
The Module Form

CO 7206 Software Evolution and Reengineering

Credits: 20 **Convenor:** Dr. M. El-Ramly **Semester:** 1st

Prerequisites: none

Assessment: Coursework: 60%

Three hour exam in January: 40%

Lectures: 36 hours

Surgeries: 12 hours

Laboratories: 12 hours

Private Study: 90 hours

Subject Knowledge

Aims To understand the problems and issues associated with legacy software systems and the difficulties in reverse engineering comprehending, maintaining, evolving and reengineering them.

Learning Outcomes Students will have a good understanding of software aging phenomenon and the issues related to it. They will understand the challenges in renovating and maintaining legacy systems and the available methods for dealing with them. They will be able to make reasoned decisions on which reengineering methods to apply for certain types of legacy system renovation tasks.

Methods Class sessions together with course notes. Selected readings. Lab. work and assignments.

Assessment Marked coursework (2 to 6 quizzes - 2 to 6 assignments - 1 to 2 mini projects), written examination.

Skills

Aims To develop analytical and problem solving skills in dealing with legacy systems and software integration challenges. To develop on hands experience in reverse engineering and reengineering existing software systems.

Learning Outcomes Students will be able to apply the methods learned to assess the situation of a small scale legacy system, and decide on a suitable reengineering strategy for it. They will learn how to reverse engineer and reengineer moderate size legacy software systems using some of the available commercial and research tools.

Methods Class sessions together with lab. work.

Assessment Marked coursework (2 to 6 quizzes - 2 to 6 assignments - 1 to 2 mini projects), written examination.

Explanation of Prerequisites This module assumes that the student has reasonable programming experience in a high level language, preferably C, C++ or Java. It also assumes that the student has some feeling for the challenge inherent in trying to understand and modify old software or software that was written by other people.

Course Description Software development is not always a "green-fields" process. More often than not, new software engineers are hired to maintain and evolve existing systems, not to develop new ones. More often than not, if a new system is to be developed, it has to be integrated with other existing "legacy" software systems. Legacy systems are valuable software systems that are still in use but are difficult to maintain, change or migrate because they were developed with technologies of the past and/or because they were not engineered properly. Very often, these systems were developed without proper

documentation, version control, or proper design. Many such systems had undergone numerous changes by different people that violate the original system design, if any ever existed. As a result, it is challenging to understand, modify or migrate these systems. Fresh software developers are usually neither equipped with the necessary skills nor have the desire to work with these software "legacies". Fresh software development is usually considered superior to software maintenance and reengineering. The year 2000 problem and the deployment of the Euro gave rise to research and practice of software system reverse engineering and reengineering. Reengineering is "the examination of a subject system to reconstitute it in a new form and the subsequent implementation of the new form." [Chikofsky, and Cross II, 1990]. Part of any reengineering efforts is a reverse engineering process, which is "the process of analyzing a subject system with two goals in mind: (1) to identify the system's components and their interrelationships; and, (2) to create representations of the system in another form or at a higher level of abstraction." [Chikofsky, and Cross II, 1990].

In the Internet era, it is very important to have the skills to deal with legacy systems because it is not always the case that Web applications will be developed from scratch. In many cases it is required to open the available information systems to Web access or integrate them with other Web applications.

In this module we will be taking an introductory look at the main issues related to software systems aging and evolution. We will examine some of the available methods and technologies for software reverse engineering and reengineering as well as some of the managerial and planning issues specific to software reengineering projects.

Detailed Syllabus This module will cover the following topics as time permits.

Software Aging: How and why software systems age.

Legacy Systems: Their issues and challenges.

Introduction to Software Evolution, Maintenance and Reengineering.

Reverse Engineering: Program analysis methods, software complexity and maintenance metrics, program visualization.

Forward Engineering: Refactoring, code transformation, Web enabling.

Software Reengineering Strategies and Management.

