

Areas of Interest/Research Topic

Name of Faculty Mentor	Areas of Interest/Research Topic	Remarks
Department Of Astronomy, Astrophysics And Space Engineering (DAASE)		
Dr. Abhirup Datta	<ol style="list-style-type: none"> 1) Observational Cosmology and Astrophysics - statistics, machine learning, and simulations. 2) Radio and X-ray Astronomy - Observations, Data Analysis and Instrumentation (Square Kilometre Array, GMRT) 3) Statistics and Machine Learning related to Space Applications 4) Space Weather and Ionosphere: NaVIC and GPS applications 5) Space Instrumentation - Payloads and future missions 	
Dr. Suman Majumdar	<ol style="list-style-type: none"> 1. Cosmology 2. Early Universe 3. Epoch of Reionization and Cosmic Dawn 4. 21-cm Cosmology 5. Statistical Inference 6. Observations of the Early Universe with Next Generation Telescopes 7. Large Scale Structures 8. Simulations of the Early Universe 9. Cosmological N-body Simulations 10. Square Kilometer Array 11. Machine Learning and Artificial Intelligence 12. Statistics with BIG DATA Cosmology 	
Dr. Saurabh Das	<ol style="list-style-type: none"> 1. Space weather/Solar wind prediction and modelling using AI/ML 2. GNSS/GPS navigation and remote sensing 3. Pulsar-based navigation for Human Space Mission 4. Hyperspectral, Multi-spectral and UAV remote Sensing 5. Cyclone and extreme weather prediction using Deep Learning/ AI 	

Dr. Amit Shukla	<ol style="list-style-type: none"> 1) Active galactic nuclei 2) Blazars 3) High Energy Astrophysics 4) Pulsars 5) Multi-wavelength & multi-messenger astrophysics 6) Kilonova (electromagnetic counterpart to a gravitational-wave) 	
Dr. Rajkumar Hajra	<ol style="list-style-type: none"> 1) Space weather 2) Geomagnetic storms and substorms 3) Earth's outer radiation belt 4) Ionospheric modeling 	
Department of Biosciences and Biomedical Engineering (BSBE)		
Dr. Sharad Gupta	<ol style="list-style-type: none"> 1) Biophotonics 2) NIR imaging 	
Dr. Prashant Kodgire	<ol style="list-style-type: none"> 1) Molecular Biology 2) Molecular Immunology 3) Genetic Engineering 4) Recombinant DNA Technology 5) Microbiology 6) Recombinant Protein Expression and Purification 7) Diagnostics 	
Dr. Mirza S. Baig	<ol style="list-style-type: none"> 1) Disease Modelling, Target Identification, and Drug Discovery 	
Dr. Hem Chandra Jha	<ol style="list-style-type: none"> 1) Project 1- Determination of Epstein Barr Virus and host interaction using bioinformatic tools. 2) Project 2- Bioinformatic approach to study plant based products as potential antivirals. 	

	<ul style="list-style-type: none"> 3) How to diagnose viral infection! 4) How to choose correct diagnostics targets in various infections! 5) Genomics & proteomics approaches to understand the host-pathogens interactions! 6) Metabolomics & other OMICS studies in modern health sciences! 7) Viral infection in brain cells 8) Our gut is more important than any other organs! 	
Dr. Parimal Kar	1) Computer Aided Drug Design for Infectious Diseases	
Department of Chemistry		
Professor Suman Mukhopadhyay	1) Biological applications of transition metal complexes	
Dr. Apurba K. Das	<ul style="list-style-type: none"> 1) Bio-organic chemistry 2) Electrocatalysis 	
Dr. Chelvam Venkatesh	<ul style="list-style-type: none"> 1) Synthesis of Natural products, Heterocycles and Carbocycles, Construction of C-C and C-X (X =N,O,S,P) bonds 2) Diagnostic Applications of New targeting ligands for Cancers and Inflammatory diseases 3) Synthesis of Inhibitors for Drug Targets, Drug delivery systems 4) Near-infra red fluorescence optical and Nuclear Imaging 5) Bio-conjugate Chemistry 	
Department of Civil Engineering		
Dr. Neelima Satyam	<ul style="list-style-type: none"> 1) Soil structure interaction 2) Environmental geotechnics 3) Transportation geotechnics 	

