



Research Facilities

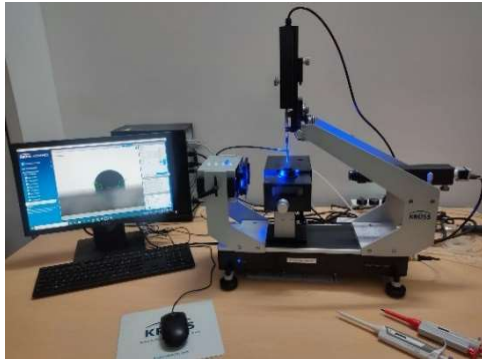


Department of Mechanical Engineering

Indian Institute of Technology Bhilai

Thermal and Fluid Engineering:

Drop Shape Analyzer



Make: KRUSS GmbH.

Model: KRUSS/DSA25

Applications: Contact angle measurement from the shadow image of a sessile drop, surface tension or interfacial tension from the shadow image of a pendant drop.

Specifications:

- Max. Sample space: 320 mm x ∞ x 165 mm (W x D x H)
- Droplet contact angle and surface energy measurement
- High power monochromatic (470 nm) light source.
- Software controlled dosing system with a droplet discharge rate of 0.02 to 25 $\mu\text{L/s}$ having a resolution 0.1 μL
- High speed camera with manual focus and 6.5x zoom (1920 x 1200 pixels, 2300 fps)
- Climate controlled chamber with temperature and humidity sensor.

IR Thermal Camera



Make: FLIR Systems.

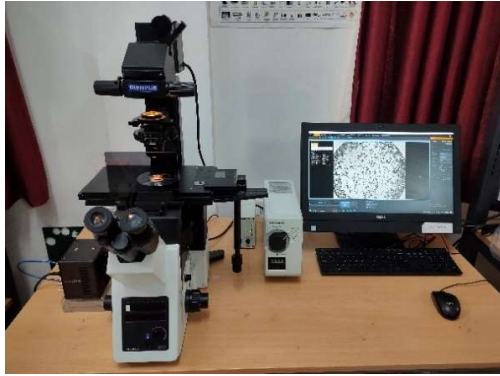
Model: Flir X6540sc – BB

Applications: Infrared and Thermal imaging, FLIR, Active thermography for non-destructive material testing and manufacturing process, Thermography

Specifications:

- Detector type: Focal Plane Array (FPA)
- IR resolution: 640 x 512 or 327680
- Temperature range
- Detector pitch (or) pixel size: 15 microns.
- Thermal sensitivity / NETD: less than 25 mK, typically 18 mK.
- Temperature measurement accuracy: $\pm 1^\circ\text{C}$ (1.8°F) or $\pm 1\%$
- Maximum frame rate: 146 Hz @ 640 x 512/IWR 528 Hz @ 320 x 256/ IWR 1510 Hz @ 160 x 128/IWR 3699 Hz @ 132 x 8/IWR.

Olympus Inverted Microscope



Make: Olympus medical system India

Model: Olympus IX 73

Applications: Used for high-resolution live cell imaging and observation.

Specifications:

- Optical system- UIS2
- Fluorescence light source- 130 W Halogen light
- 232 mm (X) × 240 mm (Y) stage size, stage insert plate exchangeable (Ø110 mm)
- Gliding stage- Upper circular stage 360° rotatable, 20 mm (X/Y) travel.
- Transmitted light illuminator- 30 W halogen illuminator
- Magnification: 5x, 10x, 20x, 40x, and 60x

Thermal Conductivity Analyzer



Make: Hot Disk

Model: TPS 2500S

Applications: To measure Thermal conductivity of material

Specifications:

- Temperature range: -60° C to 750° C.
- Radius of disk spiral: 3.3mm to 14.65mm
- Diameter of sample size: $\geq 50\text{mm}$
- Thickness of sample size: 0.1mm to 10mm
- Thermal conductivity range: 1W/m-K to 500W/m-K.
- Reproducibility - Thermal conductivity: $\pm 2\%$
 - Thermal Diffusivity: $\pm 5\%$
 - Specific Heat (per unit volume): $\pm 3\%$

Internal Combustion Engine Test Setup



Make: Accurate Test Equipment's and Engineers

Test Setup: Internal combustion engine with transient dynamometer

Highlights:

