Module title: Advanced numerical analyses

Module code: 24-14-603-02

Module credit: 3

Module objectives: This course is presented for graduate students in mechanical engineering. For provide wisdom in to numerical methods, this course has been organized into parts and has been presented unifying information through the motivation, mathematical background, orientation and epilogue elements. The main goal of this course is to enable the students for solving of complex mechanical engineering problems as numerically.

Term: Fall-September

Text: Numerical methods for engineers, Steven c. Chapra, Raymond p. Canale, sixth edition, 2010

Instructor information:

Name: Dr. Samira Payan
Academic rank: Associate professor
Email address: s_payan_usb@eng.usb.ac.ir

Assessments: The students learning will be evaluated according to the below table:

Attendance:	10%
Homework(computer codes and highlighted exercises):	10%
Mid-term exam:	20%
First mid-term(in classroom)	
Second mid-term(in computer room)	
Final-term exam:	60%

References

[1] Numerical methods for engineers, Steven c. Chapra, Raymond p. Canale, sixth edition, 2010.
[2] Numerical Methods for Scientists and Engineers, R. W. Hamming, second eddition, 1987.
[3] Analysis of Numerical Methods, Eugene Isaacson and Herbert Keller, 1994.
[٤] روشهای محاسبات عددی، دکتر بهروز قلی زاده، چاپ ششم، ١٣٩١.
[٥] محاسبات عددی، دکتر اسماعیل بابلیان، دکتر خسرو مالک نژاد، چاپ اول، ١٣٦٦

Module subjects:

1st week: Mathematical modeling and engineering problem solving
2st week: Approximations and round-off errors
3st week: Truncation errors and the Taylor series (numerical differentiation)
4st week: Root of equations
5st week: Linear algebraic equations
6st week: Unconstrained optimization

7st week: Constrained optimization

Mid-term exam

8st week: Curve fitting-interpolation
9st week: Curve fitting-Fourier approximation
10st week: Numerical integration
11st week: Ordinary differential equations (Rung-Kutta methods)
12st week: Ordinary differential equations (stiffness and multistep methods)
13st week: Ordinary differential equations(boundary-value and eigenvalue problems)
14st week: Partial differential equations(finite difference equations: elliptic equations)
15st week: Partial differential equations(finite difference equations: parabolic equations)
16st week: partial differential equations(finite element method)

Final-term exam