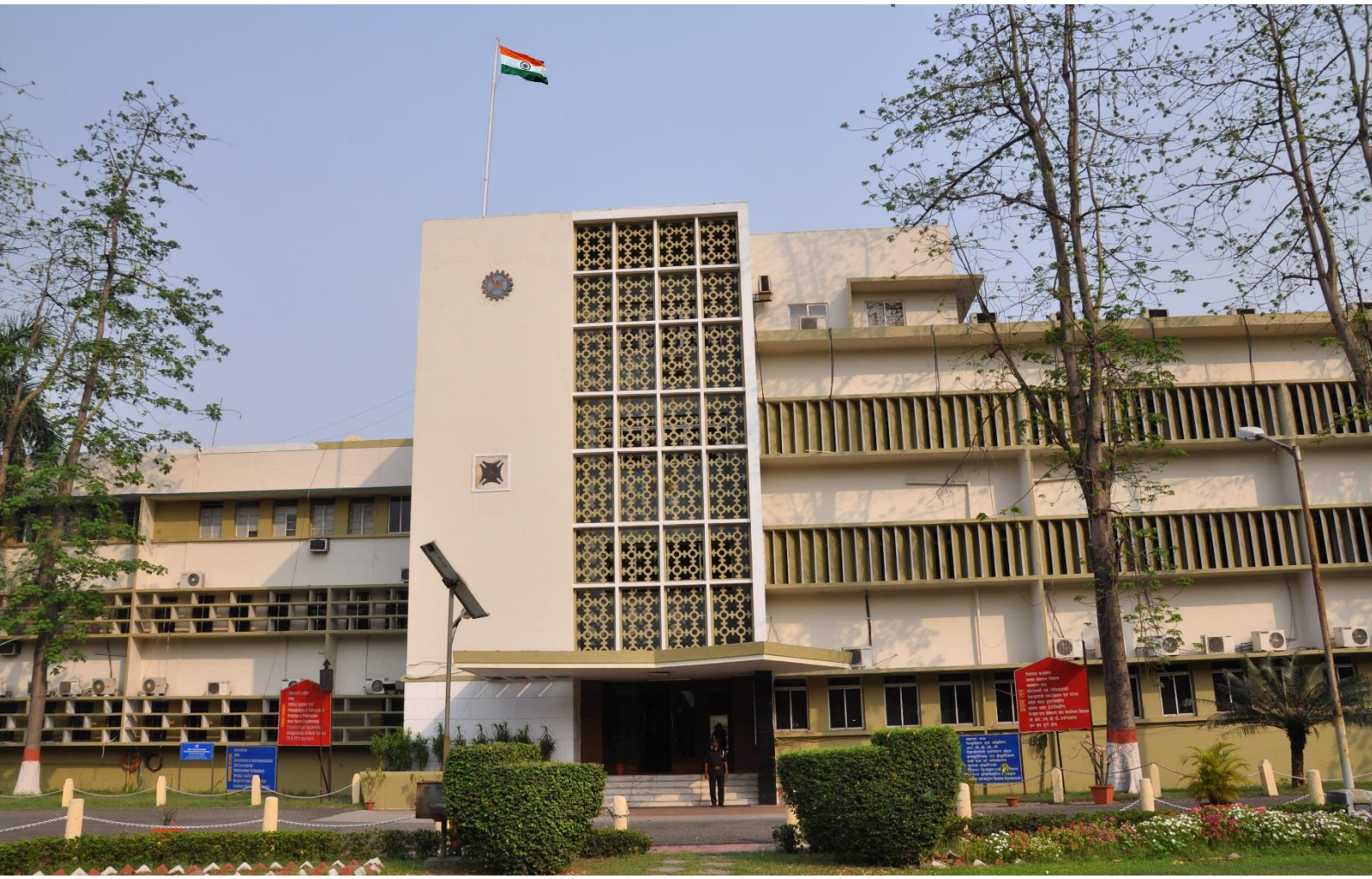
POST GRADUATE DIPLOMA PROGRAMME
IN
ADVANCED MANUFACTURING TECHNOLOGY (PGDAMT)
2018-2019

Under the Aegis of

AcSIR Academy of Scientific & Innovative Research
Set up by an Act of Parliament, An Institute of National Importance



Platinum Jubilee 1942-2016
CSIR-INDIA
75 Years of
CSIR Touching Lives

CSIR-Central Mechanical Engineering Research Institute
Durgapur-713209

CSIR - Central Mechanical Engineering Research Institute

The CSIR-Central Mechanical Engineering Research Institute (CSIR-CMERI) is the only national laboratory dedicated to Mechanical Engineering. As a constituent member under the Council of Scientific & Industrial Research, the ambit of the Central Mechanical Engineering Research Institute (CMERI) – a premier establishment dedicated to research and development – extends over mechanical and allied engineering fields.

