

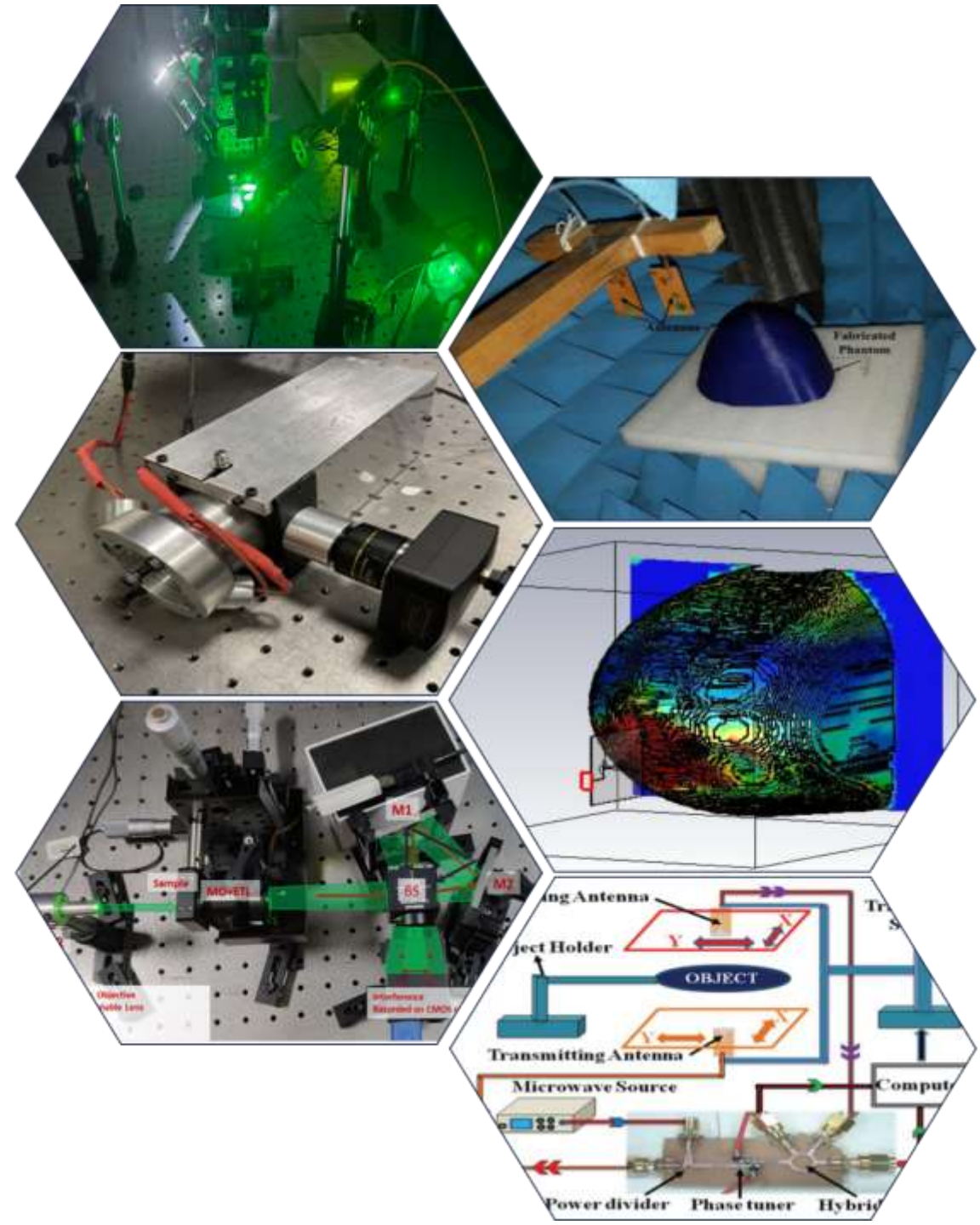


राष्ट्रीय प्रौद्योगिकी संस्थान दिल्ली
National Institute of Technology Delhi
(An autonomous Institute under the aegis of Ministry of Education, Govt. of India)

