ACADEMIC YEAR 2023-24
Programa regional de DOUTORAMIENTO EM MATEMÁTICA
UNIVERSIDADE CABO VERDE

BASES IN BANACH SPACES

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Course objectives: The objective of this module is to learn the concept of basis in Banach spaces and some special type of bases in particular Banach spaces. It is intended as a background module for the study of nonlinear approximation with the greedy algorithm.

The intended topics to be covered in the course are the following:

1. **Banach spaces**. Definitions and first results.
2. **Example of Banach spaces**. Lebesgue spaces and spaces of sequences.
3. **Linear operators in normed vector spaces**. The dual of a Banach space.
4. **Review of Hilbert space theory.** Inner product and orthonormal bases.
5. **Bases and Schauder bases.** Definitions and examples.
6. **Unconditional bases.** Equivalent conditions for unconditional bases.
7. **Exponential basis.** Properties of exponential bases in Lebesgue spaces.
8. **Haar basis**, Properties of the Haar basis in Lebesgue spaces.
9. **Wavelet bases**. Unconditionality of wavelet bases in Lebesgue spaces.

REFERENCES

[AK] F. Albiac, N.J. Kalton, *Topics in Banach Space Theory,* Second Edition, Springer, 2016.
[HW] E. Hernández, G. Weiss. *A First Course on Wavelets* CRC Press, 1997.
[LT] J. Lindenstrauss, L. Tzafriri. *Classical Banach Spaces, I*. Springer, 1997.
[R] W- Rudin, Functional *Analysis*, McGraw-Hill. 1973.
[S] I. Singer. *Bases in Banach Spaces*. Springer, 1970.

SCHEDULE

April 1, 3, 5, 8, 10, 15, 17 and 19 from 14:30 to 16:30, Cabo Verde time.

Room: Videoconference

Evaluation: Written homework with the exercises proposed in class.