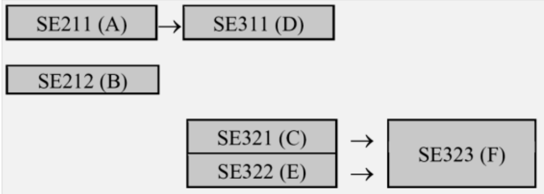
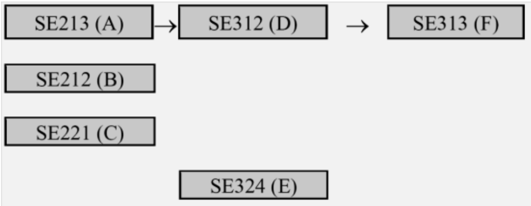
برنامه پیشنهادی برای کارشناسی مهندسی نرم‌افزار

همانطور که مطلع هستید، ACM و IEEE برنامه جامعی را برای رشته مهندسی نرم‌افزار در مقطع کارشناسی پیشنهاد کرده‌اند که مبنای تعریف این رشته در دانشگاه‌های متعدد بوده است (این برنامه در این آدرس در دسترس عموم قرار داده شده است: http://sites.computer.org/ccse/SE2004Volume.pdf).

دروس اصلی مهندسی نرم‌افزار

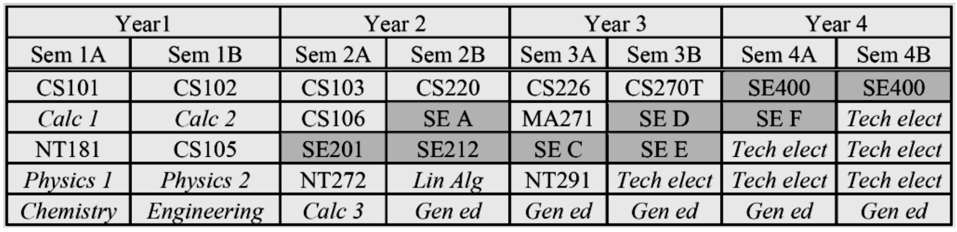
طبق پیشنهاد ACM و IEEE، برنامه درسی رشته‌های مهندسی نرم‌افزار در مقطع کارشناسی باید حداقل شامل هشت درس اصلی باشد. برنامه پیشنهادی ACM و IEEE شامل دو مجموعه هشت‌تایی از دروس اصلی مهندسی نرم‌افزار است که دانشگاه محل ارائه می‌تواند از بین این دو مجموعه پیشنهادی، یکی را انتخاب و پیاده‌سازی نماید. این دو مجموعه ذیلاً فهرست شده‌اند؛ سیلابس‌های این دروس، که عیناً از برنامه پیشنهادی ACM و IEEE برگرفته شده‌اند، در صفحات بعد آورده شده‌اند (معادل‌های فارسی تا حدی مورد مناسب‌سازی گرفته‌اند). اکثر قریب به اتفاق دروس مجموعه دوم هم اکنون در دانشگاه‌های ما ارائه می‌شوند (در قالب دروس کارشناسی یا ارشد)؛ به همین دلیل به نظر می‌رسد که مجموعه دوم برای ایران مناسب‌تر باشد.