AROMA

ऑप्टिकल एवं माइक्रोवेव अनुप्रयोगों में उन्नत अनुसंधान
Advanced Research in Optical & Microwave Applications
(AROMA Lab Room No 225, Mini campus)

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Optical imaging

- Digital holography
- Phase imaging
- Biomedical imaging
- Fringe projection

Spectral imaging

- Visible & NIR

Research Domains

Sensing

- Fiber based VIS/NIR

Instrumentation

- Optical (Visible & NIR)
- Microwave Holography

Visible Range Instruments

Sources & Detectors

Sources



Laser diodes



He-Ne Gas laser



Light Emitting Diodes

Laser Diodes: Range of 402 – 990 nm

He-Ne Gas Laser: 638 nm

LEDs: Range of 400 nm – 800 nm and Broadband white light LEDs

Applications in – Digital holography, biomedical imaging, microscopy, fringe projection, spectroscopy / spectral imaging

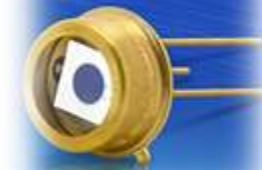
Detectors



CMOS camera



Line detector



Single pixel detector

CMOS camera: High resolution (2448 X 2048 px) with 8,10,12 bit resolution monochrome and colour cameras.

Line detector: 1X256 px., 400-1100 nm

Single pixel detector: 800 – 1700 nm

Visible Range Instruments

Optics

Optics



Linear Variable Filter



Telecentric Lens



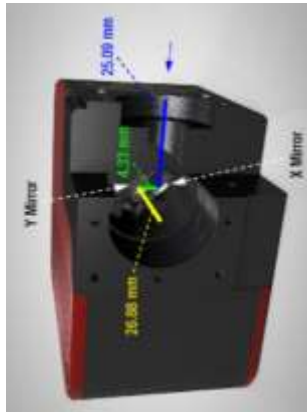
Variable Numerical Aperture
Microscope Objective



Electrically Tunable Lens



VIS - Blazed Grating



Computerized Galvo
Scanner



Shearing Interferometer
(for Collimation)

Optics:

- Range of broadband achromatic Lens (f: 2cm-100cm)
- Cylindrical lens, Large diameter lens (75mm).
- Front coated broadband mirrors (1" and 2").
- Transmission gratings (VIS)
- USAF Test charts (1" and 3")- Positive, Negative
- Microscope objectives (10X – 60X)

Some Special Optics:

- Linear variable filter (400-750 nm)
- Electrically tunable lens (f: -50mm to +50mm)
- Variable numerical aperture (0.03 -0.36)
- Galvo mirror
- Shearing interferometer (collimation testing)
- All related opto-mechanic mounts (1mm-3")

Applications:

- Digital holography, fringe profiling, spectroscopy, biomedical imaging, auto focusing, calibration etc.

Visible Range Instruments

Optomechanical Devices

Optomechanical devices



Translation stages



Spatial filter mount (Cage type)



Polarizer Mount



Kinematic Mount



Pillars, posts, base plates & clamps



Active vibration isolation tables

- Various Kinematic mounts for optics.
- Translation stages (25 mm, 10 micron pitch)
- Spatial filter assemblies with 5,10,20 micron spatial filters
- Polariser mounts
- Pillars, post holders, post bases and clamps
- Active Vibration isolation optical table

Visible Range Instruments Modulators & Spectrometer

Modulators & Spectrometer



Digital Micromirror Device



Compact visible range Spectrometer

Digital micromirror device (DMD): Visible range, 1080X1920px

Visible spectrometer: Visible – NIR (380 nm – 1100 nm)

Indigenously developed VIS-NIR Spectrometer: 400 – 1700 nm

Applications:

- Fringe profiling, spectroscopy (VIS-NIR), study of drying process.

