INFORMATION BROCHURE

INDIAN INSTITUTE OF TECHNOLGY(BHU) ,VARANASI

M.Tech

In

BIOMEDICAL ENGINEERING

Historical Background

Biomedical Engineering is a highly interdisciplinary and upcoming field of technology. The School of Biomedical Engineering is involved in Teaching and Research in collaboration with Institute of Medical Sciences (BHU), and with other Departments of IIT(BHU). The School follows a constant path of progress and diversification to be in pace with the time of change.. The school time to time updates the curriculum, introduces newelectives and new practical components according to the requirements. The objective of the School is to play an important role in the development of Biomedical Engineers. The research credentials of the School is multifarious and interdisciplinary so as to integrate all the thematic of the field in one common pool and thereby achieve progress is unison. The School of Biomedical Engineering was established by the UGC during the Fifth Five Year Plan in the year 1978. Banaras Hindu University is fortunate in having both the Institute of Technology and Institute of Medical Sciences in the same campus. This results in excellent collaborative work related to Biomedical Engineering. The infrastructure development work of the School was started in 1985 with the appointment of core faculty.

Faculty Members

Profile picture	Designation	Areas of Interest
	Dr. Neeraj Sharma neeraj.bme@iitbhu.ac.in Professor	Bioinstrumentation, Biomedical Signal and image Processing.
	Dr. Ranjana Patnaik rpatnaik.bme@iitbhu.ac.in Professor	Neurophysiology, Electrophysiology, Biomaterials, Biochemistry
	Dr. Nira Misra nmishra.bme@iitbhu.ac.in Professor	Biomaterials, Nanocomposites

	Dr. Prasun Kumar Roy pkroy.bme@iitbhu.ac.in Professor	Brain Research, Neuroscience, Neurotchnology, Medical Imaging (MRI, fMRI), Cognitive Processing
	Dr. Shiru Sharma shiru.bme@iitbhu.ac.in Associate Professor	Biological control system, Mathematical modeling of biological system, Bio-instrumentation
	Dr. Sanjay Kumar Rai skrai.bme@iitbhu.ac.in Associate Professor	Biomechanics
	Dr. Marshal marshal.bme@iitbhu.ac.in Associate Professor	Biophyiscs, Biomaterials and Tissue Engineering, Stem Cell Reprogramming, Biosensors, Bio-MEMS, Nano-medicine, Plasma Physics
	Dr. Pradip Paik paik.bme@iitbhu.ac.in Associate Professor	Materials for Health Care and Therapeutic Applications: New designing and synthesis of Polymers, Ceramic, Composites, other Nanoscale Materials of Health care and Nanomedicine, in-plantable materials, Drug Delivery, Cancer Therapy, Nano vaccination, in-vitro and in-vivo studies
	Dr. Sanjeev Kumar Mahto skmahto.bme@iitbhu.ac.in Assistant Professor	Cell and Tissue Engineering, Biomicrofluidics, Neuroengineering, Nanotoxicology

COURSE STRUCTURE

The main objective of Biomedical Engineering branch is to educate young engineers & to conduct research in the wider field of organisation and discover new ways to make life better for the general public. It is basically a wonderful blend of technology and medical science which work in collaboration so as to device new methodology of treatments and innovate the diagnostic devices.

First semester

- Artificial Intelligence & its application to Biomedical Engg.
- Mathematical Modeling & Simulation
- Biomedical Instrumentation System Design, Safety and Reliability Aspects
- Advance Biomechanics
- Electrophysiological Signal Analysis
- BioMEMS & Biosensors

Labs

- Artificial Intelligence lab
- Mathematical Modeling and Simulation lab

Second semester

- Biomedical Signal & Image Processing.
- Bioinstrumentation
- Radiation Biology & its Biomedical Application
- Rehabilitation Engineering
- Tissue Engineering
- Biomaterial Technology

Third semester

- M-tech thesis

Fourth semester

- M-tech thesis

Lab Facilities :

