GIAN SPONSORED WORKSHOP ON

Introduction to Human Machine Interfaces and its Applications in Rehabilitation Engineering

Organized by Department of Instrumentation and Control Engineering
National Institute of Technology, Tiruchirappalli
02th - 06th February, 2026

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Overview

Rehabilitation engineering is a field that deals with design, development, and evaluation of assistive/prosthetic devices for the individuals with disabilities to enhance their interdependencies and quality of life. The disabilities may be due to the pathological conditions such as spinal cord injury, stroke, brain trauma, Parkinson's disease and Amyotrophic lateral sclerosis (ALS) or may be due to road and rail accidents. In general, these disabilities lead to complete or limited loss of functions in one or both the limbs which predominantly affects the activities of daily living and quality of life. Human-machine interface is a field which is emerging rapidly, and uses the body's natural electrical signals for the effective restoration of lost activities. It includes brain-computer interface (BCI) and muscle computer interface (MCI). BCI uses the electrical manifestation of brain activity for the control purpose whereas MCI uses electric signals generated from the contraction of skeletal muscles. However, extraction of useful and reliable information from these biomedical signals are a challenge due to inherent noise and randomness present in the signals, and their nonstationary and nonlinear properties and motion artefacts. The complexities associated with the signals demand advanced signal processing and mathematical models and this course discusses all aspects of issues and challenges in the field of human machine interface. The course gives a comprehensive overview of rehabilitation needs, human factors, design and evolution of BCI and MCI along with signal processing techniques and some case studies. It is an interdisciplinary course and particularly designed for research cum higher undergraduate level students. This course will help the researchers/scientist, faculties, and students to share and enrich knowledge at national and international level in the area of human machine interface.

Course participants will learn these topics through lectures and hands-on experiments. Also case studies and assignments will be shared to stimulate research motivation of participants.

Modules	• Foundations of Human Movement, Neurophysiology, and Brain-Computer Interfaces • Neural Decoding and Muscle Interfaces for Motor Rehabilitation. • Signal Processing and Wearable Technologies in HMI. • Deep Learning and Real-Time Applications using Wearable Devices. • Control Systems, Optimization, and Future Research in HMI.
No. of Participants	**Number of participants will be limited to 50 Only.** (If more no. of participants registered, selection will be based on research interest in this field.
You Should Attend If…	➢ You are a **UG, PG, or PhD student**, or a **faculty member** working in biomedical engineering, life sciences, movement sciences, exercise physiology, neurophysiology and neurology, rehabilitation, sports and occupational medicine and related fields. ➢ You are an **engineer, research scientist, or medical doctor** who is working in the related field of rehabilitation.
Detailed Schedule	**Day 1 - February 02, 2026** Lecture 1: 1 hr – 9:30 am to 10:30 am (RV) Human Movements, Role of Central and Peripheral Nervous System on Force Generation Lecture 2: 1 hr – 10:30 am to 11:30 am (NSK) Movement disorders and Trauma, Integration of Neuroscience into Human Machine Interface Lecture 3: 1 hr – 12:00 pm to 1:00 pm (RV) Rehabilitation needs, Introduction to the Brain-Computer Interface Lecture 4: 1 hr – 2:00 pm to 3:00 pm (RV) Neural Data Acquisition Demo 1: 2 hrs– 3:00 pm to 5:00 pm (RV) Acquisition of EEG signals using 16 Channel Brain Products System, EEG Preprocessing Techniques **Day 2 - February 03, 2026** Lecture 5: 1 hr – 9:30 am to 10:30 am (RV) Natural Decoding Lecture 6: 1 hr – 10:30 am to 11:30 am (PAK) Muscle Computer Interface for Motor Rehabilitation Lecture 7: 1 hr – 12:00 pm to 1:00 pm (RV) Design and Development of Brain Computer Interface: A Case Study on Upper limb prostheses Tutorial 1: 3 hrs – 2:00 pm to 5:00 pm (RV) Analysis of High-Density EEG Signals (University of Maryland Dataset) **Day 3 - February 04, 2026** Lecture 8: 1 hr – 9:30 am to 10:30 am (PAK)

