UNIVERSITY OF MACAU
COMPUTER AND INFORMATION SCIENCE DEPARTMENT
CISB457 – Software Engineering Principles
Syllabus
1st Semester of Year 4
Part A – Course Outline

Compulsory course in Computer Science

Catalog description:
(2-2) 3 credits. The course discusses the theories, methods and tools of software engineering for developing large and complex software systems. The main contents are requirement specification, system modeling, architectural design, object-oriented analysis and design, verification and validation, and software testing. The Unified Modeling Language (UML) and its CASE tool are used to analyze and design the course project systems.

Course type:
Theoretical with substantial laboratory/practice content

Prerequisites:
None

Textbook(s) and other required material:
- Ian Sommerville: ***Software Engineering***, 9th ed. Addison-Wesley, 2011

References:
- Roger S. Pressman: ***Software Engineering: A Practitioner's Approach,*** 7th ed. McGraw-Hill, 2009.
- L. Maciaszek and B. Liong: ***Practical Software Engineering: A Case Study Approach***, Pearson Education, 2005.
- Craig Larman: ***Applying UML and Patterns***, 3rd ed. Prentice-hall, 2005.
- J. Arlow and I. Neustadt: ***UML2 and the Unified Process: Practical Object-Oriented Analysis and Design***, 2nd ed. Addison Wesley, 2005

Major prerequisites by topic:
None.

Course objectives*:
1. Introduce the concepts of software engineering. [a]
2. Specify and analyze software system requirements. [a, b, c, j]
3. Model software system design with UML. [a, d, j]
4. Verify and validate software systems. [a, d]
5. Apply software development technology to course project systems. [a, b, c, d, e, g, j]

Topics covered:
- **Introduction of Software Engineering (6 hours)**: Introduce the concepts of software, software engineering, software process, software process model, software costs, attributes of good software, software engineering methods and key challenges, professional and ethical responsibility, emergent system properties, system engineering, legacy systems, and system dependability, software development process models, process iteration, process activities, unified process, and Computer-Added Software Engineering (CASE).
- **Software Requirements Analysis and Specification (4 hours)**: Analyze and specify the requirements model, including functional and non-functional requirements, requirements engineering processes, requirements elicitation and analysis, requirements definition and specification, requirements validation and management, system models, use case diagram and conceptual class diagram, use case definition, pre and post condition and constraints.

- **Architectural Design (2 hours)**: Study the architectural design of software systems, including system architectural design decisions and views, architectural patterns and application architectures.
- **System Analysis, Design and Implementation (6 hours)**: Apply object-oriented method to developing software systems, including object concept and class identification, object-oriented design using UML, design patterns and implementation issues.
- **Verification and Validation (2 hours)**: Understand the concepts of software verification and validation, software inspection, automated static analysis, verification and formal methods, clean-room software development.
- **Software Testing (2 hours)**: Study the software testing, including system testing, component testing, white and black box testing, test case design and test automation.

Note: the topics of software project management are covered by an elective course CISB458: *Software Project Management*.

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	**Tutorial**	**Practice**				
2	2	Nil	14	56	3	2 / 2 hours

Student study effort required:

Class contact:	
Lecture	28 hours
Tutorial	28 hours
Other study effort	
Self-study	30 hours
Homework assignment	10 hours
Project / Case study	20 hours
Total student study effort	116 hours

Student assessment:
Final assessment will be determined on the basis of:

Homework	20%	Project	30%
Mid-term	20%	Final exam	30%

Course assessment:
The assessment of course objectives will be determined on the basis of:
- Homework, project and exams
- Course evaluation

Course outline:

Weeks	Topic	Course work
1,2,3	**Introduction of Software Engineering** • Concepts of software, software engineering, software process and model, software costs and attributes, software engineering methods and key challenges, emergent system properties, and system dependability, software development process models, process iteration, process activities, unified process, and Computer-Added Software Engineering (CASE).	Review UML and use its CASE tool, Assignment#1 & Course Project Instruction
4,5	**Software Requirements Analysis and Specification** Requirements model, functional and non-functional	Assignment#2 & Project

Weeks	Topic	Course work
	requirements, requirements engineering process, requirements elicitation and analysis, requirements definition, specification, validation and management.	Requirements Model
6	**Architectural Design** Architectural design decisions and views, architectural patterns and application architectures	Assignment#3 Project Requirements Model (revised)
7	**Mid-Project Presentation and Mid-Term Exam** Course project presentation on requirements model	Mid-term Exam
8,9,10	**System Analysis, Design and Implementation** Object concept and class identification, object-oriented design using UML, design patterns and implementation issues.	Assignment#4 & Project Design Model
11,12	**Verification and Validation** The concepts of software verification and validation, software inspection, automated static analysis, verification and formal methods, clean-room software development, System and component testing, white and black box testing, test case design and test automation.	Assignment#5 & Project System Validation and Testing
13	**Final-Project Presentation and Project Report**	Course Project Report

* one lecture date was on a public holiday.

Contribution of course to meet the professional component:
This course prepares students to work professionally in the area of software development.

Relationship to CS program objectives and outcomes:
This course primarily contributes to Computer Science program outcomes that develop student abilities to:

(a) An ability to apply knowledge of computing and mathematics appropriate to the programme outcomes and to the discipline
(b) An ability to apply knowledge of a computing specialisation, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models
(c) An ability to analyse a problem, and identify and define the computing requirements appropriate to its solution
(d) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, social and environmental considerations
(e) An ability to function effectively on teams to accomplish a common goal
(g) An ability to communicate effectively with a range of audiences
(j) An ability to use current techniques, skills, and tools necessary for computing practice with an understanding of the limitations.

Relationship to CS program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)		2					2				3		1	

Discrete Structures (DS), Programming Fundamentals (PF), Algorithms and Complexity (AL), Architecture and Organization (AR), Operating Systems (OS), Net-Centric Computing (NC), Programming Languages (PL), Human-Computer Interaction (HC), Graphics and Visual Computing (GV), Intelligent Systems (IS), Information Management (IM), Social and Professional Issues (SP), Software Engineering (SE), Computational Science (CN).

Course content distribution:

Percentage content for

Mathematics	Science and engineering subjects	Complementary electives	**Total**
0%	100%	0%	100%

Coordinator:
Prof. Chi Man Pun

Persons who prepared this description:
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