مجموعه اول (برگرفته از برنامه ACM/IEEE، صفحه ۵۵)	مجموعه دوم (برگرفته از برنامه ACM/IEEE، صفحه ۵۶)
۱- مقدمه‌ای بر مهندسی نرم‌افزار SE-201 ۲- ساخت نرم‌افزار SE-211(A) ۳- تعامل انسان و کامپیوتر در مهندسی نرم‌افزار SE-212(B) ۴- طراحی و معماری نرم‌افزار SE-311(D) ۵- تضمین کیفیت و آزمون نرم‌افزار SE-321(C) ۶- تحلیل خواسته‌های نرم‌افزار SE-322(E) ۷- کنترل پروژه نرم‌افزار SE-323(F) ۸- پروژه نهایی مهندسی نرم‌افزار: این پروژه، دو مرحله‌ای است و در قالب دو درس سه واحدی در سال آخر تحصیل -در دو نیمسال متوالی- ارائه می‌شود SE-400  SE211 (A) SE311 (D) SE212 (B) SE321 (C) SE322 (E) SE323 (F)	۱- مقدمه‌ای بر مهندسی نرم‌افزار SE-201 ۲- تعامل انسان و کامپیوتر در مهندسی نرم‌افزار SE-212(B) ۳- طراحی و معماری سامانه‌های نرم‌افزاری بزرگ SE-213(A) ۴- آزمون نرم‌افزار SE-221(C) ۵- طراحی تفصیلی نرم‌افزار SE-312(D) ۶- روشهای رسمی در مهندسی نرم‌افزار SE-313(F) ۷- فرایند و مدیریت ایجاد نرم‌افزار SE-324(E) ۸- پروژه نهایی مهندسی نرم‌افزار: این پروژه، دو مرحله‌ای است و در قالب دو درس سه واحدی در سال آخر تحصیل -در دو نیمسال متوالی- ارائه می‌شود SE-400  SE213 (A) SE312 (D) SE313 (F) SE212 (B) SE221 (C) SE324 (E)

جایگاه دروس اصلی مهندسی نرم‌افزار در یک برنامه نوعی

نمونه‌های متعددی از برنامه‌های کارشناسی مهندسی نرم‌افزار در برنامه پیشنهادی ACM و IEEE مشخص شده‌اند؛ جدول ۱ (برگرفته از صفحه ۶۱ برنامه پیشنهادی ACM/IEEE) نشان می‌دهد که نوعاً چگونه می‌توان یک رشته کارشناسی مهندسی نرم‌افزار را در یک دانشکده مهندسی ارائه نمود.

جدول ۱ – نمونه دوره کارشناسی مهندسی نرم‌افزار در یک دانشکده مهندسی



Year1		Year 2		Year 3		Year 4	
Sem 1A	Sem 1B	Sem 2A	Sem 2B	Sem 3A	Sem 3B	Sem 4A	Sem 4B
CS101	CS102	CS103	CS220	CS226	CS270T	SE400	SE400
Calc 1	*Calc 2*	CS106	SE A	MA271	SE D	SE F	*Tech elect*
NT181	CS105	SE201	SE212	SE C	SE E	*Tech elect*	*Tech elect*
Physics 1	*Physics 2*	NT272	*Lin Alg*	NT291	*Tech elect*	*Tech elect*	*Tech elect*
Chemistry	*Engineering*	*Calc 3*	*Gen ed*	*Gen ed*	*Gen ed*	*Gen ed*	*Gen ed*

برنامه نشان داده شده در جدول ۱ غیر از دروس مهندسی نرم‌افزار (با پیشوند SE)، که در صفحه قبل فهرست شده‌اند، شامل دروس علوم کامپیوتر زیر نیز هست (با پیشوند CS):

- **CS101 Programming Fundamentals**
- **CS102 Object-Oriented Paradigm (OO Programming)**
- **CS103 Data Structures and Algorithms**
- **CS105 Discrete Structures I**
- **CS106 Discrete Structures II**
- **CS220 Computer Architecture**
- **CS226 Operating Systems and Networking**
- **CS270T Databases**

سایر دروس این جدول، از انواع دروس عمومی، پایه یا اختیاری هستند که از توضیح آنها صرف نظر کرده‌ایم.

پیشنهادی برای ارائه این دوره (به صورت رشته مستقل یا گرایش) در دانشکده خودمان

به نظر بنده، سه درس مقدمه‌ای بر مهندسی نرم‌افزار SE-201، طراحی و معماری سامانه‌های نرم‌افزاری بزرگ SE-213(A)، و طراحی تفصیلی نرم‌افزار SE-312(D) را می‌توان با تغییراتی در قالب سه درس موجود (*تحلیل و طراحی سیستم‌ها، مهندسی نرم‌افزار، طراحی شیءگرا*) ارائه کرد. از طرف دیگر، پروژه دومرحله‌ای مهندسی نرم‌افزار SE-400 با دو درس موجود *آز مهندسی نرم‌افزار* و *پروژه کارشناسی* قابل تطبیق است.