	Design and Development of Muscle computer interface: A Case Study on Upper Hand prostheses Lecture 9: 1 hr – 10:30 am to 11:30 am (PAK) Feature Extraction Techniques, Prominent Biomarkers Lecture 10: 1 hr – 12:00 pm to 1:00 pm (RV) Issues and Challenges in Biosignals, Importance of Advanced Signal Processing Techniques Demo 1: 2 hrs – 2:00 pm to 4:00 pm (NSK) Acquisition of EMG and IMU from 16-Channel Wearable Devices **Day 4 - February 05, 2026** Lecture 11: 1 hr – 9:30 am to 10:30 am (RV) Wearable Devices for EEG and EMG Measurements and its Reliability for Real-Time Application Lecture 12: 1 hr – 10:30 am to 11:30 am (RV) Deep Learning Methods for Human Machine Interfaces Tutorial 2: 3 hrs – 2:00 pm to 5:00 pm (PAK) Analysis of EMG signals in NinaPro Myoelectric Control Dataset and NIT Tiruchirappalli dataset. **Day 5 - February 06, 2026** Lecture 13: 1 hr – 9:30 am to 10:30 am (NSK) Role of control and optimization methods in human machine interface Lecture 14: 1 hr – 10:30 am to 11:30 am (RV) Discussions: Challenges and Opportunities in HMI research for health and industry
Registration	**Course Registration:** ➢ Please use the link below for the course registration. **Link: https://forms.gle/PMJx2x9jkjYK9mDaA** ➢ Last date for Course Registration: **27.01.2026**
Course Fee	The participation fees for the course is as follows: **Indian Participants** — **Course Fee (including GST 18%)** • Students / Research Scholars — **Rs. 1000 /-** • Faculty and Scientist — **Rs. 3000 /-** • Industrial participants — **Rs. 7500/-** **Foreign Participants** • Students / Research Scholars — **US $ 200 /-** • Faculty and scientist — **US $ 500/-** • Industrial Participant — **US $ 1000/-** The above fee includes all course materials, computer use for tutorials and assignments, laboratory equipment usage charges, internet facility. Payment Gateway will be kept open till **27.01.2026**
Accommodation	**Accommodation will be provided on request (*Charges per day per person*) and based on availability, on additional payment basis as**

	given below. **1.** Hostel: ₹225 (per head) **2.** Guest House (Double Occupancy): ₹1800 + 18% GST **3.** Guest House (Single Occupancy): ₹1100 + 18% GST
Payment Procedure	**Indian participants:** Go to https://onlinesbi.sbi.bank.in/sbicollect/ → Select Category: Educational Institutions → Select Conference and Workshop NIT Trichy → Payment Category: **"GIAN 2026 - ICE - Human Machine"** and provide details of payment and submit. **International Participants:** Required to make the course fee payment via SWIFT transfer. **Account Details for SWIFT Transfer:** Account Number: **38322028974**; Account Name: **Director, NIT-Tiruchirappalli**, SWIFT Code: **SBININBB190** Bank Name: **State Bank of India**
The Faculty	**Dr. Ramana Vinjamuri, Assistant Professor, University of Maryland.**  **Dr. Ramana Vinjamuri** is an Assistant Professor at the University of Maryland, Baltimore County, specializing in brain-machine interfaces and neurorehabilitation. He holds a Ph.D. in Electrical Engineering and has received the **NSF CAREER** and **USISTEF** awards. His research focuses on synergy-based control for prosthetics, EEG-based neural decoding, and wearable technologies to aid motor recovery in neuromotor disorders.
	Dr. P.A. Karthick, Assistant Professor, National Institute of Technology, Tiruchirappalli.  **Dr. P.A. Karthick** is in the Department of Instrumentation and Control Engineering at NIT Trichy, India. His research focuses on biomedical signal processing, machine learning, and rehabilitation engineering. He has worked extensively on developing advanced algorithms for analyzing physiological signals to aid in medical diagnostics and assistive technologies. His current research explores intelligent systems for neurorehabilitation, aiming to enhance healthcare solutions for individuals with neuromuscular disorders.

	Dr. N. Sivakumaran, Professor, National Institute of Technology, Tiruchirappalli.  **Dr. N. Sivakumaran** is in the Department of Instrumentation and Control Engineering at NIT Trichy, India. His research focuses on process control, biomedical instrumentation, and automation. He has worked extensively on developing advanced control strategies for industrial processes and healthcare applications. His current research explores intelligent control techniques and their applications in biomedical systems, aiming to enhance automation and precision in medical diagnostics and treatment.
Course coordinators	**Contact information** **Dr. P.A. Karthick / Dr. N. Sivakumaran** Department of Instrumentation and Control Engineering, NIT Tiruchirappalli. Phone: 0431-2503355 / 3362 E-mail: pakartick@nitt.edu / nsk@nitt.edu Website: www.nitt.edu
Contact information	**For queries contact,** Mr. Hariharan - 8825686164 Mr. Pattu Ramesh - 6369695090