INFORMATION ON DOCTORAL DISSERTATION

Title of Thesis:

RESEARCH AND DESIGN OF SOI-BASED PHOTON INTEGRATED CIRCUIT FOR MODE DIVISION MULTIPLEXING SYSTEM

Specified field of study: **Electronic Engineering**

Code of specialty: **9.52.02.03**

Name of PhD candidate: **Duong Quang Duy**

Committees:

1. Associate Professor Doctor Dang Hoai Bac

2. Doctor Truong Cao Dung

Academic Institution: **Posts and Telecommunications Institute of Technology**

NEW RESULTS OF THE DISSERTATION

1. Design of two- and three-mode (de)multiplexer photonics devices that are independent of polarization. In particular, the rib/ridge waveguide structure is optimized for MMI and Y-Junction devices so that the generated device can conduct both TE and TM polarization with high optical efficiency. Numerical simulation shows that the optical performance of (de)multiplexer devices for two modes independent of polarization compared with devices that only support (de)multiplexer for two unipolar modes is not significantly different, even better.

While the proposed device for three-mode pairs has excellent optical performance, it is much better than the recently announced three-mode (de)multiplexer devices.

2. Implementing different interference mechanisms on cascaded MMI devices, combined with the Y-piece has resulted in 1 × 3 MSR devices for two and three TE- polarized modes. The proposed components use ITO-heated TOPS with relatively low power consumption and optimal controllability by only two control states ON and OFF. The proposed MSR components have also demonstrated efficient optical performance across the entire *C* band.

3. Applying the general and symmetrical interference mechanism of the MMI device together with the ability to equally divide the power of the symmetric Y-Junction device under the condition of matching the effective refractive index (MEI), the design of devices that generate two and three TE- polarized modes from base TE_0 mode. By numerical methods 3D-BPM and EIM, the proposed structures have been shown an optical performance extending to 140 *nm* of the active wavelength (around 1550 *nm*), within the maximum allowability of I.L is -2.3 *dB*. Considering in *C* band, the I.L index of the proposed device ranges from -0.04 *dB* to -0.65 *dB*.

APPLICATION AND USED IN THE REAL WORLD OR FUTURE WORKS

The designs, although published in reputable journals and performed using proven commercial software, can be applied to an actual photonic component fabrication process with photolithography technologies such as DUV-photolithography or ebeam lithography. Due to the current equipment in the country cannot meet, so cooperate with research groups

and advanced laboratories in the world such as Japan, Australia, Belgium, Taiwan ... to be able to manufacture, measuring and testing proposed designs is absolutely essential.

Research supervisors	**PhD candidate**
Associate Professor Doctor Dang Hoai Bac	**Dương Quang Duy**