In India, mechanical engineering technology has accounted for nearly half of the total technology imported. In terms of products, nearly one third of the value of total imports is for mechanical engineering equipment. In order to develop indigenously mechanical engineering technology for the industries so that R&D can play a key role in self-reliance, the Central Mechanical Engineering Research Institute at Durgapur, West Bengal was established in February 1958 with the specific task of development of mechanical engineering technology.

Besides conducting frontline research in the varied areas related to mechanical engineering, the Institute dedicates it R&D efforts towards different mission mode programmes to disseminate appropriate technological solutions for poverty alleviation and societal improvement.

CSIR - CMERI has a dedicated team well balanced in terms of youth and experience of highly qualified professionals and supporting staff spanning the various disciplines under mechanical engineering.

Major Research Areas

The major research areas are represented in the following schematic

In the new millennium, CSIR-CMERI is poised to expand its horizon of research activities so as to steer the country forward in the following cutting-edge and sunrise fields.

Advanced Design, Manufacturing, Immersive Visualization

Design, manufacturing and product development at CSIR-CMERI is suitably aided by a comprehensive CAD-CAM environment supporting collaborative design through analysis of mechanisms, tolerances, interferences of designated parts, etc. Current R&D in material processing is focused on development of additive manufacturing system for manufacturing of metallic components. Immersive Visualization affords rapid development of system concepts and analyzing for form, fit, function, logistics, human factors integration, and general feasibility analysis. Expertise in visualization is augmented with the induction of state-of-the-art facilities in Virtual Prototyping and Virtual Reality.

Micro Systems Technology, Surface Engineering & Tribology and Measurements

Micro Systems Technology is associated with the technology of very small parts, actuators, devices and MEMS. Development of microfluidic chips affording precise control of very small quantities of liquid for analyzing gene expression and mutation identification in cells is being targeted. Materials processing research includes ceramic cutting tool development for high speed machining. Research in Surface Engineering & Tribology has culminated in the development of μCNCmill - a five axis micro milling machine for efficient, cost effective and high resolution milling and drilling. A state-of-the-art high precision measurement Lab with NABL Accreditation for myriad gauges and instruments for quality control and assurance in product development has also been established in the area of measurement technologies.

Robotics, Mechatronics and Automation

CSIR-CMERI is undertaking extensive research in the design and development of Autonomous Underwater & terrestrial Vehicles, All Terrain Robots, Subterranean Robots, etc. R&D issues cover mechanical design, attitude control, non-conventional propulsion and manoeuvre (bio-mimicry), actuator development, parallel/distributed computing, navigation and guidance, Collision avoidance, communication protocols, sensor fusion, etc.

Renewable energy, Fluids & Thermal systems

Active research is carried out on fluid flow, heat transfer, combustion, gasification, fluidization, renewable energy, waste management, drying, etc. CFD simulation of fluidized bed hydrodynamics. Flow hydrodynamics is also being addressed through wind tunnel experimentation. Research is also carried out on power generation from hybrid resources such as solar, bio-gas etc. including development of inveter and micro-grid system,

Post Graduate Diploma Programme

Duration of the course: One year (Two Semesters)

Admission Process

Selection of the students in Post Graduate Diploma course will be done through written test / interview at CSIR-CMERI, Durgapur

No. of Seats: 30
(Reservation as per GOI guidelines)

Evaluation Procedure: As per AcSIR guidelines

Proposed Course Fee

1. Admission fee	Rs. 4,000/-
2. Tuition fee per semester for Regular candidate	Rs. 25,000/
3. Tuition fee per semester for Sponsored candidate	Rs. 50,000/
4. Security Deposit (refundable)	Rs. 10,000/-

