CE 109   COMPUTER APPLICATIONS IN ENGINEERING

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Lecturers: Dr. K. Ramachandran (KR)
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Structure: 18 contact hours

Links: see below

Aims
This course module aims to introduce students to the computing system at Imperial College and to teach how computers may be used to solve civil and environmental problems. In the first part, students will be encouraged to learn word processing and spreadsheets. Later Fortran 95 programming will be taught with a series of formal lectures followed by interactive tutorials and laboratory sessions. Finally the algebra solving software MAPLE will be introduced.

Links with other Course Modules
This course module is not dependent on other modules, but is relevant to the overall MEng programme. The material covered in this module is necessary for several other course modules and particularly useful for modules CE208 (Computing for Engineering), CE304 (Systems Engineering), CE308 (Computational Engineering Analysis), CE411 (Systems Analysis) and CE402 (Structural Dynamics).

SYLLABUS
1)   Computer Systems (5 laboratory sessions): **(RW)**
- exercise, a second spreadsheet example for submission as coursework. Introductory session: networked computing facilities at Imperial College, user registration and regulations, file handling and storage, word processing facilities, hands-on start-up session with supervision (*during induction weeks).*
- Use of spreadsheets for engineering applications: supervised tutorial session, a simple spreadsheet
- Introduction to 'MAPLE': algebra, calculus, curve plotting, visualisation, etc.

2)   Computer Programming with FORTRAN (6 lectures/2 lab. sessions): **(KR)**
- Introduction to programming: components of a computer, the programming process, FORTRAN programming language, numerical constants and variables, READ and WRITE statements.
- Assignment: the assignment statement, arithmetic operations, arithmetic expressions, intrinsic functions.
- Conditional IF statements: logical IF statement, general IF statement, nested IF statements, logical expressions, relational operators, logical operators.
- Flow control and arrays: DO loops, GO TO, CONTINUE, STOP, EXIT, CYCLE statements
- Subroutines and Functions; Character Variables
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Coursework and submission dates
1) <u>Spreadsheet exercise</u>:   use of EXCEL on a simple engineering problem.
2) <u>MAPLE assessment #1</u>:   application of functions and graphics to a beam problem.
3) <u>MAPLE assessment #2</u>:   solution of a damped and forced vibration problem.
4) <u>FORTRAN Programs</u>:   Writing a number of Fortran programs to solve civil engineering problems.

Assessment
This course module is assessed through supervised assignments only (no formal examination).

Recommended Textbooks
METCLAF, MICHAEL AND REID, JOHN. 'Fortran 90/95 explained', Oxford University Press.
ELLIS, T.M.R., PHILLIPS, I.R AND LAHEY, T.M. 'Fortran 90 Programming', Addison Wesley
CHAPMAN, S J. 'Introduction to Fortran 90/95', McGraw Hill.

Learning Outcomes
At the end of the course module the student should be able to:

- Use departmental computers for all aspects of their coursework, especially the computer tools required for report submission,
- Use the spreadsheet application EXCEL for numerical problem-solving and for visualisation.
- Use MAPLE for both numerical and symbolic problem-solving as well as for the visualisation of functions and solutions.
- Appreciate the programming process in general, including the compilation-execution-modification cycle.
- Appreciate the steps involved in computer-based problem-solving.
- Write simple programs using the FORTRAN language.