

CERTIFICATE IN QUANTUM COMMUNICATIONS

Quantum Information Science (QIS) encompasses efforts to develop quantum computers, quantum sensors, and secure communications networks, all of which obtain some advantage over their classical counterparts due to the intrinsic properties of quantum mechanics. South Dakota Board of Regents approved an 11 cr. hr. certificate in quantum communications at their Dec 4, 2023 meeting. This **CERTIFICATE** can be added to any engineering or science degree, providing an introduction to quantum computing, with training in photonics and quantum key distribution networks. The certificate requires 3 courses, including 2 laboratory courses offering hands-on training, for a total of 11 credits.

NANO 406/506/L Introduction to Quantum Computing and Applications (3+1 Cr. Hr.) Offered SP24

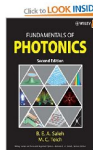
The course integrates the foundations of quantum computing with a hands-on coding approach to this emerging field. Topics include the principals of quantum computing, contemporary hardware, development libraries available for quantum computing, quantum machine learning and quantum error correction.



[Jack D. Hidary, Quantum Computing: An Applied Approach, Springer](#)

NANO 404/504 Nanophotonics (3 Cr. Hr.) Offered FA24

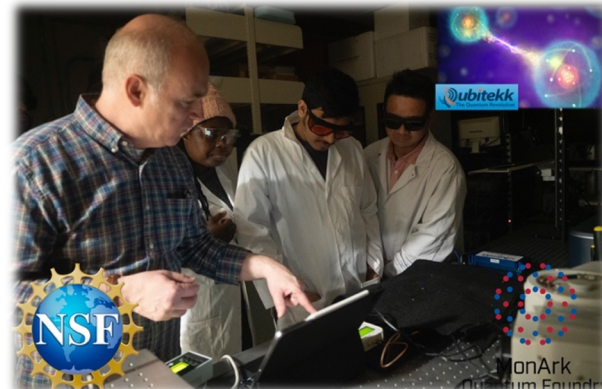
Photonics is a broad term referring to the generation, control and measurement of coherent light sources -- primarily continuous wave and pulsed lasers. This course will introduce students to the study of photonics and give background necessary to design and utilize optical systems which control and manipulate laser sources.



[Bahaa E.A. Saleh, Fundamental of Photonics, Wiley](#)

NANO 405/505/L Quantum Photonics and Communications (3+1 Cr. Hr.) Offered SP25

A leading effort towards secure communications involves the exchange of cryptographic keys using a quantum network, so called quantum key distribution (QKD) systems. This is a second course in photonics, focusing on key electrooptic components of optical communications networks, with special attention to quantum key distribution (QKD) systems. These networks include lasers, single photon emitters and detectors, modulators and fiber optic components.



[Students making single photon measurements in quantum photonics & comm. laboratory section.](#)