Near Infrared Range Instruments

Source & Detectors

Source & Detector



NIR Source – Tunable Laser Module



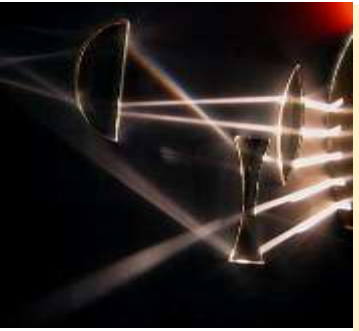
NIR Detector

Source: Tunable Laser source, 1490 – 1610 nm

Detector: 320X256 px. (900 – 1700 nm)

Applications:

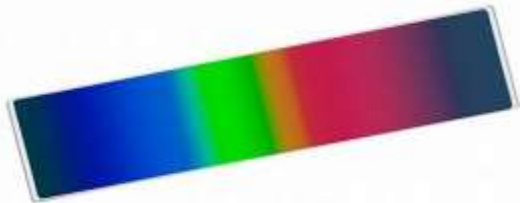
- Digital holography, biomedical imaging, imaging through turbid medium



Near Infrared Range Instruments

Optics, Optical Modulators & Spectrometer

Optics, Modulator



Linear Variable Filter



Digital Micromirror Device

Optics: Linear variable filter, notch filter, lens and mirrors etc.

Modulator: Digital micromirror device (DMD), 900-1700 nm.

Applications:

- Digital holography, biomedical imaging

Spectrometer



NIR Spectrometer



Indigenously developed VIS – NIR Spectrometer

NIR Spectrometer: 900 nm – 1700 nm

Indigenously developed VIS-NIR Spectrometer: 400 – 1700 nm

Applications:

- spectroscopy (VIS-NIR), plant disease detection

Microwave Imaging and Instrumentation

Microwave Source and Detector



Microwave sources (upto 20GHz)

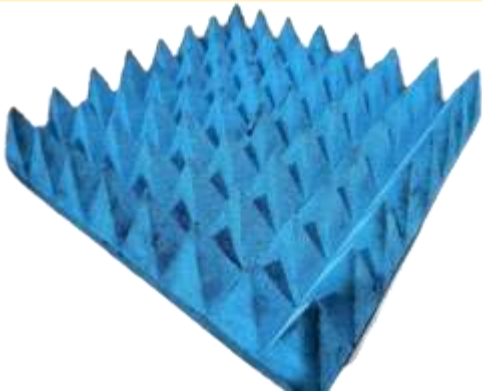


Microwave Detector

Applications:

- Near Field Indirect Holographic Imaging (NFIHI) as an efficient and economical tool for breast cancer detection
- In-house development of tissue mimicking 3D printed breast phantoms
- Locating and identifying the tumors up to the minimum size of 4mm and maximum depth of 25mm

Absorber & Translation stage

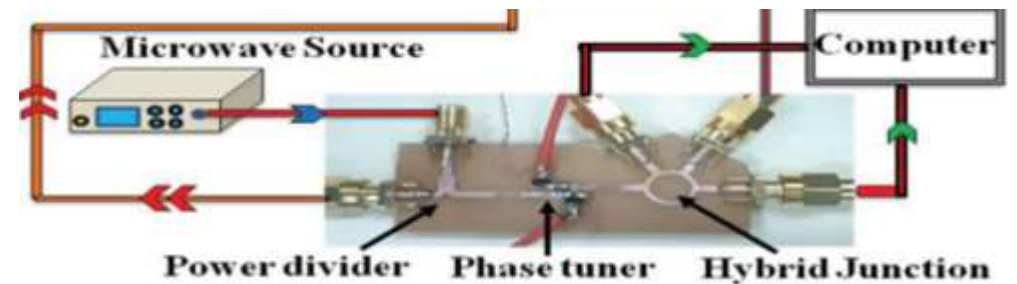


Microwave absorber



Motorized XYZ translation stage

Phase shifter



In house fabricated phase shifter and power coupler

Fiber Based Sensing Applications

Source and Detector



Fiber coupled source (1550nm)