- Test setup is equipped twin-cylinder, 793 cc, four stroke water cooled engine with CRDI injection system
- Engine setup is coupled with Transient dynamometer to perform tests
- Setup is capable to perform detailed combustion (in-cylinder parameters, performance, and emissions tests)
- Engine Rating:
 - o Power Rated: 24 KW@3500 RPM
 - o Rated Torque: 75 MN@ 200 RPM

Emission Analyzer



Make: AVL India

Model: AVL DiTEST MDS 450

Applications: Finding composition of the exhaust gases that are coming out of the engine

Highlights:

- Measures CO, CO₂, HC, O₂ and NO with high accuracy.
- Configurable to different C/H ratio for possible alternative fuels.
- Coupled with AVL DiSMOKE 480 BT to measure exhaust opacity.
- Measurement resolution up to 1 ppm for HC and NO measurement.

High speed camera 1



Make: FASTCAM

Model: Mini UX50

Applications: Videography of high-speed events such as microfluidics, molten pool dynamics during welding, machining

Specifications:

- Frame rates: 2,000 fps (at full resolution) to 1,00,000 fps (at reduced resolution)
- Full resolution: 1.3 MP CMOS Monochrome sensor

On-board memory: 16 GB

High speed camera 2



Make: Photron

Model: Nova S9

Applications: Videography of high-speed events such as impact testing, high speed machining, spray cone measurement, droplet dynamics

Specifications:

- Full Frame Performance: 9,000fps, 1024 x 1024 pixels
- 1-Megapixel CMOS Image Sensor
- Maximum Frame Rate: 900,000fps (128 x 16 pixels)
- Minimum Exposure Time: Global electronic shutter to 0.2 μ s
- Dynamic Range (ADC): 12-bit monochrome

3D Scanner



Make: Altem Technologies (P) Ltd

Model: Artech 3D/Artech Eva

Applications: Creating high-precision 3D models of real-world objects.

Specifications:

- Output formats:
 - 3D mesh formats- OBJ, PLY, WRL, STL, AOP, ASC, PTX, E57, XYZRGB
 - CAD formats- STEP, IGES, X_T
 - Formats for measurements- CSV, DXF, XML
- 3D point accuracy, up to: 0.1mm
- 3D resolution, up to: 0.2mm
- 3D accuracy over distance, up to: 0.1mm + 0.3mm/m
- Working distance: 0.4 – 1m
- 3D reconstruction rate, up to: 16 fps.

Multicomponent Gas Analyzer



Make: GASMAT

Model: GT5000 TERA

Applications: Used to measure multiple emission gases.

Highlights:

- Measuring principle - Fourier transform infrared, FTIR
- Multigas capability - Simultaneous analysis of up to 50 gas compounds
- Response Time - Typically < 120 s, depending on the measured components and measuring time
- Spectrometer -
 - Resolution - 8 cm⁻¹
 - Scan frequency - 10 scans / s
 - Detector - Peltier cooled MCT
 - Beamsplitter - ZnSe
 - Wave number range - 900 - 4 200 cm⁻¹

Particle Image Velocimetry (PIV)



Make: Microvec

Model: PIVotal-200

Applications: Used to measure fluid flow patterns and velocities.

Specifications:

- Dual Pulse PIV Laser
- Resolution - 8 cm⁻¹
- Scan frequency - 10 scans / s
- Detector - Peltier cooled MCT
- Beamsplitter - ZnSe
- Synchronization Unit -
- Delay 0 to 5,000 s
- Pulse width 10 ns to 1,000 s
- - Resolution 0.25 ns
- - RMS jitter ≤ 50 ps
- - Outputs TTL 0 to 5V
- - Impedance 50 Ohms
- Inverted Microscope Nikon -
- Inverted Microscope Eclipse Ti2-U Main Body (100-240V)
- 4-AC AC Adapter
- Eyepiece
- TI2-T-B S Eyepiece Tube Base Unit
- TC-T-TS S Tube
- CFI 10X Eyepiece w/diopter adjustment (F.O.V. 22 mm)
- Diascopic Illuminator
- C-S-HP35 Petridish Holder 35mm
- Tracer Particles for Water - 5 to 10 μm, 10 to 20 μm and 20 to 50 μm hollow glass spheres tracer particles.