	<ul style="list-style-type: none"> 4) Soil dynamics 5) Rock mechanics and underground structures 	
Professor Sandeep Chaudhary	<ul style="list-style-type: none"> 1) Sustainable building materials 2) Concrete Technology 3) Tall Buildings 	
Dr. Gourab Sil	<ul style="list-style-type: none"> 1) Performance Based Geometric Design of Highways 2) Safety of Roadway Infrastructure 3) Effects of Highway Infrastructure on Driver Behavior 4) Traffic Engineering 	
Department of Computer Science and Engineering		
Dr. Aruna Tiwari	<ul style="list-style-type: none"> 1) Artificial Intelligence 2) Machine Learning for Big Data handling 3) Soft-computing 4) Data Mining 	
Dr. Anirban Sengupta	<ul style="list-style-type: none"> 1) Hardware Security 2) Digital Forensics 3) CAD-VLSI 4) Machine Learning Chips 5) Computer Architecture and Optimization 6) Soft Computing 	
Dr. Surya Prakash	<ul style="list-style-type: none"> 1) Machine Learning 2) Deep Learning 3) Pattern Recognition 4) Computer Vision 5) Image Processing 6) Biometrics 	

Dr. Somnath Dey	<ol style="list-style-type: none"> 1) Biometric Security 2) Image Processing 3) Machine Learning 	
Dr. Gourinath Banda	<ol style="list-style-type: none"> 1) Developing Application and Guidance notes for formal analyses of software systems 2) Applied Static analyses for systems programs 3) Precision positioning system for laboratory scales 4) Developing medical cyber physical systems 5) Systematic studies into ancient yogic practice affects on human anatomy, physiology and genetics 	
Dr. Neminath Hubballi	<ol style="list-style-type: none"> 1) Network Security 2) Cyber Security 3) Cloud Security 4) Fault Detection in Networks 	
Dr. Bodhisatwa Mazumdar	<ol style="list-style-type: none"> 1) Secure Lightweight Cryptographic Implementations for IoT Devices. 2) Machine Learning Model for Synthesizing Lightweight Cryptographic Primitives. 3) Fault Analysis Techniques for Lightweight Cryptography. 	
Dr. Puneet Gupta	<ol style="list-style-type: none"> 1) Deep Learning 2) Computer Vision 3) Image Processing 4) Artificial Intelligence 	
Dr. Chandresh Kumar Maurya	<ol style="list-style-type: none"> 1) Machine learning 2) Deep learning 3) Natural language processing 4) Text Mining 	

Department of Electrical Engineering		
Professor Ram Bilas Pachori	<ol style="list-style-type: none"> 1) Signal Processing 2) Biomedical Signal Processing 3) Speech Signal Processing 4) Machine Learning 	
Dr. Shaibal Mukherjee	<ol style="list-style-type: none"> 1) Solar cell 2) RF transistor 3) Artificial neurons/Silicon brain/RRAM for image processing 4) 2D materials for RRAMs 5) Biochemical sensor 	
Dr. Vivek Kanhangad	<ol style="list-style-type: none"> 1) Image analysis 2) Computer vision 3) Machine learning with a focus on biometric security and biomedical applications. 	
Dr. Mukesh Kumar	<ol style="list-style-type: none"> 1) Optoelectronics/Photonics 2) Integrated CMOS-Photonics 3) On-chip Optical Biosensors 4) Device Fabricatoin 	
Dr. Abhinoy Kumar Singh	<ol style="list-style-type: none"> 1) Stochastic estimation and filtering 2) Target tracking 	
Dr. Saptarshi Ghosh	<ol style="list-style-type: none"> 1) Electromagnetics 2) Frequency selective surfaces (FSSs) 3) Metamaterials 4) Microwave absorbers 5) Microwave antennas 	

	6) 3-dimensional (3-D) printing	
Dr. Swaminathan R.	<ol style="list-style-type: none"> 1) Space-Air-Ground Integrated Networks (SAGIN) 2) Hybrid Optical-RF Communication 3) Blind Channel Code and Interleaver Reconstruction Techniques 4) Index Modulation Techniques for Next-generation Wireless Communication 5) Energy Harvesting Schemes for Integrated Optical-RF Networks. 6) Non-Orthogonal Multiple Access (NOMA) Techniques 7) Intelligent Reflecting Surface-based Wireless Communications 8) TeraHertz Wireless Communication 9) Machine Learning/Deep Learning for Communication Systems 	
School of Humanities and Social Sciences		
Dr. Nirmala Menon	1) Digital Humanities	
Dr. Ruchi Sharma	<ol style="list-style-type: none"> 1) Economics of innovation 2) International economics 3) Industrial organization 4) R&D 5) Patenting 6) Patent policy 7) Technology transfer 8) Foreign direct investment and licensing 9) Entrepreneurship 	
Dr. Akshaya Kumar	<ol style="list-style-type: none"> 1) Indian Cinema 2) Comparative Media studies 3) Cultural studies 4) Sociology of labour migration 5) Performance studies 	

