The centre for laser and photonics is one of the distinguished institutions throughout the country which combines cutting-edge technology from engineering and theoretical advances in science to create new horizons in the ever growing field of photonics. The interdisciplinary centre derives its roots from various other departments (Electrical Engineering, Mechanical Engineering, Aerospace Engineering, Civil Engineering, Physics and Chemistry) and pursues research in the fields of Optical Communication, Laser Fabrication, Semiconductor Photonic Devices, Optical Imaging, Ultrafast Optics, Quantum Computing, Material Processing, LiDAR/Laser Scanning, Bio-Photonics and other related fields.

The diversity of background of students from various departments allows them to perform a wide variety of research and hence develop skill sets which are perfect to work in different environments and industries. Over the period of time the department has earned its reputation in the industries as well as research groups by contributing in preparing and producing good students to many industrial organizations. Our alumni are working in prestigious organizations such as DRDO, BEL, MathWorks, Intel, Texas Instruments, GE, Tata Steel, Sasken, Niksun, ASML, TSMC, Infinera to name a few.
The Centre for Lasers and Photonics is the premier educational centre in the country that offers multifaceted education and training in light related technologies spanning multiple engineering disciplines. Apart from the state-of-the art facilities we have a dynamic, open and research focused environment, where students get to participate in skill development and contribute to creation of new knowledge.

During the course work we train students in critical thinking that emphasizes on development of fundamental understanding in Photonics science and engineering. Intensive courses on computational modelling and experimental skills are provided to them so that they are ready to undertake the most challenging research problems as part of their thesis work. Such all-round development of scientific skill set that we offer is probably unique in the country.

The faculty in this interdisciplinary centre are drawn from Aerospace Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Chemistry and Physics. Apart from these areas the students take up courses across the institute depending on their research interests, and furthermore, they are exposed to path-breaking ideas from visitors across the world, drawn from both academia and industry, through visits, seminars and colloquia in the Institute.

I believe our students are ready to take on the world and develop into industry leaders who will set the agenda for the future. I wish them all the best in their future endeavours.
The department offers the following degrees:

- Master of Science (M.S.)
- Master of Technology (M.Tech)
- Doctor of Philosophy (Ph.D.)

Students admitted to all PG programmes are required to take the following core courses:

1. PSE 601: Introduction to Photonics
2. PSE 602: Principles of Lasers and Detectors
3. PSE 604: Photonic Systems and Applications
4. PSE 605: Photonics Lab Techniques

M. Tech students enrol for an additional four electives taken across from various departments in second semester and then register for thesis credits in the last two semesters. M.S and PhD students enrol for thesis credits after clearing the department core courses.

The course work offered by the department and electives available from various core branches are integrated well enough to develop the research as well as the industry-oriented knowledge among the students. These courses not only develop strong theoretical fundamentals of the field but also help students acquire experimental skills through a specially designed laboratory course.

Students of this programme also have knowledge of programming and modelling skills in domains such as Comsol multiphysics, MATLAB, python, C, C++, PSPICE, optilux, CUDA GPU programming, etc.

Hands-on experience on lasers through laboratory course
1. **Optical Communication Laboratory**

Lab In-charge: Dr. K Pradeep Kumar

The major research areas of this lab are:
- Quantum Cryptography
- Nonlinear fiber Optics
- Optical Fiber Communications
- Fiber-optic lasers and modelling

This lab develops single-photon detectors, single and subcarrier RF transceivers, and true random number generators.

2. **Ultrafast Laser Laboratory**

Lab In-charge: Dr. D. Goswami

The major research areas of this lab are:
- Femto second pulse shaping
- Nonlinear Spectroscopy
- Quantum computing
- Multidimensional Spectroscopy
- Development of Optical Analogue of MRI

Facilities/Software’s in the lab include:
- Beam Chamber
- Ti-Sapphire Laser
- Altium
- Protel
- NI LabView
- Arbitrary Wave form Generator
- Femtosecond laser and Micromachining system
3. Optoelectronics and Nanofabrication Laboratory