- o Camera -
- o CMOS monochrome sensor with resolution 5
- o MP or more.
- o Frame rates: 30 fps or more (at full
- o resolution), minimum frame rate should be
- o as per the frequency of laser.
- o Pixel size: 5 μm or lower
- o Quantum efficiency 60% or more for spectral
- o range 400 - 1000 nm,
- o Minimum interframe time 1 to 0.5 μs ,
- o Software: MICROVEC3

Environment Chamber



Applications: Used to simulate specific environmental conditions for testing product performance, durability, and reliability.

Specifications:

- Size of the test chamber (internal dimensions): 4000 mm (L) x 4000 mm (B) x 3000 mm (H)
- Size of the ante chamber (internal dimensions): 2000 mm (L) x 4000 mm (B) x 3000 mm (H)
- Wall and ceiling: 150 mm thick PUF panels.
- Room PUF panel: 150 mm thick monowall
- Flooring: 150 mm PUF panel with Marine plywood of 25 mm thick & 3 mm Aluminium
- chequered sheet.
- Double glazed window (1m x 1m)
- Main door : 750 mm x 2000 mm, Double walled door inner lined with Stainless steel SS 304.
- Temperature & humidity controller:
 Temperature range for test chamber: -40°C to 60°C.
 Temperature range for ante chamber: 5°C to 30°C.
 Humidity range for test chamber: 30 to 95% RH @ 30 to 60°C.
- Humidity range for ante chamber: below 60 % RH.

Manufacturing

CNC Turning Centre



Make: DMG MORI Asia Pvt. Ltd.

Model: DMG MORI/CLX350 V3

Applications: Turning, Thread cutting, Grooving, Drilling, Indexing, Boring, Chamfering and end milling.

Specifications:

- Max. workpiece diameter: 320mm
- Max. workpiece length: 530mm
- Max. chuck size: 250 mm
- Max. spindle motor speed: 5,000 rpm
- Drive power rating (100% DC): 11 kW (AC) Max. bar capacity diameter: 65
- Siemens Controller

4 axis CNC Vertical Machining Centre



Make: ACE Manufacturing Systems Ltd.

Model: 540V.

Applications: Face milling, Sizing, Slot milling, Side Milling, Indexing, Gear cutting, Drilling, Tapping, Reaming, Incremental forming.

Specifications:

- Travel (X, Y and Z axes): 500 x 400 x 450 mm
- 40 / 40 / 40 m/min rapid rate for X/Y/Z axes
- 20 tool ATC
- Spindle speed: 60-6000 RPM
- Additional 4th axes for related operations.
- CNC Control: FANUC 0I MF

CNC Wire EDM machine



Make: Electronica India Ltd.

Model: ECOCUT

Applications: Preparation of Specimen for various characterisation, contour cutting.

Specifications:

- Workspace: 250 x 350 mm
- Max. workpiece height: 150 mm
- Max. table size: 370 x 600 mm
- Max. cutting speed: 70 mm²/min
- Taper: $\pm 5^\circ$ over 100 mm

High-speed Micro-machining Centre



Make: MicroMach Innovations Pvt. Ltd., India

Model: HSM 080

Applications: Micro drilling, Micro milling, Surface texture, Manufacturing micro channel and variety of micro components,

Specifications:

- Travel distance: 100 mm (X-Y), 60 mm (Z)
- Feed Rate: 0.06-6000 mm/min
- Resolution: 0.5 μ m (X-Y), 1 nm (Z)
- Accuracy: $\pm 0.5 \mu$ m (X-Y), $\pm 0.3 \mu$ m (Z)
- Spindle Speed: 5000 -80000 rpm with variable frequency drive.
- Spindle torque: 11.9 N-cm (80000 rpm)

Metal Inert Gas Welding Machine



Make: Kemppi India Private Limited

Model: Fast MIG X450c

Applications: Welding thin/thick materials, Additional features such as root wise, root thin, scratch TIG etc.

Specifications:

- Multi-process power solution: MIG, 1-MIG, pulsed MIG, MMA
- voltage range 10V to 50V
- Current: 450 A
- Materials- Cu, Al, Fe.

Friction stir welding machine



Make: ETA Technology Pvt. Ltd.

Model: ETA /WS007

Applications: Friction stir welding, processing and solid-state additive manufacturing

Specifications:

- Max. Axial thrust of 50kN.
- Linear CNC machine with maximum axis movement- 500mm length x 300 mm Width.
- Spindle speed- up to 3000 rpm
- Weld speed- up to 250 mm/min

Stir-Casting Facility



Make: SwamEquip

Applications: Casting of aluminium, magnesium alloys and composites

Key specifications:

- Casting Options: Gravity casting, Vacuum Die Casting, Squeeze Die Casting, Centrifugal Casting
- Maximum temperature: 900°C
- Squeeze casting load: 400 kN
- Die/Mould: Few standard moulds for cylinders and rectangular plates available.