- ## Electrophysiology Lab

The lab focuses on cerebral circulation, neruophysiology, neurological disorders and neuroprotection. Ongoing Research(es) :Neurodegenerative diseases and neuroprotection; Molecular biology of Neurological disorders Outcome (Till Date) :Low cost hearing aid; Android operated caregiver bed; Electromagnetic healing apparatus; Dynamic cerebral pressure modelling; phytochemicals as potent drugs in Stroke (MCAO, TBI) model LAB Facilities :HPLC-ECD; Laser Doppler Blood Flow Monitor; Non-invasive Blood Pressure Monitor; Tissue Oxygenation Monitor; Probe Sonicator; -20 Freezer; Rota Rod

- ## Bioinstrumentation and Signal Processing Lab

The recording and analysis of biosignals and Images have gained much more important in these recent years, which allows the medical practitioners to extract needed information for analyzing the physiological events real-time, leading to the accurate diagnosis and better medical treatment of the patients. This Lab, is used for giving hands on experience to UG, PG and Research students. In this lab we are mainly working on: (i) Digital Signal processing techniques, (ii) Image Processing techniques, and (iii) Application of Artificial Intelligence to Biomedical Engineering areas.

At research level we are working to improve the disease diagnosis, and particularly interested to develop the new algorithms to improve the quality of radiological images in terms of artifact corrections, enhancement and automatic segmentation. A strong interest is arising in the field of deep learning based segmentation and medical image quality assessment.

- ## Biomechanics Lab

Biomechanics Laboratory is associated with the research in the field of Orthopaedic Implants, Dental Biomechanics and Energy Harvesting using Piezo electric devices. Present work focuses primarily on Computational Biomechanics of lower extremity as well as dental biomechanics. It deals with 3D modeling using CT and MRI data, implant design (CAD/CAM) and Optimization as well as Simulations (Finite Element Analysis). Lab has its collaboration with Institute of Medical Sciences, BHU and faculty of Dental Sciences, Trauma Centre, BHU. Lab has fully equipped with the licensed versions of software:- Ansys, Anybody, Creo and Mimics Medical+ 3Matic Medical.

- ## Cellular therapeutics and Bio-devices Lab

Research Interests

- Developing cellularised platforms which enables selective differentiation of human stem cell into tissue specific cells.
- Developing cost effective Biosensors and Bio-MEMS/Bio-Devices.
- Process development towards large scale production of nanomaterials of clinical significance for nano-therapeutics uses.
- Biocompatible metal ion impregnated polymeric nanocomposite films as efficient antibacterial materials.

Achievements

- Achieved selective differentiation of human stem cell into osteoblasts and other lineages.
- Developed surface analytical methods for label-free quantification of molecules.

- Established detection methods for cost effective biosensors.

Outreach activities

Lab provide training / dissertation work support to UG/PG students of other institutes in the area of stem cell and biosensors .

- ## Electronic Circuit and Control Lab

Facilities available:

Transducer and Instrumentation Trainer (DYNA1750) , 3MHz Function generator(HM5030S4), Analog Digital Trainer Kit(EDC-20),, Analog circuit development(Scientech 2612),Digital circuit development platform (Scientech 2611), Analog digital circuit development platform (Scientech 2613), Advanced Analog circuit development (Scientech ST2612A), Understanding characterstics of MOSFET, FET & UJT(Nvis 6512A), Autoranging Digital Multimeter(SM5011A), OP-Amp Application Trainer(ST2323), BJT amplifier and Emitter Follower(NV6542), Transient analysis of RLC circuit(Nvis 6515), Light and Temperature sensor module(DT-4001), Signal conditioning Ckts(DT-4004), Universal breadboard system (1MHz FG)(AET-205A), Component Development System(PDC-20), 30MHz CRO scientech(SM410), 30MHz 2 channel CRO scientech(801C), 30MHz CRO + 1MHz FG scientech(820), Thermocouple Trainer kit(VPL), Thermistor Sensor steady card(VPL), LVDT Trainer(VPL), Microprocessor Trainer Kit(VPL), DC motor Speed control set(SCL 107 + 106), AC servo motor speed torque characterstics(SCL 112), AC motor position control(CL-ACM), Temperature system, stimulator(CLTSS), Linear system stimulator(CLSS &Vijayanta), Potentiometric error detector(CL-PED), PID temperature control(TCS101), PID Control trainer(CPID101), Compensation design trainer(CNS101).