Hostel Fee

1. Accommodation charge including electricity & water	As per Institute Guidelines
2. Food charges	At actual
3. Deposit (Refundable)	Rs. 2,000/-

Proposed timeline

17-08-18	Commencement of Academic Session
13-08-2018 – 14-08-2018	Enrolment
27-07-2018	Declaration of Results (on web)
23-07-2018 – 24-07-2018	Aptitude Test/ Interview
05-07-2018 – 06-07-2018	Intimation of Shortlisted Candidates
22-06-2018	Application Closing Date
01-06-2018	Date of Advertisement

Post Graduate Diploma in Advanced Manufacturing Technology (PGDAMT)

At the heart of any manufacturing system, a set of processes that converts raw materials into the desirable configuration contribute significantly to the sustainability of national economy. The proposed course emphasizes on practical training in combination with necessary theoretical aspects on advanced manufacturing areas. This course is designed in a way for the personnel who would like to take up careers in manufacturing industries and for practicing engineers, to get acquainted with technological challenges and opportunities that have witnessed significant growth in the last 5 decades.

All the major economies in the world recorded growth due to the contribution from industries that were innovative in product design and efficient manufacturing. The key to knowledge deployment in a growing economy requires acquaintance of students with the fundamentals of advance manufacturing through pedagogy on current theoretical and practical developments. The manufacturing course will give a detailed understanding on advanced manufacturing by covering topics such as multi-scale (macro to sub- micron size) metal removal process, CAD & CAM, near net shape manufacturing processes, Additive manufacturing and precision measurement and quality assurance. This practical intensive course backed by theoretical lecture, aimed to promote significantly national skill development initiatives for sustainable empowerment.

The programme traverses a wide range of applications that includes manufacturing methods, computer integration and process & device control, with specific emphasis on innovative engineering. This one year post graduate program would provide an exposure to the manufacturing concepts, scientific principles, methodology by providing an opportunity for the students to directly associate with real-life R&D projects to gain hands-on experience.

Eligibility: BE/BTech/AMIE in Mechanical/Manufacturing/Production Engineering or equivalent

Post Graduate Diploma in Advanced Manufacturing Technology (PGDAMT)

SEMESTER I

Sl. No.	Course Code	Course Title	Hours/Week			Credit Points
			Lecture	Tutorial	Practical	
1	ENG-CMERI-1-2120	Theory of Manufacturing Processes & Systems	2	0	2	3
2	ENG-CMERI-1-2121	Near-net-shape Manufacturing	1	0	4	3
3	ENG-CMERI-1-2122	Precision Measurement & Quality Assurance	1	0	4	3
4	ENG-CMERI-1-2123	CAD/CAM	1	0	4	3
5	ENG-CMERI-2-2108	Computer Programming & Numerical Methods	2	0	2	3
6	ENG-CMERI-1 -2149	Seminar	0	1	0	1
					Semester Credit Points	16

SEMESTER II

Sl. No.	Course Code	Course Title	Hours/Week			Credit Points
			Lecture	Tutorial	Practical	
1	ENG-CMERI-1-2125	Prototype Assembly & Maintenance	0	2	12	8
2	ENG-CMERI-1-2150	Project Work and Viva-voce	0	2	16	10
					Semester Credit Points	18
					Total Credit Points	34

