Key Research Themes of IIT Mandi

https://www.iitmandi.ac.in

Overview: Research Vision of IIT Mandi

Indian Institute of Technology Mandi pursues interdisciplinary, high-impact research that integrates fundamental science, engineering innovation, sustainability, and societal relevance, with a strong contextual focus on the Indian Himalayan Region (IHR). Research at IIT Mandi is aligned with national missions (energy, sustainability, digital India, health, agriculture, and climate resilience) and global scientific frontiers, emphasizing translation from lab to field, technology development, and innovation.

IIT Mandi's research ecosystem is characterized by:

- Interdisciplinarity
- Strong alignment with national missions
- Himalayan and sustainability focus
- Translation from fundamental science to societal impact

The Institute's research ecosystem is organized across multiple Schools, each contributing distinct disciplinary strengths while actively collaborating across domains. Together, the Schools position IIT Mandi as a **globally relevant yet locally grounded research-intensive institute**.

School-wise Key Research Domains and Themes

School of Computing and Electrical Engineering (SCEE) **Page 2**

School of Mechanical and Materials Engineering (SMME) **Page 3**

School of Civil and Environmental Engineering (SCENE) **Page 4**

School of Physical Sciences (SPS) **Page 5**

School of Chemical Sciences (SCS) **Page 6**

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School of Mathematical and Statistical Sciences (SMSS) **Page 8**

School of Humanities and Social Sciences (SHSS) **Page 9**

School of Management (SOM) **Page 10**

School of Computing and Electrical Engineering (SCEE)

Key Contact for Academic/Industry R&D and Consultancy

https://sric.iitmandi.ac.in

Contact: sricoffice@iitmandi.ac.in; arsric@iitmandi.ac.in; deansric@iitmandi.ac.in

School of Computing and Electrical Engineering (SCEE)

https://scee.iitmandi.ac.in/

Strategic Strength: Translation of AI, electronics, and power systems into scalable, real-world technologies with strong industry and government engagement.

Key Contact: chairscee@iitmandi.ac.in

Core Research Domains

- **Intelligent Systems & Artificial Intelligence**
- **Control, Automation & Cyber-Physical Systems**
- **Intelligent Communication Systems**
- **Microelectronics & VLSI**
- **Power Engineering**
- **Theoretical Computer Science & Systems**
- **Other areas – see website [https://scee.iitmandi.ac.in/]**

Key Research Themes

- AI and ML for healthcare, agriculture, smart cities, robotics, and cybersecurity
- Computer vision, biometrics, speech and audio processing, multimodal sensor fusion
- Cognitive science, human–computer interaction, brain decoding, EEG and biosignal analytics
- Smart grids, EV charging infrastructure, power electronics, renewable energy systems
- 5G/6G communication, IoT, wireless networks, photonics, and information theory
- Analog, digital, and mixed-signal VLSI, hardware security, neuromorphic and quantum computing
- Algorithms, cryptography, complexity theory, graph algorithms, and distributed systems

School of Mechanical and Materials Engineering (SMME)

https://smme.iitmandi.ac.in/

Strategic Strength: Sustainable materials and manufacturing aligned with **Clean Energy**, **Semiconductor**, **Waste-to-Wealth**, and **National Water Missions**.

Key Contact: chairsmme@iitmandi.ac.in

Core Research Domains

- **Design & Mechanics**
- **Thermal–Fluids & Energy Systems**
- **Manufacturing & Advanced Processing**
- **Materials Science & Engineering**
- **Other areas - see website https://smme.iitmandi.ac.in/**

Key Research Themes

1. Composite structures, fracture mechanics, smart structures, biomechanics, and implants
2. Thermal management, turbulence, combustion, multiphase and porous media flows
3. Additive manufacturing, laser-based and microwave-assisted manufacturing, biofabrication
4. Advanced ceramics, battery materials, supercapacitors, semiconductors, biomaterials
5. Sustainable materials, grain boundary engineering, urban mining, e-waste recycling
6. Materials for clean energy, electronics, health, and environmental applications

School of Civil and Environmental Engineering (SCENE)

https://scene.iitmandi.ac.in/

Strategic Strength: Climate-resilient infrastructure and disaster risk reduction tailored to **mountain ecosystems**.

Key Contact: chair_scene@iitmandi.ac.in

Core Research Domains

- **Structural Engineering**
- **Environmental & Water Resources Engineering**
- **Geotechnical, Geomatics & Transportation Engineering**
- **Other areas - see website https://scene.iitmandi.ac.in/**

Key Research Themes

- Multi-hazard resilient infrastructure for the Himalayan region
- Landslide risk assessment, permafrost and glacier hazards, GLOFs
- Sustainable geotechnical solutions and nature-based ground improvement
- Hydrology, hydroclimatology, ecohydrology, and water resource management
- Environmental chemistry, microbiology, aerosols, sustainable agriculture
- Road safety, transportation systems, and remote sensing applications

School of Physical Sciences (SPS)

https://sps.iitmandi.ac.in/

Strategic Strength: Bridging **fundamental physics** with **quantum technologies, energy applications, and advanced materials**.