- ## Microprocessor Lab

This is an UG Lab. mainly designed to give student hand on experience in the area of assembly level programing of microprocessor/microcontroller, interfacing peripheral devices. This Lab. is also equipped with PIC and ARM processer trainer system.

This lab provides support to the UG/PG students introduced in carrying out project work on the design and fabrication of embedded system of biomedical design. Further the facilities available in the lab are also used by student for carrying out exploratory projects.

- ## Physiology Lab

Major Facilities:

Non-invasive Blood Pressure Monitor (ADinstrument); Laser Doppler Blood Flow Meter(ADinstrument); Tissue oxygen Monitor (Oxford Optronix); HPLC-ECD; RotaRod; Ultrasound Probe Sonicator; -200C Refrigerator; Stereotactic Device with surgical table; Polyrite-D for EEG, ECG and EMG; EMF generator.

Minor Facilities:

Centrifuge; Electronic Weighing Balance; Water Bath; Incubator; Oven; Bone Driller; Tissue Homogeniser; Refrigerator; Digital Sonicator; Double Distallation Unit; Liquid Nitrogen Container; Magnetic Stirrer; Vortex, pH meter; Heating Mantle.

Major Thrust Area:

- Rodent Model Development: Middle Cerebral Artery Occlusion; Bilateral Common Carotid Artery Occlusion; Stress; Wound Healing etc.
- Neuroprotection In silico Drug Designing

- ## Tissue Engineering & Biomicrofludics Lab

  Research interests in Tissue Engineering and Biomicrofluidics (TEBM) Laboratory forge multidisciplinary teams covering expertise ranging from core engineering and biomaterials discovery to the in-depth understanding of human physiological systems. The primary research areas include the recreation of three-dimensional (3D) tissue constructs and functional entities of complex organs, biomaterial scaffolds, 3D bioprinting, Stem cells, biocompatibility assessment and characterization of microengineered tissue reconstructs, and testing of their physiological compatibility upon implantation in the animal models. In addition, we focus on integrating microfluidics technology with tissue engineering and implementing them in fabricating on-chip tissue and organ models. Fabrication of biomedical microelectromechanical systems (Bio-MEMs) and lab-on-a-chip platforms for low-cost point-of-care diagnostics (POCD) and biosensor development is one of our major goals

- ## Transducer Instrumentation Lab

- ## Computational Neuroscience & Neuro-Imaging Lab

Message from Prof. Incharge:

It gives me immense pleasure to extend you a most cordial invitation to participate in the Campus Recruitment Programme of the Indian Institute of Technology (BHU), Varanasi. With an increasing thrust being placed on Institute-Industry Interaction, it is my sincere belief that your esteemed organization and IIT (BHU) Varanasi will stand to gain immensely from this symbiotic relationship.

Our Institute holds the pride of place being pioneer in the field of engineering and technical education in this country and has a glorious heritage. We have been continuously ranked amongst the elite by all peers and stakeholders. Our constant pursuit of excellence has made our institute a focal point in technical education for students and faculty members alike. Admissions to the institute take place through the reputed Joint Entrance Examination (JEE) and Graduate Aptitude Test in Engineering (GATE).

At this institute, we take utmost care to groom our students according to the needs of the industry. We seek to open frontiers of knowledge and reveal new horizons of change to broaden mindset and to create positive attitude in our students. Our students receive industrial exposure by their frequent industrial visits. Besides, our undergraduate students undergo an eight-week training during summer vacation in reputed industries/institutions/organizations (in India as well as abroad) as part of their academic requirements.

We would be most delighted to host you for campus recruitment and beyond.

Dr. Sanjay Kumar Rai
Associate Professor
School of Biomedical Engineering IIT BHU
skrai.bme@iitbhu.ac.in
+91-9984235990

Training & Placement Representative:

Amit Kumar (Biomedical Engineering M. Tech.)
Email : amitkumar.bme18@itbhu.ac.in
Phone : +91-7587068812