چهار درس باقیمانده عبارتند از: تعامل انسان و کامپیوتر در مهندسی نرم‌افزار SE-212(B)، فرایند و مدیریت ایجاد نرم‌افزار SE-324(E)، آزمون نرم‌افزار SE-221(C) و روشهای رسمی در مهندسی نرم‌افزار SE-313(F). دو درس اول در حال حاضر در مقطع کارشناسی در دانشکده ارائه می‌شوند؛ دو درس دیگر در مقطع ارشد ارائه می‌شوند، اما می‌توان نسخه‌های مناسب دوره کارشناسی برای آنها طراحی نمود (نمونه‌هایی از این دروس در دانشگاه‌های کانادا

وجود دارند). برای پیشنهاد چارت جدید، این چهار درس باید جایگزین چهار درس موجود در برنامه فعلی کارشناسی نرم‌افزار شوند؛ مقایسه با برنامه کارشناسی مهندسی نرم‌افزار در دانشگاه واترلو نشان می‌دهد که دروس زیر کاندیداهای مناسبی برای اختیاری شدن هستند، تا بدین ترتیب جا برای ارائه چهار درس جدید باز شود:

۱ - بازیابی پیشرفته اطلاعات
۲ -هوش مصنوعی
۳ -محاسبات عددی
۴ -طراحی سیستم‌های دیجیتال + آز

با عرض احترام

رامان رامسین

SE-201 Introduction to Software Engineering

Course description

Main Topics:

1. Principles of software engineering: Requirements, design and testing.
2. Review of principles of object orientation.
3. Object oriented analysis using UML.
4. Frameworks and APIs.
5. Introduction to the client-server architecture.
6. Analysis, design and programming of simple servers and clients.
7. Introduction to user interface technology.

Learning objectives

Upon completion of this course, students will have the ability to:

- Develop clear, concise, and sufficiently formal requirements for extensions to an existing system, based on the true needs of users and other stakeholders
- Apply design principles and patterns while designing and implementing simple distributed systems-based on reusable technology
- Create UML class diagrams which model aspects of the domain and the software architecture
- Create UML sequence diagrams and state machines that correctly model system behavior
- Implement a simple graphical user interfaces for a system
- Apply simple measurement techniques to software
- Demonstrate an appreciation for the breadth of software engineering

Suggested sequence of teaching modules

1. Software engineering and its place as an engineering discipline
2. Review of the principles of object orientation
3. Reusable technologies as a basis for software engineering: Frameworks and APIs.
4. Introduction to client-server computing
5. Requirements analysis
6. UML class diagrams and object-oriented analysis; introduction to formal modeling using OCL. Examples of building class diagrams to model various domains
7. Design patterns (abstraction-occurrence, composite, player-role, singleton, observer, etc.)
8. Use cases and user-centered design
9. Representing software behavior: Sequence diagrams, state machines, activity diagrams
10. General software design principles: Decomposition, decoupling, cohesion, reuse, reusability, portability, testability, flexibility, etc.
11. Software architecture: Distributed architectures, pipe-and-filter, model-view-controller, etc.
12. Introduction to testing and project management

Sample labs and assignments

- Evaluating the performance of various simple software designs
- Adding features to an existing system
- Testing a system to verify conformance to test cases
- Building a GUI for an application
- Numerous exercises building models in UML, particularly class diagrams and state machines
- Developing a simple set of requirements (to be done as a team) for some innovative client-server application of very small size
- Implementing the above, using reusable technology to the greatest extent possible

این درس تا حد زیادی با درس کارشناسی "طراحی شیءگرای سیستم‌ها" قابل تطبیق است.

SE-211 Software Construction

Course Description

Main Topics:

1- General principles and techniques for disciplined low-level software design.
2- BNF and basic theory of grammars and parsing.
3- Use of parser generators.
4- Basics of language and protocol design.
5- Formal languages.
6- State-transition and table-based software design.
7- Formal methods for software construction.
8- Techniques for handling concurrency and inter-process communication.
9- Techniques for designing numerical software.
10- Tools for model-driven construction.
11- Introduction to Middleware.
12- Hot-spot analysis and performance tuning.

