LEARNING MODULE DESCRIPTION

GENERAL INFORMATION

1. Module title: From polynomials to wavelets: introduction to the theory of approximation
2. Module code:
3. Term:
4. Duration: 30 h of lectures + 30 h of exercises
5. ECTS:
6. Module lecturer: prof. dr hab. Leszek Skrzypczak
7. E-mail: lskrzyp@amu.edu.pl
8. Language: English

DETAILED INFORMATION

1. Module aim (aims)

The aim of the module is to introduce the main concepts and ideas of modern approximation. However, the classical approximation results will also be presented as a background and motivation for the modern concepts. After the course the student should be able to use main approximation schemes in different mathematical problems and in application

2. Pre-requisites in terms of knowledge, skills and social competences (where relevant)
   It is assume that students have basic knowledge in mathematical analysis, e.g. in the scope of modules Analysis I, II, III offered by Faculty of Mathematics and Computer Science

READING LIST

1. O.Christensen, K.L.Christensen, Approximation theory. From Taylor polynomials to wavelets, Birkhauser 2004
2. O.Christensen, Function, Spaces and expansions. Mathematical tools in physics and engineering, Birkhauser 2010
3. O.Christensen, Frames and Bases. An introductory course. Birkhauser 2008
4. E. Hermander, G.Weiss, A first course in wavelets. CRC Press 1996
5. G.G.Lorentz, Approximation of Functions, AMS Chelsea Publishing 1986
6. P. Wojtaszczyk, A mathematical introduction to wavelets. Cambridge University Press 1997

SYLLABUS:

Week 1: Approximation by polynomials: Taylor's theorem, Weierstass' theorem, Bernstein polynomials
Week 2: Approximation in norm linear spaces: convexity and the best approximation problem.
Week 3: Approximation in Hilbert spaces.
Week 4: Quantitative questions: modulus of continuity and modulus of smoothness
Week 5: Theorems of Jackson and Bernstein type
Week 6: Theorem of Stone-Weierstrass
Week 7: Series in Banach spaces: convergence, absolute convergence and unconditional convergence.
Week 8: Orthogonal and orthonormal bases in Hilbert spaces
Week 9: Bases and unconditional bases in Banach spaces
Week 10: Fourier transform on real line
Week 11: Multiresolution analysis
Week 12: Construction of wavelets via multiresolution analysis. Examples of wavelet systems.
Week 13: Best N-term approximation
Week 14: Widths: approximation numbers, Kolmogorov numbers, entropy numbers
Week 15: Approximation of operators.