Reading List

- [C] Ian Sommerville, *Software Engineering, 6th edition*, Addison Wesley.
- [C] Several Articles from different Authors, *IEEE Software Magazine*, IEEE.
- [C] DM. J. Harold and G. Roethermel, *Notes on Representation and Analysis of Software*, .
- [C] S.H. Kan, *Metrics and Models in Software Quality Engineering*, Addison Wesley.
- [C] Imagix Corporation, *Imagix 4D User Manual*, .
- [C] B. Braswell, G. Forshay and J. Martinez, *IBM Web-to-Host Integration Solutions*, Redbook Series IBM, 2002.

Resources The Software Technology Review (www.sei.cmu.edu/str/index.html) is a directed guide containing the latest information on more than 69 software technologies. It contains a useful glossary of Software Technology terms (www.sei.cmu.edu/str/index.html).

Module Evaluation Course questionnaires, course review.

General Information

1 Lecture Timetable

Day	From	To	weekly in	Room
Wednesday	13:30	14:30	weeks 2-12	BEN LT2
Thursday	17:30	18:30	weeks 2-12	BEN LT2
Friday	15:30	16:30	weeks 1-12	BEN LT2

The first lecture is on Friday 26th September.

2 Surgeries

Day	From	To	weekly in	Room
Monday	13:30	14:30	weeks 3-12	BEN LT5

The first surgery is on Monday 6th October.

3 Laboratories

Day	From	To	weekly in	Room
Thursday	14:30	15:30	weeks 2-12	MCS Lab

The first lab is on Thursday 2nd October.

4 Coursework There will be about 9 pieces of assessed coursework. However, this number may be adjusted as the course goes, after consultation with the students. The coursework will consist of 3 quizzes and five assignments, and one mini project (which is a major or big assignment). Each piece is worth 6% of the total course mark, excluding the mini project which equals 12%. Students will be handed an instruction sheet, prepare and make their submission. Assignments are due two weeks from the date of handing them. Tentatively, quizzes are scheduled for weeks 5, 8 and 11 and assignments for weeks 3, 5, 7, 9 and 11. The mini project will be announced on week 7 and collected on week 12.

Coursework accounts for 60% of the total module mark.

You should appreciate that coursework is an essential component of the module, both as an important part of the learning process and also as a significant factor in the formal assessment. In particular, failure to attempt a worksheet has two consequences; first, you will find it much more difficult to understand the material, and second, you will have to score higher on the exam than would otherwise have been the case in order to pass the module. If you fail the module and are granted a resit, **your original coursework marks will be blended in with your resit exam mark to give the resit total; you will not be allowed to attempt the coursework again.**

5 Examination Arrangements There will be a written examination in January which will account for 40% of the total module mark. Subject to approval by the external examiner.

You will have 3 hours in which to answer the paper.

6 Module Assessment Course work is worth 60% and the final exam is worth 40%

7 Attendance at Surgeries and Problem Classes The nature of students' academic obligations varies from course to course. In the case of all the Computer Science modules offered by the Department of Computer Science, the obligations include attendance at all surgeries and laboratories. The surgeries and supervised laboratories offered on these modules make a vital contribution to the learning process needed if you are to pass the module. Experience has shown that students who fail to attend these sessions do significantly worse than those who do attend. It has therefore been decided that attendance at all surgeries and laboratories is a **requirement of this module** and registers of attendance will be kept. The department can decide that students who do not attend have **failed the module**. In addition, your attention is drawn to the University's regulations to the effect that students may be reported to the Faculty Board for serious neglect of their academic obligations. This can result in a variety of actions, such as a formal warning from the Dean or Sub-Dean of the Faculty, or even, in severe cases, a recommendation to Senate that the student's course be terminated.

In the event of your missing a surgery or laboratory due to illness or other such reasons, it is essential that you inform the module convenor so that this fact can be recorded. If you are having problems, you should discuss them with the module convenor and/or your personal tutor (or other members of staff as appropriate).