Prerequisite: (SE201 or SE200), CS103 and CS105.

Learning objectives

Upon completion of this course, students will have the ability to:

- Apply a wide variety of software construction techniques and tools, including state-based and table-driven approaches to low-level design of software
- Design simple languages and protocols suitable for a variety of applications
- Generate code for simple languages and protocols using suitable tools
- Create simple formal specifications of low-level software modules, check the validity of these specifications, and generate code from the specifications using appropriate tools
- Design simple concurrent software
- Analyze software to improve its efficiency, reliability, and maintainability

Suggested sequence of teaching modules

1- Basics of formal languages; syntax and semantics; grammars; Backus Naur Form. Parsing; regular expressions and their relationship to state diagrams
2- Lexical Analysis; tokens; more regular expressions and transition networks; principles of scanners
3- Using tools to generate scanners; applications of scanners. Relation of scanners and compilers
4- Parsing concepts; parse trees; context free grammars, LL Parsing

5- Overview of principles of programming languages. Criteria for selecting programming languages and platforms
6- Tools for automating software design and construction. Modeling system behavior with extended finite state machines
7- SDL
8- Representing concurrency, and analyzing concurrent designs

Sample labs and assignments

- Use of software engineering tools to create designs
- Use of parser generators to generate languages

تا جایی که من اطلاع دارم، این درس معادل نزدیکی در بین دروس فعلی مهندسی نرم‌افزار دانشگاه‌های ایران ندارد.

SE-212 Software Engineering Approach to HCI

Course Description

Main Topics:

1. Psychological principles of human-computer interaction.
2. Evaluation of user interfaces.
3. Usability engineering.
4. Task analysis, user-centered design, and prototyping.
5. Conceptual models and metaphors.
6. Software design rationale.
7. Design of windows, menus, and commands.
8. Voice and natural language I/O.
9. Response time and feedback.
10. Color, icons, and sound.
11. Internationalization and localization.
12. User interface architectures and APIs.
13. Case studies and project.

Prerequisite: SE201 or SE200

Learning objectives

Upon completion of this course, students will have the ability to:

- Evaluate software user interfaces using heuristic evaluation and user observation techniques
- Conduct simple formal experiments to evaluate usability hypotheses.
- Apply user centered design and usability engineering principles as they design a wide variety of software user interfaces

Suggested sequence of teaching modules

1. Background to human-computer interaction. Underpinnings from psychology and cognitive science
2. More background. Evaluation techniques: Heuristic evaluation
3. More evaluation techniques: Videotaped user testing; cognitive walkthroughs
4. Task analysis. User-centered design
5. Usability engineering processes; conducting experiments
6. Conceptual models and metaphors
7. Designing interfaces: Coding techniques using color, fonts, sound, animation, etc.
8. Designing interfaces: Screen layout, response time, feedback, error messages, etc.
9. Designing interfaces for special devices. Use of voice I/O

10. Designing interfaces: Internationalization, help systems, etc. User interface software architectures
11. Expressing design rationale for user interface design

Sample labs and assignments

- Evaluation of user interfaces using heuristic evaluation
- Evaluation of user interfaces using videotaped observation of users
- Paper prototyping of user interfaces, then discussing design options in order to arrive at a consensus design
- Writers-workshop for style critiquing of prototypes presented by others
- Implementation of a system with a significant user interface component using a rapid prototyping environment

این درس تا حد زیادی با درس اختیاری کارشناسی "تعامل انسان و کامپیوتر" قابل تطبیق است.

SE-213 Design and Architecture of Large Software Systems

Course Description

Main Topics:

1. Modeling and design of flexible software at the architectural level.
2. Basics of model-driven architecture.
3. Architectural styles and patterns.
4. Middleware and application frameworks.
5. Configurations and configuration management.
6. Product lines.
7. Design using Commercial Off-The-Shelf (COTS) software.