Dr. Ananya Ghoshal	<ol style="list-style-type: none"> 1) 20th Century American and British Literature 2) William Blake- Poet and Printmaker 3) Narratives of the Anthropocene/Climate Change 4) Parallel Cinema/The Indian New Wave 5) Literature and Disability 6) Photography and Children's Literature/Picture books 7) 19th Century Bengal: Thoughts and Ideas 	
Dr. Kalandi Charan Pradhan	<ol style="list-style-type: none"> 1) Assessing the Vulnerability to Climate Change 2) Sustainable Development 3) Economics of Labour Migration 4) Socio-Economic Impacts of Climate Change 	
Department of Mathematics		
Dr. Md. Aquil Khan	<ol style="list-style-type: none"> 1) Modal Logic 2) Rough Set Theory 	
Dr. Anand Parkash	<ol style="list-style-type: none"> 1) Commutative Algebra 	
Dr. Sanjeev Singh	<ol style="list-style-type: none"> 1) Special functions related to Bessel function 	
Dr. Santanu Manna	<ol style="list-style-type: none"> 1) Mathematical Modelling of near-surface Love wave fields. (Minimum time required one month) 2) Asymptotic analysis of the Rayleigh wave propagation in layered media. (Minimum time required 2 months) 3) Dynamic stiffness formulation and Wave motion in a Non-homogeneous structure. (Minimum time required 2 months) 4) Apart from the above 3 topics faculty/students can propose any other topic from Applied Mathematics or Wave Theory 	

Dr. Bapan Ghosh	<ol style="list-style-type: none"> 1) Chaotic Dynamics and Computations 2) Delay Differential Equations and Applications 3) Fractional Differential Equations 4) Mathematical Biology 	
Department of Mechanical Engineering		
Professor Anand Parey	<ol style="list-style-type: none"> 1) Condition monitoring 2) Noise and vibration 3) Mechanical Systems Signal Processing 	
Dr. Shanmugam Dhinakaran	<ol style="list-style-type: none"> 1) Computational Fluid Dynamics and Heat Transfer: Mathematical modelling and CFD simulations in all areas. 2) COVID-19: Modelling of SARS-CoV-2 transmission 3) Analytical solutions: Advanced fluid flow and heat transfer problems 4) CFD Softwares: CFD modelling and simulations with OpenFOAM and Ansys Fluent 5) Bluff Body Aerodynamics: Drag reduction techniques; Flow control; Vortex shedding and heat transfer, etc. 6) Marine Hydrodynamics 7) Porous Media: Fluid flow and heat transfer in Porous Media applied to all fields of Science and Engineering 8) Non-Newtonian fluid Mechanics: Viscoelastic fluid flows; Flow in microchannels; Optimization of microfluidic devices 9) Multi phase flows: Modelling and simulation of multiphase flows 10) Heat transfer enhancement: Electronic cooling; Nanofluids; Science and technology of heat pipes; Evaporation, etc. 11) Renewable energy: Solar air heaters; Solar collectors; Solar stills, etc. 12) Development of numerical schemes: Finite volume methods: Development of high resolution schemes; Lattice Boltzmann methods, etc. 	

- 13) **Biofluid Mechanics and Bio-heat transfer:** Respiratory air flow, Blood flow in diseased arteries; Cancer treatment; Drug delivery; Human body heat transfer.
- 14) **Engineering Device development:** Design and development of devices that involves fluid flow, heat and mass transfer.
- 15) **Other areas:** Fuel cells; Thermal Energy Storage; CFD in welding and Metallurgy; CFD in Sports

Who can apply? All those who are awarded or pursuing B.Tech/M.Tech/B.Sc/M.Sc/Ph.D in **Engineering** (Aerospace, Agriculture, Automobile, Chemical, Civil, Environmental, Mechanical, Textile, Manufacturing, Petroleum, Geotechnical, Nuclear, Marine, Nanotechnology, Mining, Ceramics, Metallurgy, Biomedical, Biotechnology etc) or **Science** (Applied mathematics, Physics, Biosciences, Biochemistry, Life Sciences, Sports science, etc.)

BSBE Department:

- 1) **Computational Fluid Dynamics and heat transfer:** CFD applied to all areas of Biochemistry, Biosciences, Bioengineering, Biotechnology and Biomedical Engineering
- 2) **COVID-19:** Mathematical modelling and simulations of infectious SARS-CoV-2 virus transport
- 3) **Biofluid Dynamics:** Biofluids & general biological fluid flows; BioMEMS; Biomicrofluidics; Lab-on-a-chip, etc.
- 4) **Human body:** Respiratory obstructive diseases; Blood flow in diseased arteries (Stenosis & Aneurysm); CFD in cardiovascular disease; Modelling of heat transfer from human body
- 5) **Diseases diagnosis and treatment:** Drug delivery; Cancer treatment; COPD, etc.
- 6) **Tissue Engineering:** Heat transfer in biological tissues; Scaffolding; Porous scaffolds; Bio-reactor, etc.