Hot Extrusion Setup



Make: SwamEquip

Applications: Used to Extrude samples of aluminium, magnesium alloys and composites

Specifications:

- Hydraulic Press
 - Load capacity: 100 tons
 - RAM: Diameter -200 mm, Stroke - 250 mm
- Sample heating furnace Maximum temperature :650°C

High energy Planetary Ball mill



Make: Mechmin

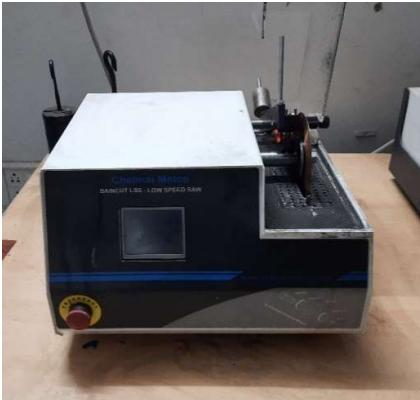
Model: MM2502

Applications: To make powder metals, Milling, Mixing and Alloying.

Specifications:

- Mode of grinding: Dry and wet.
- Materials: soft, hard, brittle, and fibrous, metals (Al, Ti, Ni, etc.) and non-metals (Al_2O_3 , SiC, WC, etc.).
- Feed size ≤ 10 mm approx. dia.
- Final fineness $\leq 1 \mu\text{m}$ approx. dia.
- For colloidal (wet) grinding $\leq 0.1 \mu\text{m}$ approx. dia
- Speed ratios- planetary disk: grinding bowl speed ratio - 1:2
- Sun wheel speed - 500 rpm and Jar speed 1000rpm.
- Feed quantity- 100ml and 250 ml Jar and ball material available- harden steel, Zirconia and Tungsten carbide.

Low speed precision diamond cutter



Make: Chennai metco

Model: Baincut LSS003

Applications: It is applicable to accurate cutting of all materials especially Hard materials like high value fragile artificial crystals

Specifications:

High precision Tabletop machine.

- Cutting capacity up to 20mm using 4 inch wheel and up to 30mm using 5 inch wheel.
- Continuously variable speed 60rpm to 600rpm.
- Positioning accuracy 0.01mm
- Arbor size- 12.7mm.

Hot mounting press



Make: Chennai metco

Model: MPH007A

Applications: Fully automatic hydraulic hot mounting press for various characterisation

Specifications:

- Automatic water-cooling system
- Temperature: 180°C and pressure: 150 bar
- Mould size: 30mm, 40mm

Dual-disc sample polisher



Make: Chennai metco

Model: PMV018

Applications: Grinding and Polishing of materials for metallurgical application

Specifications:

- Double 8"-disc (standard), 10"/12" disc (Optional) polisher with individual drive.
- Variable speed from 50-100RPM.
- The Working disc can be operated clockwise/counter clockwise.
- accessories: Air drier, Ferromagnetic carrier sheet for sandpaper/cloth and water filtering system

Laser Powder Bed Fusion (LPBF) – Based Additive Manufacturing System



Make: Amace india

Model: STLR 180

Applications: metal additive manufacturing of different engineering components.

Specifications:

- Build Envelope - Dia 180x200 mm
- Laser Power - 400 W
- Scanning Speed - 7 m/s
- Max Layer Thickness - 60 Micrometer
- Preparation Software - Materialise Magics Print LM
- Weight - 800 kg
- Recoater Type - High Durability Soft Multi Blade Recoater

Wire Arc Additive Manufacturing (WAAM) with 8-axis robot



Make: Robot (ABB) and Power source (Fronius)

Applications: Arc based additive manufacturing of metals through wire.

Specifications:

- 6-axis industrial robots (With positioners)
- Size up to approx. Ø600 mm × 600 mm
- Power Source: Fronius TPS 500i
- Technology: Pulse, CMT etc.
- Wire Diameter: 0.8, 1.2 1.6mm

Hot & Cold Rolling Mill



Make: Newfield Engineers Pvt. Ltd.