Prerequisites: SE201 or SE200, and CS103

Learning objectives

Upon completion of this course, students will have the ability to:

- Take requirements for simple systems and develop software architectures and high-level designs
- Use configuration management tools effectively, and apply change management processes properly
- Design simple distributed software
- Design software using COTS components
- Apply a wide variety of frameworks and architectures in designing a wide variety of software
- Design and implement software using several different middleware technologies

این درس تا حد زیادی با درس کارشناسی ارشد "معماری نرم‌افزار" قابل تطبیق است.

SE-221 Software Testing

Course Description

Main Topics:

1. Testing techniques and principles: Defects vs. failures, equivalence classes, boundary testing.
2. Types of defects.
3. Black-box vs. Structural testing.
4. Testing strategies: Unit testing, integration testing, profiling, test driven development.
5. State based testing; configuration testing; compatibility testing; web site testing.
6. Alpha, beta, and acceptance testing.
7. Coverage criteria.
8. Test instrumentation and tools.
9. Developing test plans.
10. Managing the testing process.
11. Problem reporting, tracking, and analysis.

Prerequisites: SE201 or SE200

Learning objectives

Upon completion of this course, students will have the ability to:

- Analyze requirements to determine appropriate testing strategies.
- Design and implement comprehensive test plans
- Apply a wide variety of testing techniques in an effective and efficient manner
- Compute test coverage and yield according to a variety of criteria
- Use statistical techniques to evaluate the defect density and the likelihood of faults.
- Conduct reviews and inspections.

این درس تا حد زیادی با درس کارشناسی ارشد "آزمون نرم‌افزار" قابل تطبیق است.

SE-311 Software Design and Architecture

Course Description

Main Topics:

1- An in-depth look at software design.
2- Continuation of the study of design patterns, frameworks, and architectures.
3- Survey of current middleware architectures.
4- Design of distributed systems using middleware.
5- Component-based design.
6- Measurement theory and appropriate use of metrics in design.
7- Designing for qualities such as performance, safety, security, reusability, reliability, etc.
8- Measuring internal qualities and complexity of software.
9- Evaluation and evolution of designs.
10- Basics of software evolution, reengineering, and reverse engineering.

Prerequisites: SE211

Learning objectives

Upon completion of this course, students will have the ability to:

- Apply a wide variety of design patterns, frameworks, and architectures in designing a wide variety of software
- Design and implement software using several different middleware technologies
- Use sound quality metrics as objectives for designs, and then measure and assess designs to ensure the objectives have been met
- Modify designs using sound change control approaches
- Use reverse engineering techniques to recapture the design of software

این درس تا حدی با درس کارشناسی ارشد "معماری نرم‌افزار" قابل تطبیق است.

SE-312 Low-Level Design of Software

Course Description

Main Topics:

1. Detailed software design and construction in depth.
2. In-depth coverage of design patterns and refactoring.
3. Introduction to formal approaches to design.
4. Analysis of designs based on internal quality criteria.
5. Performance and maintainability improvement.
6. Reverse engineering.
7. Disciplined approaches to design change.

Prerequisite: SE213

Learning objectives

Upon completion of this course, students will have the ability to:

- Apply a wide variety of software construction techniques and tools, including state-based and table driven approaches to low-level design of software
- Use a wide variety of design patterns in the design of software
- Perform object-oriented design and programming with a high level of proficiency
- Analyze software in order to improve its efficiency, reliability, and maintainability.
- Modify designs using sound change control approaches
- Use reverse engineering techniques to recapture the design of software

تا جایی که من اطلاع دارم، این درس معادل نزدیکی در بین دروس فعلی مهندسی نرم‌افزار دانشگاه‌های ایران ندارد، هر چند که بسیاری از مطالب آن به صورت پراکنده در دروس مختلف کارشناسی ارشد پوشش داده می‌شوند.

SE-313 Formal Methods in Software Engineering

Course Description

Main Topics:

1. Review of mathematical foundations for formal methods.
2. Formal languages and techniques for specification and design, including specifying syntax using grammars and finite state machines.
3. Analysis and verification of specifications and designs.
4. Use of assertions and proofs.
5. Automated program and design transformation.

Prerequisite: SE312.