COURSE DETAILS*

*** The course structure, syllabus and credit points of few courses may change subject to the approval of AcSIR.**

ENG-CMERI-1-2120	THEORY OF MANUFACTURING PROCESSES AND SYSTEMS	L-T-P-C : 1-0-4-3
Introduction: Overview of Machining Technology, Theory of Chip Formation in Metal Machining, cutting tools and materials. Conventional Manufacturing Processes: Different types of material removal processes, Joining & Forming processes, Machine tools & their structure. Non-Conventional Manufacturing: Electrical Discharge Machining, Electro Chemical Machining, Laser Assisted Machining, Forming and joining. Finishing and Polishing Processes. Production Planning and Control: Process planning & Scheduling, Inventory Control, Material and Capacity Requirements Planning, Just-In-Time and Lean Production. Introduction to Micro Machining. Experimentation and hands-on for understanding the machines and manufacturing processes, extensive practical study will be carried out.		
ENG-CMERI-1-2121	**NEAR NET SHAPED MANUFACTURING PROCESSES**	**L-T-P-C : 1-0-4-3**
Metal Casting: Casting processes, Methoding, Casting defect and salvaging and Solidification of Metal and composite Metal powder processes: Fundamentals of Powder Metallurgy, Metal Injection molding, Powder forging and Sintering Heat treatment: Austempering, Solutionising and ageing, material testing Extensive experiments with related processes covered in theoretical classes for better understanding through practical training		
ENG-CMERI-1-2122	**PRECISION MEASUREMENT AND QUALITY ASSURANCE**	**L-T-P-C : 1-0-4-3**
Basics of measurement & Important terms: standards, scales, error, precision, accuracy, inspection and calibration, measuring instruments and their uses, effects of environment in measurement. Coordinate measuring machine (CMM): Its major types and elements, coordinate systems, process, probes and softwares, prismatic component inspection and reverse engineering, causes of parametric errors of CMM and its evaluation. Laser interferometry: Principle in measurement, elements of laser interferometer, measurement of position, straightness, squareness, flatness and angular, performance evaluation CNC machine by laser measurement system and auto error compensation. Surface texture: Surface texture measurement and its importance, instruments used for surface texture		

measurement, filtering, surface texture parameters, surface data analysis.

Machine vision: Machine vision system, principle of working, fields of machine vision system, gray scale image processing techniques, binary imaging, mathematical morphology for shape analysis, photogrammetry.

Quality Assurance: Measurement system analysis, quality assurance through gage R & R study, process capability indices, one sided and two sided specifications, statistical control of processes, control charts - X bar, s and p, uncertainty of measurement.

Hands-on on study and use of standards and instruments. Extensive practical training with related measurement techniques covered in theoretical classes for better understanding.

ENG-CMERI-1-2123	COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)	L-T-P-C : 1-0-4-3

Introduction to CAD/CAM: Definition, Historical development of CAD/CAM, Evolution of CAD, Exposure to different CAD platforms, Exposure to different formats of data exchange in CAD, Integration of CAD with manufacturing, Advantages of CAD/CAM.

Concept of machine centers: Principles of Numerical Control, Types and classification of CNC Machine Tools, Features of CNC Systems, Direct numerical control (DNC), Elements of CNC viz. ball screws, rolling guide ways, structure, machining centers and interpolators, drives and controls, standard controllers, control resolution, spatial resolution, accuracy, repeatability, compliance.

CNC programming: Machine coordinate systems, Planning for NC operations, Work holding for CNC operations, APT, Manual ISO Part Programming, Subroutines, Compensation and Offsets, Canned Cycle, Part modeling in CAD/CAM software, Pre-processing of a part model for CNC machining, Tool path generation and simulation for CNC machining.

Economics and Maintenance: Factors influencing selection of CNC Machines, Cost of operation & commissioning of CNC Machines, Maintenance features and Preventive Maintenance of CNC Machines.

Flexible Manufacturing Systems : Concept of Manufacturing Cell, Single Machine Cell, Flexible Manufacturing Cell, Pallet Changers, Automatic Tool Changers, Part Buffers, Flexible Manufacturing Systems (FMS), Typical FMS layouts, Advantages and disadvantages of FMS, Concept of Additive Manufacturing and Rapid Prototyping.

Hands-on on study and extensive practical training on 3D modelling, selection of machining strategies, tool path generation, machining simulation, data transfer techniques including automatic tool changing operations in vertical machining center and CNC lathe covered in theoretical classes for better understanding

ENG-CMERI-2-2108	Computer Programming & Numerical Methods	L-T-P-C : 2-0-2-3

Computer Programming: Introduction of C, Operators, Conditional statements and loops, Arrays, Functions, Structures and Unions, Pointers, Files handling.

C++ Overview, Classes in C++, Overloading, Inheritance, Overview of visual C++

MatLab - Basic, Matrix operations and functions in MATLAB, MATLAB scripts and functions (m-files) Simple sequential algorithms. Reading and writing data.