Model: 2Hi/4Hi

Applications: For hot and cold rolling operation

Specifications:

	Hot Rolling	Cold Rolling
Work Roll Diameter	200 mm	75mm
Backup Roll Diameter	-	200mm
Input Size of material	15mm Thick × 50mm width	8mm Th × 5 width
Finished thickness of material	2mm in multiple passes	0.5mm multipl passes
Max Roll Separating Force	50 tonnes	

Tubular Furnace



Make: Carbolite

Model: Gero

Applications: Used for heating materials in a controlled environment.

Specifications:

- Max temp : 1600°C
- Furnace Ø 32, 60, 100, 125 mm.
- Heated length(s) 150, 180, 300, 450, 600, 800, 1000, 1200 mm.
- Number of heated zones 1 zone or 3 zones.

Sheet Metal Forming



Make: Erichsen

Model: 142-40 (ERICHSEN)

Applications: Used to shape, cut, and form metal sheets into a wide variety of components.

Specifications:

- max. drawing force 400 kN and for pre-setting the blank holder pressure of 400 kN
- ERICHSEN Cupping Test according to EN ISO, EURONORM, BS, NF, GOST, UNI, UNE.
- Deep Drawing Cup Test in a first and a redrawing operation; Bore Expanding Tests acc. to ISO 16630.
- Nakajima and Marciniak Tools for Determination of Forming Limit Curves (FLC) acc. to ISO 12004.
- Hydraulic Deformation (Bulge Test), including:
- Blanking press in the test head.
- Test piece ejector.
- PLC, Hydraulic test head opening.
- Digital display of drawing force, punch stroke, drawing speed, and sheet holder force.

Material Testing and Characterization:

Micro-indentation Hardness Tester



Make: INNOVATEST

Model: FALCON 502

Applications: Hardness measurement.

Specifications:

- Indenters- Vickers and Knoop.
- Magnification- 100x, 200x and 500x.
- Motorized CNC X-Y stage
- Total load upto 100kgf max,
- Displacement- 100x100mm
- Resolution- 0.001mm
- Repeatability- ± 0.003 mm.

Scratch Tester



Make: DUCOM

Model: DUCOM TR101

Applications: Used to measure coating adhesion, scratch resistance of materials.

Specifications:

- Load range (N): 2-20, 20-200
- Tangential Force (N): 0-20, 20-200
- Stroke (mm): Up to 50
- Speed (mm/sec): Up to 5
- Loading Rate (N/sec): 0.1-20
- Stylus: Diamond indenter Rockwell C,
with tip radius R2000

Non-contact type 3D Optical surface Profilometer



Make: Sensofar

Model: S neox

Applications: Used to study the surface features such as roughness, flatness, and topography of various materials.

Specification:

- Measuring principle: Confocal, PSI, ePSI, CSI, Ai Focus variation and thin film
- Observation types: Brightfield, DIC, Sequential Color RGB, Confocal, Interferential phase contrast
- Measurement types: Image, 3D, 3D thickness, profile and coordinates
- Camera 5Mpx: 2448x2048 pixels (60 fps)
- MAG- 25x, 50x, 100x, 200x, 500x, 1000x.

- XY Travel range (mm) – Manual: 40x40, Motorized: 154x154.
- Sample weight up to 25 Kg

Digital Stereo-zoom Microscope



Make: Leica

Model: S9i

Applications: Used to take macro images of specimen.

Specifications:

- Viewing angle: 35°, Focusing range: 135 mm
- Working distance: 122 mm, Optics carrier rotatable through 360°
- Magnification: 10×, 20×, 30×, 40×, and 50×

Integrated camera: 10 MP resolution, Live image up to 35 fps (1,024 × 768 pixels)

Inverted Metallurgical Microscope



Make: Leica

Model: DMi8

Applications: Used to study micro and macro surface/microstructure.

Specifications:

- Focus: Manual 2-gear
- Magnification: 25 to 1000x
- Contrasting techniques: Incident light (BF, UC-3D, DIC, Pol) and Transmitted light.
- Illumination: LED Halogen.