Lab In-charge: Dr. Utpal Das

The major research areas of this lab are:
- Multi-quantum Well Intermixed Waveguide Grating Assisted Couplers
- High Speed Waveguide Photodiodes
- SiGeC/SiC Quantum Dash LEDs on silicon by spin-on technique
- Photodiode Arrays

Facilities in the lab include:

- Optical Bench and Optical waveguiding setup
- Reactive Ion Etch System
- Photolithography room
- Optical Surface Profiler
4. Photonics Laboratory

Lab In-charge: Dr. R.Vijaya

The major research areas of this lab are:
- Photonics
- Non-linear Optics
- Photonic crystals
- Optical Nano structures
- Fiber Optics

Facilities in the lab include:

- DC/RF Magnetron Sputtering System Facility for Thin Film Deposition
- Pulsed Laser Facility: Mode Locked Pico-Second Laser
- Spectro Photometer
5. Optical Metrology and Imaging Laboratory

Lab In-charge: Dr. G.Rajshekhar

The lab develops novel optical techniques for precision metrology. The relevant application areas include surface characterization, 3D shape sensing, non-destructive inspection and biomedical imaging.

The experimental techniques being investigated in the lab involve:
- Digital holography
- Fringe Projection
- Quantitative phase microscopy

The computational research involves the development of robust signal processing techniques in optical imaging. Some relevant problems include:
- Phase retrieval methods
- Phase gradient estimation
- High performance techniques

6. Bio-photonics Laboratory

Lab in-charge: Dr. Asima Pradhan

The main research areas of this lab include laser spectroscopy and bio photonics. Following facilities are available:
- Micro-Raman Facility
- Fluorolog Spectrofluorometer
- Cryostat
- ANDOR CCD-Spectrograph System
7. Microfluidics and Sensor Laboratory

Lab In-charge: Dr. P.K. Panigrahi

The major research areas of this lab are:
- Holography
- Particle Image Velocimetry
- Laser induced Fluorescence
- Laser Schlieren

Facilities in the lab include:

- Confocal Microscopy
- Mach-Zender Based Interferometer
- Laser/Colour Schlieren System
- Liquid Crystal Thermography
• Stimulated Brillouin Scattering
• Quantum Key Distribution
• Study and simulation of helical bend loss in optical fibers
• Coherence characterization of broadband laser generated by four wave mixing in a ring cavity
• Replicating photonic crystals for anti-reflecting surfaces – experiment and modelling
• Study of Stimulated Raman scattering (SRS) in toluene and the threshold for anti-Stokes generation
• Fluorescence correlation spectroscopy
• Deep learning in photonics communication
• Erbium doped fiber laser
• Optical tweezers
• Investigation of state space methods for optical fringe analysis
• Carrier recovery for coherent optical communication links
## Ongoing Projects

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Prof. H Wanare
Area of Interest: Quantum Optics, Imaging in Complex Media & Biological Tissues
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Dr. Pradeep Kumar K
Area of Interest: Quantum cryptography, Quantum Optics for gravitational wave detectors, Fiber-optic communications, Photonics
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Prof. Utpal Das
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Prof. D Goswami
Area of Interest: Femtosecond Pulse Shaping, Nonlinear Spectroscopy, Coherent Control, Multiphoton Imaging, Quantum Computing.
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Area of Interest: Laser spectroscopy, Bio-medical applications of lasers
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Prof. K Muralidhar
Area of Interest:
Interferometric Tomography
Laser & Rainbow Schliern
Imaging Growth of Protein Crystals
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Prof. Bharat Lohani
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Laser imaging and cross-section
Flash and scanning laser applications
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Prof. Sudhir Kamle
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Experimental Stress Analysis
Smart Materials
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Dr. Naren Naik
Area of Interest:
Development and analysis of reconstruction, algorithms for nonlinear tomography, shape-based tomography, subsurface imaging
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Dr. G Rajshekhar
Area of Interest:
Quantitative Phase Imaging, Optical Metrology, Applied Signal Processing, Fringe Analysis, Biophotonics
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Dr. Saurabh Mani Tripathi
Area of Interest:
Fiber and integrated optics, infrared and terahertz frequency sensors, long-period gratings, fiber optic Bragg gratings, plasmonics and metamaterials
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