Numerical Methods :Introduction, finite floating point arithmetic, catastrophic cancellation, chopping and rounding errors; Solution of nonlinear equations; bisection, Newton's & Muller's

method, fixed point iteration;

Numerical optimization, Golden section search, Newton's method optimization; linear algebraic equations; forward Gaussian elimination, pivoting, scaling, back substitution, LU-decomposition, norms and errors, condition numbers, iterations, Newton's method for systems, computer implementation; Interpolation- Lagrange, Newton & inverse ;

Numerical Integration; finite differences, Newton cotes, trapezoidal, Simpson's rule, extrapolation, Gaussian quadrature; Numerical solution of ODE; Euler's method, Runge-Kutta method, multi-step methods, predictor-corrector methods, rates of convergence, global errors, algebraic and shooting methods, boundary value problems, computer implementation.

ENG-CMERI-1-2125	PROTOTYPE ASSEMBLY & MAINTENANCE	L-T-P-C : 0-2-12-8

Practical training on limits-fits and tolerances for better understanding on assembly requirements of two mating parts including hands on study on measurements and error budgeting of assembled machines/systems.

Hand on study on manufacturing of critical miniature components having micro-nano scale geometries.Assembly, Inspection Testing & performance evaluation of micro machines including system engineering.

Practical training on product –process design starting from CAD data preparation, slicing, tool path generation & layered deposition of metals to build components by bottom-up approach manufacturing.

Workshop practices including CAD design, process planning, scheduling, manufacturing & inspection of live components.

Practical training on 3D modeling, selection of machining strategy, tool path generation, data transfer and operation of CNC machine for manufacturing of critical components.

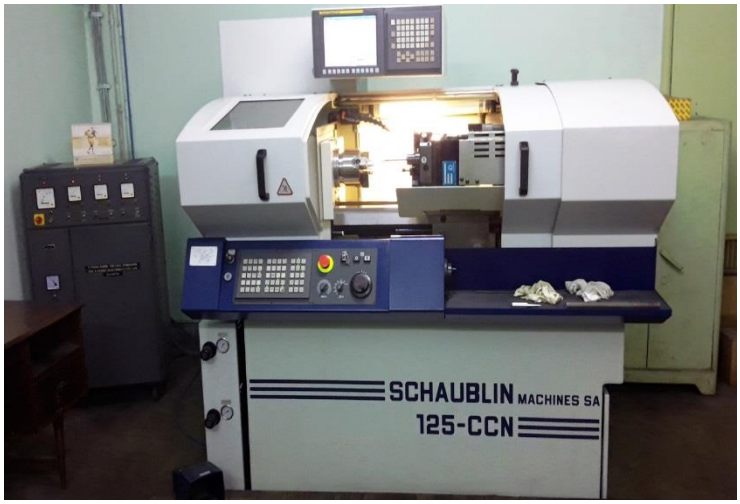
Casting simulation, training on sand mould preparation, metal casting and finishing of live components.

Hands on study on range of heat treatment processes including solutioniging and austempering of cast components.

Hands on study and extensive practical training powder metallurgy and powder injection moulding for manufacturing of small and complex components and assembly plastic parts.

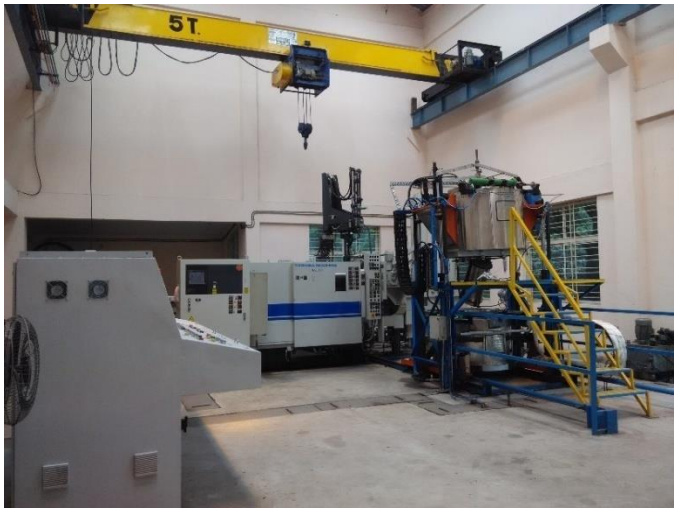
Facilities Available at CSIR-CMERI Relevant to PGDAMT