Learning objectives

Upon completion of this course, students will have the ability to:

- Create mathematically precise specifications and designs using languages such as OCL, Z, etc.
- Analyze the properties of formal specifications and designs
- Use tools to transform specifications and designs

این درس تا حد زیادی با درس کارشناسی ارشد "توصیف و وارسی برنامه‌ها" قابل تطبیق است.

SE-321 Software Quality Assurance and Testing

Course Description

Main Topics:

1- Quality: how to assure it and verify it, and the need for a culture of quality.
2- Avoidance of errors and other quality problems.
3- Inspections and reviews.
4- Testing, verification and validation techniques.
5- Process assurance vs. Product assurance.
6- Quality process standards.
7- Problem analysis and reporting.
8- Statistical approaches to quality control.

Prerequisite: SE201 or SE200

Learning objectives

Upon completion of this course, students will have the ability to:

- Conduct effective and efficient inspections
- Design and implement comprehensive test plans
- Apply a wide variety of testing techniques in an effective and efficient manner
- Compute test coverage and yield, according to a variety of criteria
- Use statistical techniques to evaluate the defect density and the likelihood of faults
- Assess a software process to evaluate how effective it is at promoting quality

Suggested sequence of teaching modules

1- Introduction to software quality assurance
2- Inspections and reviews
3- Principles of software validation
4- Software verification
5- Software testing
6- Specification based test construction techniques
7- White-box and grey-box testing
8- Control flow oriented test construction techniques
9- Data flow oriented test construction techniques
10- Cleanroom approach to quality assurance
11- Software process certification

Sample labs and assignments

- Use of automated testing tools
- Testing of a wide variety of software
- Application of a wide variety of testing techniques
- Inspecting of software in teams; comparison and analysis of results

این درس تا حدی با درس کارشناسی ارشد "آزمون نرم‌افزار" قابل تطبیق است.

SE322 Software Requirements Analysis

Course Description

Main Topics:

1- Domain engineering.
2- Techniques for discovering and eliciting requirements.
3- Languages and models for representing requirements.
4- Analysis and validation techniques, including need, goal, and use case analysis.
5- Requirements in the context of system engineering.
6- Specifying and measuring external qualities: performance, reliability, availability, safety, security, etc.
7- Specifying and analyzing requirements for various types of systems: embedded systems, consumer systems, web-based systems, business systems, systems for scientists and other engineers.
8- Resolving feature interactions.
9- Requirements documentation standards.
10- Traceability.
11- Human factors.
12- Requirements in the context of agile processes.
13- Requirements management: Handling requirements changes.

Prerequisites: SE201 or SE200.

Learning objectives

Upon completion of this course, students will have the ability to:

- Discover or elicit requirements using a variety of techniques
- Organize and prioritize requirements
- Apply analysis techniques such as needs analysis, goal analysis, and use case analysis
- Validate requirements according to criteria such as feasibility, clarity, freedom from ambiguity, etc.
- Represent functional and non-functional requirements for different types of systems using formal and informal techniques
- Specify and measure quality attributes
- Negotiate among different stakeholders in order to agree on a set of requirements
- Detect and resolve feature interactions

Suggested sequence of teaching modules

1- Basics of software requirements engineering
2- Requirements engineering process: requirements elicitation, specification, analysis, and management
3- Types of requirements: functional, non-functional, quality attributes
4- Requirements elicitation: identifying needs, goals, and requirements. Customers and other stakeholders. Interviews and observations
5- Requirements specification: textual and graphical notations and languages (UML, User Requirements notation). Techniques to write high-quality requirements. Documentation standards
6- Requirements analysis: inspection, validation, completeness, detection of conflicts and inconsistencies. Feature interaction analysis and resolution
7- Goal- and use-case-oriented modeling, prototyping, and analysis techniques
8- Requirements for typical systems: embedded systems, consumer systems, web-based systems, business systems, systems for scientists and other engineers
9- Requirements management: traceability, priorities, changes, baselines, and tool support
10- Requirements negotiation and risk management
11- Integrating requirements analysis and software processes (including agile ones)

Sample labs and assignments

- Writing good requirements.
- Analysis of a wide variety of existing software systems: Measuring qualities, and reverse engineering requirements.
- Interviewing users, and translating the results into prototypes iteratively
- Use of tools for managing requirements.
- Modeling, prototyping, and analyzing requirements with UML/URN tools
- Resolving feature interactions

تا جایی که من اطلاع دارم، معادل این درس تنها در دانشگاه امیرکبیر ارائه می‌شود.