8 Late Submission of Course Work Please note that every assessed worksheet has associated with it a deadline for submission. We need you to meet these deadlines, since it is in your interest that we keep to the prearranged timetable for the marking and return of coursework so that you receive constructive feedback on your progress in good time.

As a result of the need to get your work marked, the deadline stated for each worksheet is a **strict deadline**, that is there will be **no extensions** and work handed in late may receive **no marks**. In the event of your being unable to do a worksheet because of illness or other bona fide reason, allowance will be made provided that a medical certificate or other adequate documentary evidence is produced (see the section on Self Assessment).

In view of the importance of handing in work on time, you need to make a conscious effort to organize your time effectively. Note in particular that when we allocate, say, three weeks for a worksheet, we mean that it will take you three weeks (allocating the correct proportion of your time to the module) to carry out the work. You will not be able to meet the deadline if you spend two and a half weeks on something else and then try to do all the work in the last three days.

9 Plagiarism The University takes the issue of plagiarism very seriously. While you may certainly ask the lecturers for help if you are having difficulties on any part of the worksheets, and while you may discuss the worksheets with other students in general terms, the work you hand in must be your own. **Copying other people's work is a form of plagiarism, is strictly forbidden, and will result in all the people concerned being given no marks.** Given that coursework assignments (unless stated otherwise by the lecturer) are required to be individual pieces of work, this means that submitting work done in close collaboration with another student is also regarded as plagiarism, and any such submitted coursework will result in no marks for all concerned.

You should read the statement concerning plagiarism, which can be found in the MSc Handbook.

The Department operates the principle that both the plagiarised and the plagiariser are equally guilty. Students are therefore responsible for ensuring that their work is not plagiarised, and note that this includes ensuring that any work stored on the departmental and/or university computer systems is suitably protected.

Note that the Department reserves the right to exact any penalties which are in accordance with the University's code of practice on plagiarism. However, the following describes our normal procedure:

1. In all cases where plagiarism is committed, zero marks are awarded for the piece of coursework plagiarised. Relevant tutors, other departments etc will be informed where appropriate.
2. In all cases, the Department will exact additional penalties, in line with the University guidelines. For students registered in this department, the penalties are:
 - (a) First offence: warning from tutor and module convener;
 - (b) Second offence: departmental warning letter;
 - (c) Third offence: deduction of 10% from the module mark (with a further warning letter);
 - (d) Fourth offence: the module mark will be reduced to 0 (with a further warning letter);
 - (e) Fifth offence: reduction of final degree classification by one class;
 - (f) Sixth offence: recommendation of termination of course.

Offences would normally be cumulative **throughout the degree programme**.

For students registered outside this department, the first steps listed above will normally be followed, and the other department will be kept informed. Repeated offences will result in severe penalties which will be decided by (or in conjunction with) the other department.

Offences would normally be cumulative throughout the degree programme.

10 Self Certification The University is now operating a system in which students fill out a self certification form if they are absent from the University due to illness or physical incapacity for a period of less than five working days, where this has resulted in

- absence from teaching sessions at which attendance is compulsory;
- a failure to meet submission deadlines;
- interrupted study to a significant extent.

It is the responsibility of the student to make all reasonable efforts to hand in coursework to the Department on time, even if absent due to ill health. The Department will accept coursework handed in by other people, and also by mail, as long as the date on the post mark of the submission is the submission date (or earlier). If a student is too ill to get to a post box then we would strongly recommend the student call out a doctor.

In the case of electronic submission, late submission will be accepted as long as the last modification date of the relevant files is for the submission date (or earlier).

The self certification form can be obtained from the Departmental Office, and must be completed and returned to either the Departmental Office or the student's personal tutor within the first three days of return to the University. **SELF CERTIFICATION FORMS WILL NOT BE ACCEPTED IF RETURNED TO THE DEPARTMENT AFTER THE THREE DAY PERIOD.**

For a period of absence of five days or longer a medical certificate is still required.

Medical certificates and self certifications will be taken into account when producing the final mark for a module, and also when final degree classifications are being decided.