S No	Facility
1.	Conventional Milling, Drilling, Turning, Grinding, Welding and other Machines, CNC Lathe, Plastic injection moulding m/c, Robotic LASER process set-up, CNC vertical Machining centre, CNC EDM m/c, CNC Milling, Jig boring m/c, CNC wire-cut m/c, Vision based measurement system, CAD/CAM software
2.	Conventional foundry machines and tools, various furnaces, Investment casting facility, Pressure die and rheo pressure die casting facility, Micro and macro injection moulding m/c, Simulation and analysis software (ANSYS, FLUENT etc.), UTM, Differential scanning calorimeter, hardness tester etc.
3.	Micro machining centre, Micro EDm M/c, Optical, Fluorescence & Atomic Force Microscope, High speed camera, Micro fluidic laboratory set-up
4.	Coordinate measuring machine, Laser Interferometer, Universal Measuring Machine (SIP), Horizontal length Measuring machine, OMT Vertical Omtimeter, Micro Optic Angle Dekkor, Micro Optic Auto-Collimeter, 3D optical Profilometer, Perthometer (S6R), Universal Profile Projector, Electrolimit Com-Parator, Slip Gauge Calibrator
5.	Magnetic crack detector (For coil magnetization), Magnetic field indicator&particle test block, Black light (UV) source for Fluorescent inspection, Ultrasonic flaw detector and thickness gauge, Crack depth meter, X-ray Machine, Radiation survey meter, Video- imagescope, Digitally controlled closed loop servo-hydraulic (100 KN) capacity dynamic testing machine with accessories/softwares, Hardness tester (Brinnel/Rockwell/Vickers)
6.	Field Emission Scanning Electron microscope (FESEM), Scanning Electron Microscope (SEM), Fatigue strength measuring machine, High temperature Rheometer