High-Speed Fiber-Coupled Detectors

Applications:

- Study of Distributed Buried Fiber Optic Intrusion Detection (FOID) for Perimeter Surveillance.
- Experimental realization, simulation and analysis of intrusion signals for human, vehicle, animal etc. using Rayleigh based optical time domain reflectometry (OTDR) in optical Fiber.

Amplifiers



Erbium-Doped Fiber Amplifiers (EDFA)

Fiber Components



Fiber Optic Circulator



Long Fiber optic bundle



1 X 2 wideband Fiber optic coupler

Fiber Based Sensing Applications

Fiber Components



Fiber Inspection Scope



Faraday Mirrors with Fiber Optic Pigtail



Acousto optical Modulator

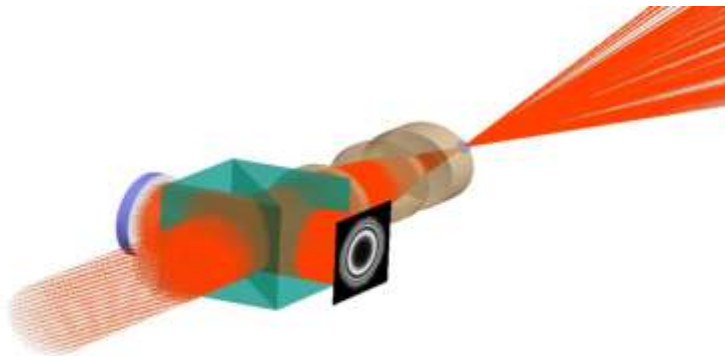
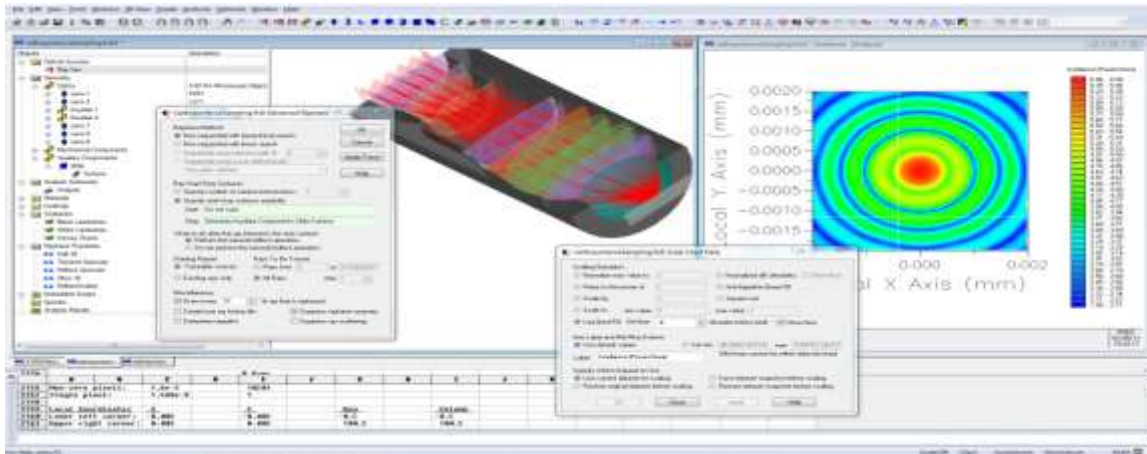
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Softwares

Fred Optical Engineering Software (FRED)

FRED



Applications: (design and simulation of)

- Physical Optics
- Imaging & Stray light Analysis
- Illumination Applications
- Biomedical Systems

Design and simulation of Michelson's interferometer