COMPUTATIONAL METHODS

SCHEDULE OF LECTURES AND CLASSES - SUMMER SEMESTER 2012/2013

CIVIL ENGINEERING II YEAR

W.	LECTURES (1H/WEEK)	LAB EXERCISES (2H/WEEK)
1	Computer simulations in mechanics and enginnering. Mathematical modelling.	ROBOT package - introduction, solution of a frame - exercise.
2	Local and global formulation of BVPs. Weighted residual, Galerkin method, approximation.	MATLAB language - recap and new instructions.
3	Finite element method (FEM).	Approximation using interpolation functions.
4	FEM for framed structures.	Solution of ODE using FEM - exercise. FEM solution for a beam (assign't 1).
5	FEM for framed structures - truss example.	FEM solution for a beam (assign't 1 cont'd).
6	FEM - truss example (cont'd).	FEM solution for a truss using CALFEM (assign't 2).
7	FEM formulation for 2D problems - stationary heat flow.	FEM solution for a truss (assign't 2 cont'd). Solution of example test problems.
8	Overview of 1D/2D/3D elements. Conditions for solution convergence.	FEM solution for a frame using CALFEM.
9	FEM for stationary heat flow - example.	FEM simulation of heat flow (assign't 3).
10	FEM for 2D problems - statics of a panel.	FEM simulation of heat flow (assign't 3 cont'd).
11	FEM for plane stress statics - example.	Computation of stresses in a panel using FEM - ROBOT package (assign't 4).
12	Estimation of approximation error.	Computation of stresses in a panel using FEM (assign't 4 cont'd).
13	FEM for different structures. Isoparametric elements.	Computation of stresses in a panel using FEM (assign't 4 cont'd).
14	Simulations of frame buckling and vibrations using FEM.	Delivery of assignments. Solution of example test problems.
15	Test no. 2.	Delivery of assignments.

REQUIREMENTS AND GRADING

- In order to obtain a positive grade the student is obliged to pass two tests and deliver the reports on 4 assignments:

  exercise - check of equilibrium equations for a frame,

  assign't 1 - solution of a beam using ROBOT and MATLAB script,

assign't 2 - solution of a truss by hand and using CALFEM,

assign't 3 - simulation of two-dimensional heat flow using HEAT-MIL and CALFEM,

assign't 4 - solution of two-dimensional statics problem using ROBOT.

The presence at lectures and laboratory exercises is compulsory. If an assignment report is delivered with a delay, the grade will be lowered. Exercise as well as assignments 1 and 2 have to be delivered before test 1, assignment 3 before test 2. Assignment 4 must be delivered by the summer break.

- Test 1 will take place at additional class in week no. 8 and cover lectures 1-6 and labs 1-7. Test 2 will take place at lecture 15 and cover lectures 7-13 and labs 8-13. There will be one more opportunity to take each of the tests after the results are announced. For those who do not pass (one of) the two tests, additional tests can be held in the first half of September, but only for the students who have a positive grade for laboratory classes and scored at least 30% of points to be obtained in tests 1-2.

- The grade recorded in student's index book is computed as:
0.5 * lab grade + 0.5 * average grade from 2 tests.

TEACHERS

LECTURES: Prof. J. Pamin

CLASSES: Dr J. Jaśkowiec (coordinator)
Dr P. Mika, Dr S. Milewski, Dr P. Pluciński,
Dr A. Stankiewicz, Dr A. Wosatko, Ms M. German

RECOMMENDED (*) AND SUPPLEMENTARY READING

1. (*) P.-E. Austrell et al, CALFEM - a finite element toolbox, version 3.4, Structural Mechanics, LTH Sweden 2004.
2. Cz. Cichoń, W. Cecot, J. Krok, P. Pluciński, *Metody komputerowe w liniowej mechanice konstrukcji*, Skrypt PK, Kraków 2010.
3. (*) R.D. Cook, *Finite Element Method for Stress Analysis*, J. Wiley & Sons 1995.
4. C.A. Felippa, *Introduction to Finite Element Methods*, University of Colorado, http://www.colorado.edu/engineering/CAS/courses.d/IFEM.d/Home.html
5. (*) N. Ottosen and H. Petersson, *Introduction to the Finite Element Method*, Prentice Hall 1992.
6. M. Radwańska, *Metody komputerowe w wybranych zagadnieniach mechaniki konstrukcji*, Skrypt PK, Kraków 2004.
7. G. Rakowski, Z. Kacprzyk, *Metoda elementów skończonych w mechanice konstrukcji*, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.
8. (*) Online documentation of ROBOT.
9. (*) WWW.L5.pk.edu.pl - instruction documents online.