SE323 Software Project Management

Course Description

Main Topics:

1- Project planning, cost estimation, and scheduling.
2- Project management tools.
3- Factors influencing productivity and success.
4- Productivity metrics.
5- Analysis of options and risks.
6- Planning for change.
7- Management of expectations.
8- Release and configuration management.
9- Software process standards and process implementation.
10- Software contracts and intellectual property.
11- Approaches to maintenance and long-term software development.
12- Case studies of real industrial projects.

Prerequisites: SE321 and SE322

Learning objectives

Upon completion of this course, students will have the ability to:

- Develop a comprehensive project plan for a significant development effort
- Apply management techniques to projects that follow agile methodologies, as well as methodologies involve larger-scale iterations or releases
- Effectively estimate costs for a project using several different techniques.
- Apply function point measurement techniques
- Measure project progress, productivity and other aspects of the software process
- Apply earned-value analysis techniques
- Perform risk management, dynamically adjusting project plans
- Use configuration management tools effectively, and apply change management processes properly
- Draft and evaluate basic software licenses, contracts, and intellectual property agreements, while recognizing the necessity of involving legal expertise
- Use standards in project management, including ISO 10006 (project management quality) and ISO 12207 (software development process) along with the SEI’s CMM model

Suggested sequence of teaching modules

1- Basic concepts of project management
2- Managing requirements
3- Software lifecycles
4- Software estimation
5- The project plan
6- Monitoring the project
7- Risk analysis
8- Managing quality
9- People problems

Sample labs and assignments

- Use a commercial project management tool to assist with all aspects of software project management. This includes creating Gantt, PERT, and Earned Value charts
- Make cost estimates for a small system using a variety of techniques
- Developing a project plan for a significant system
- Writing a configuration management plan
- Using change control and configuration management tools
- Evaluating a software contract or license

این درس تا حد زیادی با درس کارشناسی "مدیریت پروژه" همپوشانی دارد.

SE-324 Software Process and Management

Course Description

Main Topics:

1. Software processes: standards, implementation, and assurance.
2. Project management with a focus on requirements management and long-term evolution: Eliciting and prioritizing requirements, cost estimation, planning and tracking projects, risk analysis, project control, change management.

Prerequisites: SE201 or SE200, plus at least two additional software engineering courses at the 2 level or higher.

Learning objectives

Upon completion of this course, students will have the ability to:

- Elicit requirements using a variety of techniques
- Organize and prioritize requirements
- Design processes suitable for different types of project
- Assess a software process, to evaluate how effective it is at promoting quality
- Develop a comprehensive project plan for a significant development effort
- Measure project progress, productivity and other aspects of the software process
- Effectively estimate costs for development and evolution of a system using several different techniques
- Perform risk management, dynamically adjusting project plans
- Use standards for quality, process and project management
- Perform root cause analysis, and work towards continual improvement of process

این درس تا حد زیادی با درس کارشناسی "مدیریت پروژه"، و تا حدی با درس کارشناسی ارشد "متدولوژی‌های ایجاد نرم‌افزار"، همپوشانی دارد.

SE-400 Software Engineering Capstone Project

Course Description

This is a two-semester senior course focusing on development of a significant software system, employing knowledge gained from courses throughout the program. Includes development of requirements, design, implementation, and quality assurance. Students may follow any suitable process model, must pay attention to quality issues, and must manage the project themselves, following all appropriate project management techniques. Success of the project is determined in large part by whether students have adequately solved their customer's problem.

Sample deliverables

Students should be expected to deliver one or several iterations of a software system, along with all artifacts appropriate to the process model they are using. These would likely include a project plan (perhaps updated regularly, and containing cost estimations, risk analysis, division of the work into tasks, etc.), requirements (including use cases), architectural and design documents, test plans, source code, and installable system.