

GUIDELINES FOR THE MASTER OF SOFTWARE ENGINEERING (MSE) DEGREE
Department of Computing and Information Sciences
Kansas State University
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Graduate Studies Committee
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I. The Software Engineering Discipline

The discipline of software engineering covers the application of engineering principles to the building of computer software. The field covers the theories, tools and methods for systematic representation, design, verification, development, production, validation, and maintenance of software products including programs, prototypes, documentation, user interfaces, training, and evaluation. Software engineering is applicable not only to computer systems software; the techniques of software engineering offer benefits for software developed for all disciplines.

Engineering is the “practical application of scientific knowledge.” The application of knowledge about software is made practical through the use of common techniques, components, tools, and methods of management.

Specifically, like other branches of engineering, software engineering:

- Uses formal models and methods of computing to develop formal requirements of and specifications for application domain software
- Uses established techniques of design to establish the structure of software before it is actually programmed
- Uses established techniques for verification (formal analysis of correctness of properties) of system design
- Uses established techniques for validation (systematic measurement and analysis of properties) of systems implementation
- Uses numerous software tools to provide assistance in all activities of software development
- Studies the processes of software development as the basis for systematic management

II. Requirements for MSE Degree

MSE students should have a bachelor’s degree in computer science, computer engineering, or a related engineering, math, or science area.

The MSE degree consists of 33 semester credit hours that must include the following:

- CIS 740, CIS 748 and CIS 771
- One course from CIS 725, CIS 744, CIS 746 or CIS 764
- One course from CIS 826, CIS 841, CIS 842, CIS 844 or CIS 864
- Two courses (6 credit hours) from an application area such as: Parallel and Distributed Systems, Operating Systems and Real-time Systems, Database Engineering, Knowledge-based Systems, Graphics, or AI. Specialty areas from other Engineering departments may be used with supervisory committee permission.
- Two computer science technical electives (6 hours)

The student must receive a grade of “B” or better for each course assigned by the Graduate Studies Committee and for each course used to satisfy the above requirements.

Each student will specialize in an application area. It is expected that each student will do his/her project in an area related to that application area and that one supervisory committee member will have expertise in the application area. Each student will produce a software portfolio which will contain a representation of the student’s most important software expertise. The electives will allow the MSE students the opportunity to strengthen their overall computer science skills or to gain some expertise in related areas.

III. Core Courses in the MSE Degree

CIS 725 Advanced Computer Networks. Network algorithms: routing and congestion control; protocol engineering: protocol decomposition, specification and verification, synthesis; protocols for high-speed networks, parallel implementations, light-weight protocols. Prereq.: CIS 520 and CIS 525

CIS 740 Software Engineering. Software life cycle, requirements, specifications, design, validation, measures, and maintenance. Prereq.: CIS 540

CIS 744 Advanced Software Analysis and Design. Advanced concepts and practicum in object-oriented analysis, modeling, design, implementation, testing, and use of CASE tools; relationships among structural, static, and dynamic models; relationship among conceptual, system, and implementation models. Prereq.: CIS 540

CIS 746 Software Measurement. Measurement theory; development, validation and use of software measures; software measures in the lifecycle, including cost estimation, design measures, software complexity and software reliability. Prereq.: CIS 540

CIS 748 Software Management. Topics related to the management of software, including organization, project planning, process models, life cycle models, TQM, software quality assurance, cost estimation, configuration management. Prereq.: CIS 540

CIS 764 Data Base Management Systems. Data models and languages, hierarchical, network, relational systems; implementational and operational requirements; programming projects using data base management systems. Prereq.: CIS 501

CIS 771 Software Specification. Formal logic or specification of software components; algebraic vs. model-based specifications; common abstract types; verification of properties of specifications; introduction to specification of concurrent systems. Prereq.: CIS 301

CIS 826 Protocol Engineering. Basic concepts of protocol design, specification languages and formal description techniques, safety and liveness properties, protocol validation, protocol synthesis, protocol translation and conformance testing. Prereq.: CIS 725

CIS 841 Verification and Validation. Practical techniques for verifying and validating software including formal verification, software testing, reliability measurement and modeling. Prereq.: CIS 740

CIS 842 Specification and Verification of Reactive Systems. Review of formal specification languages; architecture of concurrent and reactive systems; specification methods including: A, Petri nets, temporal logic, state transition models; development and evaluation of system specifications verification structures including layered systems, serialization and predicate automata. Prereq.: CIS 771

CIS 844 Agent-Oriented Software Engineering. Analysis, design, and implementation of large, complex, distributed, and adaptive software systems using agent-oriented paradigm. Will survey various modeling languages and agent-oriented methodologies. Prereq.: CIS 730 and CIS 740

CIS 864 Data Engineering. Advanced topics in database design and maintenance including performance monitoring, query optimization and tuning in centralized and distributed data systems. Prereq.: CIS 761 or 764

CIS 895 MSE Project. This course takes the student through the process of developing a project. This process typically takes more than one semester to complete. Includes reviews and walkthroughs of the requirements, design, and implementation. Prereq.: CIS 740, CIS 748, CIS 771 plus three additional courses, and Program of Study filed.

IV. Normal Progress Towards the MSE Degree

Each semester of enrollment, a student must make *normal progress* towards the MSE degree. Normal progress is considered to be:

- a grade point average of 3.0 or better
- a supervisory committee and major professor chosen and a Program of Study filed after the completion of 12 credit hours.
- A coursework load of 9 credit hours each fall or spring semester (Distance Education students may take as few as 3 credit hours a semester)