	<p>7) Bioenergy: Bioenergy systems and modelling; Biomass, Biomass thermochemical conversion; Bioreactors; Microbial fuel cells; Waste water treatment</p> <p>8) Biomedical device development: Respiratory devices; Devices for the disabled and elderly; other medical devices.</p> <p>Who can apply? All those who are awarded or pursuing B.Tech/M.Tech/B.Sc/M.Sc/Ph.D in the following streams: Biosciences, Biochemistry, Biotechnology, Bioengineering, Biomedical Engineering and other relevant science/engineering backgrounds.</p>	
Dr. Shailesh I. Kundalwal	<ol style="list-style-type: none"> 1) Composite Structures 2) Experimental Characterization of Composites 3) Finite Element Applications 4) Flexoelectricity and Piezoelectricity 5) Mechanics of Nanostructures 6) Nanomechanics & Micromechanics of Composites 7) Nanotechnology in Engineering 8) Smart Materials and Structures 	
Dr. Indrasen Singh	<ol style="list-style-type: none"> 1) Finite Element Methods (Linear as well as Non-linear) 2) Finite Element Modeling of Indentation in Elastic-Plastic solids in Abaqus 3) Fracture Mechanics 4) Continuum Mechanics 5) Theory of plasticity 6) Mechanical Behaviour of Materials 7) Metallic Glasses 8) Piezoelectric Materials 	
Dr. Harekrishna Yadav	<ol style="list-style-type: none"> 1) Fluid-Structure Interaction 2) Shear Flow 	

	<ul style="list-style-type: none"> 3) Flow and Turbulence Measurement using Optical Techniques 4) Heat Transfer Enhancement 5) Supersonic Flow 6) Renewable and Sustainable Energy 	
Dr. Satyanarayan Patel	<ul style="list-style-type: none"> 1) Thermal energy harvesting using pyroelectric materials 2) Heat Transfer analysis for solid-state refrigeration 3) Image-based FEM analysis of Composite materials for thermal stress and electric properties 4) Energy conversion, storage and harvesting materials 5) Piezoelectric, Pyroelectric and ferroelectric materials 	
Dr. Ankur Miglani	<ul style="list-style-type: none"> 1) Combustion of next-generation fuels: Gel fuels and nanoparticle laden fuels 2) Thermal management of power-dense electronics: Flow boiling in microchannels 3) Microfluidics 4) Soft-matter: Instabilities in drying colloidal systems 5) Machine learning based pattern recognition in energy systems 	
Department of Metallurgy Engineering and Materials Science		
Dr. Rupesh Devan	<ul style="list-style-type: none"> 1) Nanomaterials for energy applications 2) Thin films: synthesis and characterization 3) Nanomaterials: synthesis and characterization 	
Dr. Santosh Hosmani	<ul style="list-style-type: none"> 1) Surface Engineering and Characterisation 2) Tribology 3) Physical Metallurgy 4) Microstructure-Property correlation 	
Dr. Jayaprakash Murugesan	<ul style="list-style-type: none"> 1) Advanced welding techniques 	

	2) Fatigue and fracture behavior of advanced materials 3) Surface engineering	
Dr. Hemant Borkar	1) Materials Science and Engineering 2) Mechanical metallurgy 3) Lightweight materials for automotive applications	
Dr. Ram Sajeevan Maurya	1) Bulk Metallic glass (BMG) 2) Composite Materials 3) Oxide dispersion strengthened (ODS) alloys 4) High entropy alloys (HEAs) 5) Alloy/composite development by powder technology route: Mechanical alloying 6) Spark plasma sintering	
Dr. Dudekula Althaf Basha	1) Deformation behavior of magnesium alloys	
Department of Physics		
Dr. Raghunath Sahoo	1) High Energy Nuclear Physics, Quark-Gluon Plasma (Experiment and Phenomenology) 2) Application of Statistical Mechanics in High-energy Physics 3) Relativistic Kinematics, Statistical Methods in Physical Sciences and Engineering 4) Experimental Techniques in Nuclear and High-energy Physics	
Dr. Rajesh Kumar	1) Devices physics 2) semiconductor nanomaterials 3) Raman spectroscopy	
Dr. Sudeshna Chattopadhyay	1) Electrical Energy Storage: Lithium-ion batteries, and batteries beyond Lithium.	

	<ul style="list-style-type: none">2) X-ray scattering (including X-ray diffraction (XRD), X-ray reflectivity (XRR), Grazing incidence small angle X-ray scattering (GISAXS)): Characterization of Nanomaterials, Surface and Interfaces.3) Spectroscopy for interdisciplinary research (for Physicist, Materials scientist and Biologist)4) Nanotechnology in Biomedical applications and Environmental remediation	
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Note: Outside Faculty members/Students are requested to contact concerned faculty mentor for any query/clarification. Consent form faculty mentor of IIT Indore is a must.