Current subject area:
Physics

Status	**Course code / number in the book: F.2** ***Fundamental problems of quantum mechanics*** **Taught by: Volodymyr Tkachuk**			
Acad. cycle	**ECTS credits**	**Duration**	**Semester**	**Contact hours**
Master	5	1 semester	Autumn	48
Year of study	**Weekly lectures/seminars**		**Prerequisites**	
1st	2 / 1		Quantum mechanics	
Languages	**Examination**		**Assessment**	
English	Written exam		100-point scale	

Aims and objectives: provide with knowledge of physical phenomena in quantum information. Main objectives are to analyze the fundamental problems of quantum mechanics processes in the framework of quantum information. These issues are of particular interest due to recent experimental achievements in this area.

Intended capabilities: to know foundations of quantum information, namely, theoretical basis of quantum cryptography, quantum teleportation, quantum computing and quantum computers, decoherence; to be capable of solving basic problems of quantum information.

Description. The course covers the following topics: Mathematical foundations of quantum mechanics; Two state quantum systems; Quantum communications; Quantum computing and quantum computers; Measurement in quantum mechanics; Geometry of quantum state space; Evolution of a quantum system; Decoherence; Operator identity and mean value of functions of bosonic operators.

Reading list:

1. P. A. M. Dirac. *Principles of Quantum Mechanics*, Oxford University Press, 1967.
2. A. Einstein. “Can quantum-mechanical description of physical reality be considered complete”. *Phys. Rev.* **47**, 777–780 (1935).
3. *Bell’s Theorem, Quantum theory, and Conception of Universe*, ed. by M. Kafatos. Dordrecht: Kluwer, 1989.
4. M. A. Nielsen, I. L. Chuang. *Quantum Computation and Quantum Information*, Cambridge University Press, 2000.
5. W. H. Zurek “Decoherence, einselection, and the quantum origins of the classical”. *Rev. Mod. Phys.* **75**, 715–765 (2003).