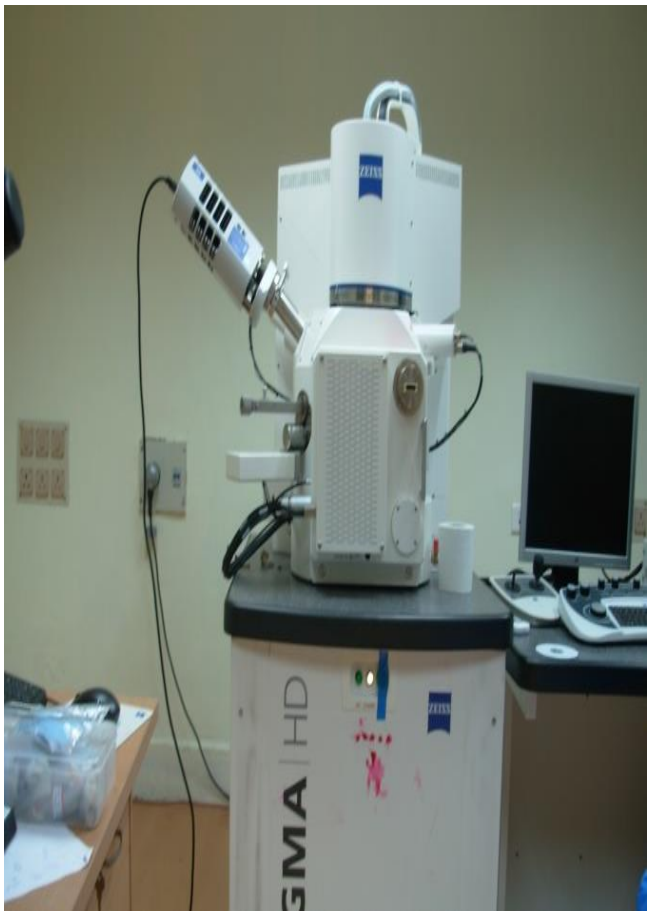


High Precision CNC Turn-Mill

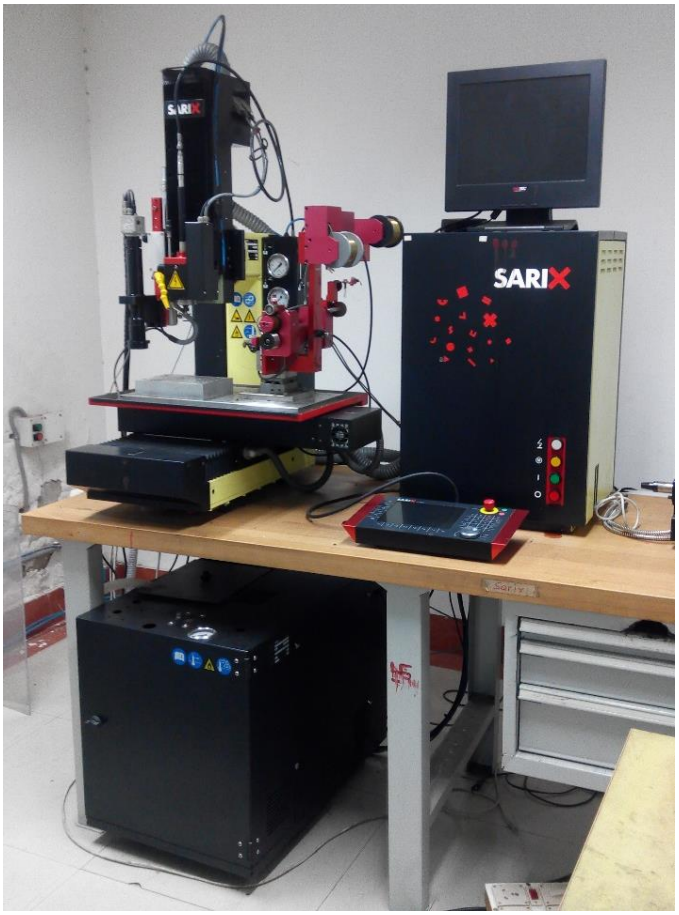
Robotic LASER processing set up



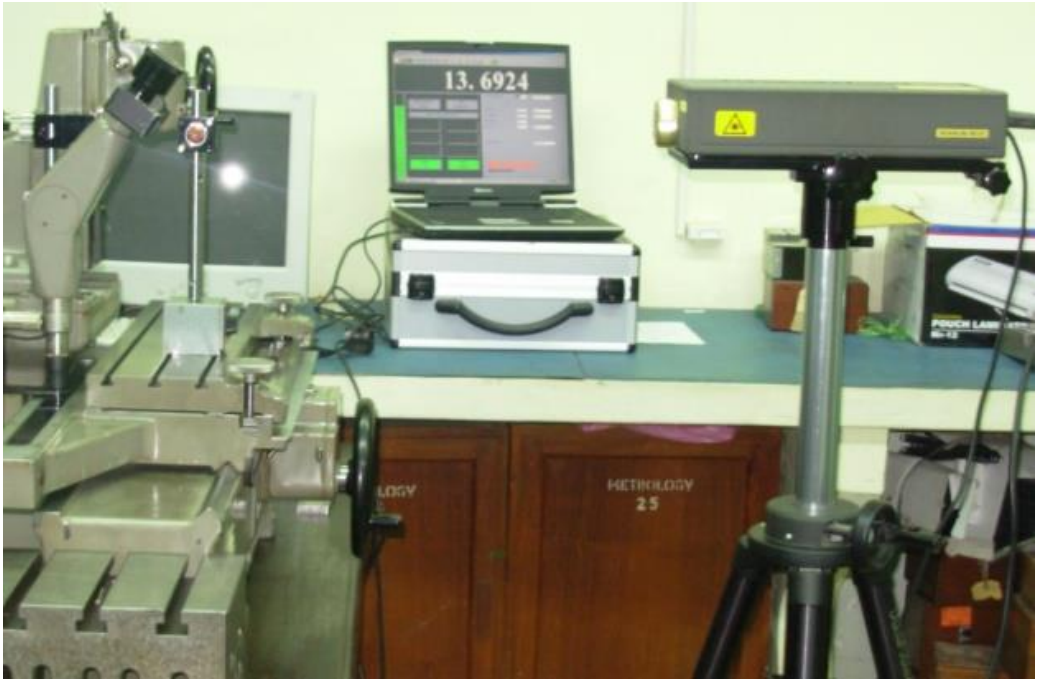
Rheo Pressure Die Casting Facility



FESEM with EDS & Straining stage



Micro EDM

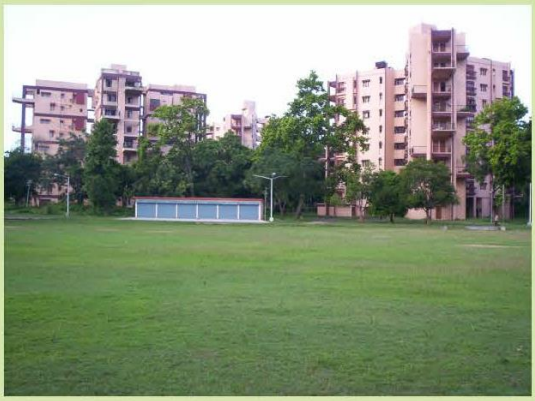


Laser Interferometer

AMENITIES

Amenities, be it at the Institution or at the place of residence is a primary element supporting research and innovation. Over the years, CMERI has incrementally augmented the general amenities to support and nurture a peaceful and fulfilling life at the campus. The CMERI residential campus is one of the green spots in the Durgapur steel city. Adequately secured by guard walls all around with regulated gate operation, the CMERI colony is one of the safest places of stay in the city. The colony boasts of three multi-storied complexes that till a short while back used to be the hallmark of the residential campus. Compact Scientists' Apartments provide the young Scientists a cosy ambience of stay during the formative years at the Institute.

The CMERI Staff Club is a meeting place for all members of the CMERI family. Be it the pursuit of recreation, or of an urge to take part in cultural activities, or simply for keeping fit through proper exercises, the Club premises serve as a desired destination. The Club houses two properly maintained badminton courts, has a Multigym facility, a Table Tennis board, and a horde of indoor games such as