Key Contact: chairsps@iitmandi.ac.in

Core Research Domains

- **Condensed Matter & Quantum Materials**
- **Atomic, Molecular & Optical Physics**
- **Soft Matter Physics**
- **High Energy Physics, Cosmology & Gravity**
- **Other areas - see website https://sps.iitmandi.ac.in/**

Key Research Themes

- Quantum and 2D materials, superconductivity, spintronics, topological systems
- Raman spectroscopy, phonon engineering, nano-functional devices
- Soft matter, polymers, liquid crystals, active matter, biological physics
- Atomic and optical physics at nanoscale, quantum optics
- Fundamental studies in particle physics, cosmology, and quantum gravity

School of Chemical Sciences (SCS)

https://scs.iitmandi.ac.in/

Strategic Strength: Chemistry-driven solutions for **energy transition**, **sustainable synthesis**, and **advanced functional materials**.

Key Contact: chairscs@iitmandi.ac.in

Core Research Domains

- **Organic, Inorganic, Physical & Materials Chemistry**
- **Green Chemistry & Catalysis**
- **Polymers, Nanoscience & Functional Materials**
- **Computational & Theoretical Chemistry**
- **Other areas - see website https://scs.iitmandi.ac.in/**

Key Research Themes

- Organic synthesis, C–H activation, metallo-radical catalysis
- Functional polymers, supramolecular and stimuli-responsive materials
- Photochemistry, photocatalysis, electrocatalysis, and energy materials
- Materials for solar cells, LEDs/OLEDs, imaging, and sensing
- Green chemistry, nitrogen fixation, hydrogen evolution, flow chemistry

School of Biosciences and Bioengineering (SBB)

https://sbb.iitmandi.ac.in/

Strategic Strength: Integrative fundamental biology, Bioengineering, **multi-omics and systems biology** spanning **health, environment, and agriculture**.

Key Contact: chairsbb@iitmandi.ac.in

Core Research Domains

- **Disease Biology**
- **Biomedical Engineering & Technologies**
- **Biology of Ageing & Age-Related Diseases**
- **Metabolic & Microbial Systems Biology**
- **Other areas - see website https://sbb.iitmandi.ac.in/**

Key Research Themes

- Biology of ageing, neurodegeneration, protein quality control
- Immune engineering, inflammation, and disease prognosis
- Collagen Post-Translational Modifications at The Interface of Extracellular Matrix (ECM) Remodelling, Fibrosis and Regeneration
- Biomaterials for Tissue Engineering
- Nanomaterials for Biomedical Applications
- Mechanobiology for Understanding Diseases
- Multi-omics, metabolic flux analysis, and systems-level modeling
- Microbiome research, probiotics, fermented foods
- Synthetic microbial consortia, waste valorization, bioremediation
- Plant metabolism, phytochemical discovery, smart agriculture, lab-to-field translation
- AI & ML for Rehabilitation

School of Mathematical and Statistical Sciences (SMSS)

https://smss.iitmandi.ac.in/

Strategic Strength: Mathematical foundations underpinning **AI, climate science, engineering systems, and data-driven decision-making**.

Key Contact: chairsmss@iitmandi.ac.in

Core Research Domains

- **Pure & Applied Mathematics**
- **Differential Equations & Mathematical Modeling**
- **Statistics, Optimization & Data Science**
- **Other areas - see website https://smss.iitmandi.ac.in/**

Key Research Themes

- Mathematical modeling of infectious diseases, ecology, and social systems
- Dynamical systems, fractional and time-scale equations
- Numerical methods, CFD, image processing, physics-informed neural networks
- Climate statistics, rainfall analysis, extreme value theory
- Optimization, machine learning, deep reinforcement learning
- Algorithms, complexity theory, and graph algorithms

School of Humanities and Social Sciences (SHSS)

https://shss.iitmandi.ac.in/

Strategic Strength: Integrating **humanities and social sciences** into technology, sustainability, and policy discourse.

Key Contact: chairshss@iitmandi.ac.in

Core Research Domains

- **Literature, History & Cultural Studies**
- **Sociology & Anthropology**
- **Economics, Energy & Environmental Policy**
- **Other areas - see website https://shss.iitmandi.ac.in/**

Key Research Themes

- Postcolonial, comparative, and world literature; translation studies
- Social and cultural history, migration, refugees, Himalayan societies
- Sociology of science, religion, urbanization, and infrastructure
- Development economics, health economics, macroeconomics
- Energy and environmental economics, sustainability policy

School of Management (SOM)

https://som.iitmandi.ac.in/

Strategic Strength: The School of Management advances interdisciplinary, data-driven, and behaviourally informed management research, integrating AI, decision sciences, and human insights to address challenges of digital transformation, inclusive growth, and the future of work.

Key Contact: chairsom@iitmandi.ac.in

Core Research Domains

- **Digital and Computational Management Sciences**
- **Decision Sciences and Analytics**
- **Finance, Entrepreneurship and Inclusive Growth**
- **Marketing, Consumer Insights and Digital Markets**
- **Organizational Behaviour, Human Capital and Leadership**
- **Other areas - see website https://som.iitmandi.ac.in/**

Research Themes

- Digital and Intelligent Decision Systems (multicriteria decision-making, fuzzy logic, decision support under uncertainty)
- Artificial Intelligence, Machine Learning and Business Analytics
- Computational Finance, FinTech and Financial Inclusion
- Entrepreneurship, Innovation and Startup Ecosystems
- Consumer Behaviour, Neuromarketing and Decision Psychology
- Digital Marketing, Sales and Technology Adoption
- Bottom of the Pyramid (BoP) Markets and Inclusive Business Models
- Human Capital, Leadership and HR Analytics (behavioural analytics, diversity, AI in HR)