		security issues and gain an in-depth understanding of the principle paradigms used in the area. They will learn techniques for thinking about cryptography, analysing primitives and protocols, and synthesizing solutions to make secure a network.
CS 739	Selected Topics in Computer Networks	some current and most recent topics in Computer Networks will be selected each term.
CS 660	Advanced Artificial Intelligence.	The main aim of this course is to provide advanced techniques of problem solving. It is a deepening of different techniques covered in the Artificial Intelligence course of BCs. Uninformed, informed searching, genetic algorithms and tabu search technique will be deeply developed. Different types of knowledge representations and reasoning will be studied as propositional logic, first order logic. This course also includes constraint programming techniques dealing with constraint satisfaction problems (CSPs) and their extensions (weighted CSPs and SAT).
CS 661	Natural Language Processing.	This course introduces major concepts of Computational Linguistics and keeps the student with the challenges of the state of the art in natural language processing and its applications. It also initiates students in basic techniques of mathematical analysis of natural language at various levels of the structure of language, especially morphological, syntactical and semantic analysis. This course examine some of the technologies of written and spoken natural language processing, including grammars, parsing, spelling correction, part-of-speech tagging, and spoken dialogues systems.
CS 662	Machine Learning	Machine Learning is the study of how to build computer systems that learn from experience. It is a subfield of Artificial Intelligence and intersects with statistics, cognitive science, information theory, and probability theory, among others. The course will explain how to build systems that learn and adapt using real-world applications from industry and science. Main topics include linear discriminants, neural networks,

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		decision trees, support vector machines, unsupervised learning, etc.
CS 763	Constraint based-reasoning and Optimization.	The course covers both the theory and the practice of combinatorial optimization and constrained programming. This course is divided into two main parts: constraint programming (CP) and integer programming (IP). We will discuss fundamental methods such as branch and bound, Lagrangean relaxation, solving techniques of constraint satisfaction problem, and extensions of CSP and SAT to weighted constraint satisfaction problem.
CS 764	Intelligent Robotics	This course attempts to cover all the topics needed to program an artificially intelligent robot for applications involving sensing, navigation, path planning, and navigating with uncertainty. Although machine perception is a separate field of endeavor, the course covers enough computer vision and sensing to enable students to embark on a serious or prototype robot project or competition.
CS 769	Selected Topics in Artificial Intelligence	Some current and most recent topics in Artificial Intelligence will be selected each term.
CS 681	Advanced Object Analysis and Design.	This course covers advanced aspects of object technology. The course teaches a variety of approaches to advanced issues important in real world applications. Particular attention is given to topics that improve the precision and quality of developed systems. The course covers a variety of techniques encountered in complex mission critical applications today and guides students through the best practices of complex system development. Particular attention is given to topics that present the most productive solutions and identify approaches that may cause deficiencies during the lifetime of the system. In addition, the course covers areas of object storage and retrieval, distributed systems, business rules and objects and introduces architecture for supportable systems. Emphasizing

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		productivity and quality, the course concludes with pragmatic guidelines on how to incorporate testing and quality assurance into the development process of object-oriented systems.
CS 682	Advanced Software Management	This course presents a detailed knowledge of software project management field. Students will learn state of art and state of practice techniques, technologies and methodologies in managing people, scope, quality, cost and schedule of projects. The course also introduces the emerging trends in software project management through practical research exercises.
CS 683	Advanced Software Testing	This course examines fundamental software testing and program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. Students will learn the state of the art in testing technology for object-oriented, component-based, concurrent, distributed, graphical-user interface, and web software. In addition, closely related concepts such as mutation testing and program analysis (e.g., program-flow and data-flow analysis) will also be studied. Emerging concepts such as test-case prioritization and their impact on testing will be examined. Students will gain hands-on testing/analysis experience via a multi-phase course project. By the end of this course, students should be familiar with the state-of-the-art in software testing. Students should also be aware of the major open research problems in testing.
CS 784	Advanced Software Specification	This course introduces students to the use of formal (mathematical) notation for specifying software systems. Formal specification notation allows for concise, unambiguous specification together with the ability to formally prove properties of the specification and to discover counterexamples to aid in the redesign of a specification. The course aims to provide students with experience in software specification, including mechanized support for