Carom, Cards, Chess, etc. The Club also has Library with a moderate holding. Adjacent to the Club Auditorium complex reposes a volleyball ground. Two fields are available at two corners of the Colony for outdoor games like football and cricket.



Residential Complex & Football Ground

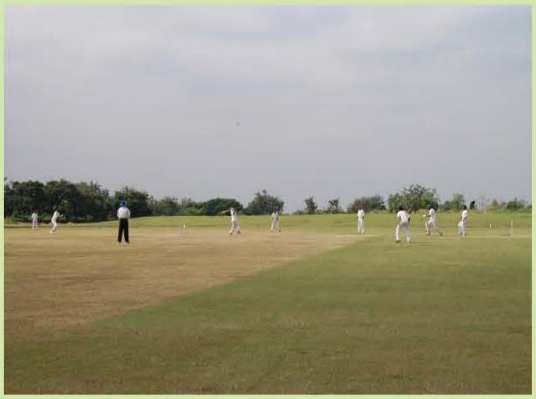
CMERI Staff Club Auditorium with indoor badminton courts

Medical Centre

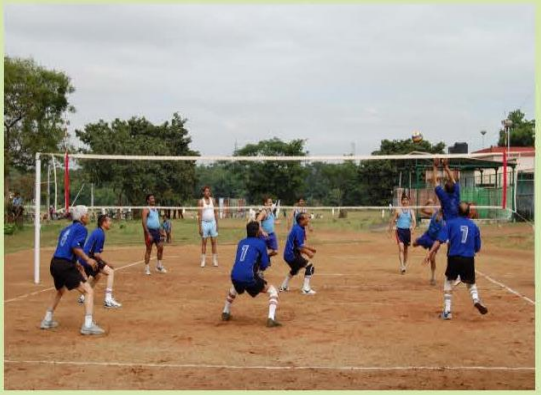
CMERI has a small but adequately equipped Medical Centre that caters to the primary health needs of the denizens. The Medical Centre accommodates regular visits by practitioners and moreover serves as a distribution centre for prescribed medicines. CMERI has tie-ups with the local hospitals including a super-speciality hospital at Durgapur.

Life at the Academic Hall of Residence is perhaps ideal for young students and research scholars who are provided with secured, simple and comfortable residence and is released from the worry of arranging for their own meals, which is taken care of by a catering arrangement. CMERI is steadily adding to the existing amenities for making their lives even more enjoyable.

Accommodation for visiting scientists, guests and other stakeholders of research and development is provided in the Main Guest House and in the Executive Hostels in the Residential Campus.



Cricket Field adjacent to the Academic Hall of Residence



Volleyball Ground adjacent to the Academic Hall of Residence

CMERI Guest House

Academic Hall of Residence