Digital Image correlation



Make: Dantec

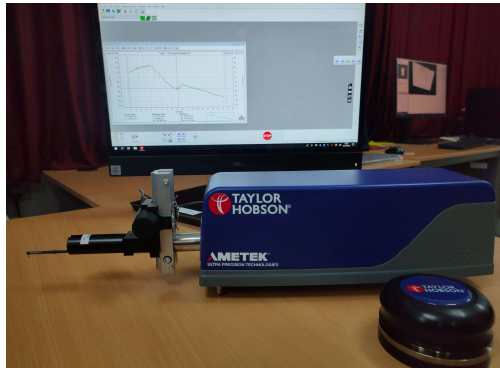
Model: Q-400

Applications: Measurement of in-plane and out of plane displacements/deformations of structures subjected to external loading

Specifications:

- Displacement resolution: Up to 1/100 of the Field of View depending on measuring conditions.
- CMOS-resolution: up to 12.5 Mpx
- Measuring range: From a few microns up to several millimetres
- Measuring area: 50 mm x 70 mm down to 3 mm x 4 mm

Contact type Surface Roughness Tester



Make: Taylor Hobson

Model: Intra touch

Applications: To measure various Surface roughness parameters on both flat and curved specimen, generation of 2D profile

Specifications:

- 90 mm Z height adjust and optional 350 mm column to accommodate large or tall components.
- Gauge with up to 2 mm (0.08 in) of range and an outstanding range to resolution ratio of 262,144:1.
- Measurement speeds from 0.25mm/sec to 10mm/sec.
- 0.20um / 20mm straightness error.
- Contains all kind of stylus and other accessories comes with this instrument.
- RMS Repeatability: <0.01 nm

RMS Precision: <0.1nm

Tribometer



Make: Anton Paar

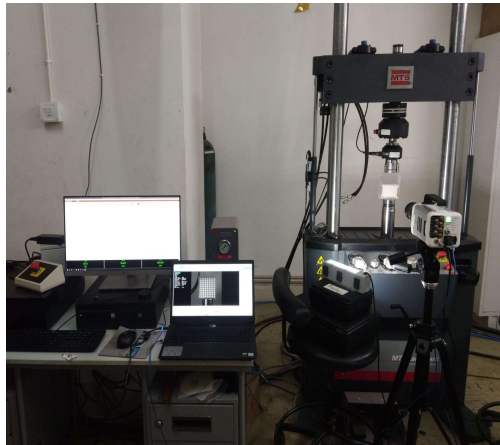
Applications: Used to evaluate the friction and wear characteristics of metals.

Specifications:

- Max. temperature: Up to 1000°C
- Normal force range: Up to 10N
- Frictional force range: Up to 10N
- Frictional force resolution: 0.03mN
- Angular reciprocating angle: ± 10 to $\pm 150^\circ$
- Angular resolution: 0.1°
- Angular reciprocating frequency: 0.01 to 7 Hz
- Online wear depth: Up to 1.2 mm
- Rotating speed: 0.3 to 600rpm
- Torque is up to 450 mN-m
- Speed is up to 1500 RPM
- The System allows rotation in both the directions.
- Angular reciprocating frequency is 0.01 to 7 Hz
- Angular resolution is 0.1 degrees.

Design Engineering:

Servo Hydraulic UTM



Make: MTS Landmark

Model: Servo Hydraulic System MTS 370.10

Applications: Tensile testing, Compression testing, Three-point and four-point bending testing, fatigue, fracture test.

Specifications:

- Max load capacity: 100 KN
- Travel Extension: -100 to +100mm
- Grippers: For $\leq 5\text{KN}$ - Pneumatic grippers
 $\geq 5\text{KN}$ - Hydraulic grippers
- Max. frequency for fatigue: 10 Hz

Laser Doppler Vibrometer (LDV)



Make: MTS Landmark

Model: Servo Hydraulic System MTS 370.10

Applications: Non-contact vibration measurement suitable for wide range of applications which includes health monitoring of machines, aerospace structures, automobiles, civil structures and acoustic engineering.

Specifications

1. The stand-off distance

- Minimum stand-off distance: 125 mm
- Max stand-off distance: 10 m

2. Laser specification

Measurement Laser

- Laser type: IR laser
- Wavelength: $1549.7 \pm 0.2 \text{ nm}$
- Laser class: 2
- Emitted laser power = 2 mW

Software's:

1. CAD Modelling: SOLIDWORKS, Solid Edge
2. Numerical Analysis: ANSYS, DEFORM-3D, ABAQUS, LS DYNA, LabVIEW, GT-Suite
3. Statistical: Minitab
4. CNC Programming: Mastercam

Contact Us



outreach_me@iitbhilai.ac.in



Department of Mechanical Engineering,
Indian Institute of Technology Bhilai,
Dist.- Durg, Chhattisgarh – 491002

[LinkedIn](#)



[YouTube](#)



[Website](#)