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		specification, program semantics, and integrating specification into software engineering methodology. The emphasis in writing good specifications is that they should make it easy to comprehend what the system does, rather than how it does it.
CS 785	Requirements Engineering and Software Structure	The course focuses on software requirement elicitation, analysis, specification, high-level design (including trade-off decisions) validation and verification, and management in an iterative development process that includes prototyping and demonstrates traceability from requirements through to design. The course is intended to provide the student with a comprehensive understanding and an ability to critically evaluate software and systems requirements engineering and architectural approaches.
CS 789	Selected Topics in Software Engineering	Some current and most recent topics in Software Engineering will be selected each term.
CS 671	Data Warehouse Technologies.	This course exposes the fundamental concepts of a data warehouse. It explores the issues involved in planning, designing, building, populating and maintaining a successful data warehouse.
CS 672	Data and Web Mining.	Computer science data mining is part of the broader endeavour of exploratory data analysis and principled inference from data which explores how computers (software tools and algorithms) can be used to help with data mining tasks. This includes: - how to mine efficiently over the web and very large data sets (or databases), - determining to what degree data mining tasks can be automated, - devising new algorithms that make given data mining tasks easier (or even possible), and

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		- building interactive tools that help analysts in data mining tasks.
CS 673	Advanced Web Services.	This course explains the use of web services, the design principles and application of SOAP and REST based web services. It enables students to design collaborating web services according to a specification, and to Implement an application that uses multiple web services in a realistic business scenario.
CS 773	E-commerce.	This course explains the nature, the business impact and the potential of e-Commerce. Students will learn the technologies required to make e-Commerce viable and discuss its new trends. The course will also expose the economic consequences of e-Commerce and discuss it from an enterprise point of view.
CS 774	Semantic Web Technologies.	In this course, the student will learn the current state of the art of the semantic web, and programming skills to use this technology in specific applications. The semantic web aspires to use the "meaning" of information and services to satisfy the requests of people and machines. Students will learn what is possible and the direction of this evolving field as well as acquire an ability to implement applications using semantic web technology.
CS 779	Selected Topics In Data Base Systems	Some current and most recent topics in Data Base Systems will be selected each term. The objective is to identify the techniques in advanced application development that lead to modern systems.
CS 611	Advanced Automata Theory	This course focuses on the fundamental constructs and concepts underlying the theory of computability and complexity. The course starts with a brief overview of finite automata and then progress to the exploration of Turing machines and the appreciation of how they represent the power of a general computing machine in abstract. The issue of undecidability is explored. Then space and time complexity and hierarchy are introduced.
CS 710	Advanced Parallel Computing	This course presents : - The leading high-end computing systems and their

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		programming environments.
		- Advanced models of parallel computation.
		- Mapping of parallel algorithms to architectures.
		- Performance programming and tools for performance optimization on parallel systems.
		- Execution environments and system software for large-scale parallel computing.
		- Case studies of parallel applications.
CS 711	Advanced Parallel Computer Algorithms	This course provides the students with all the skills necessary to write efficient algorithms, able to solve large-scale problems on parallel computers. Emphasis is made on teaching concepts applicable across a wide variety of problem domains, and transferable across a broad set of computer architectures.
CS 719	Selected Topics in Parallel Computing	Some current and most recent topics in Parallel Computing will be selected each term.
CS 790	Selected Topics in Computer Science	Some current and most recent topics in different domains of Computer Science will be selected each term.
CS 799	Thesis	The Master's thesis consists of original research work done under the supervision of a faculty member. The thesis is chosen by the student at the beginning of the third semester and must be approved by the Master's Committee.