मौलाना आज़ाद राष्ट्रीय प्रौद्योगिकी संस्थान भोपाल
(शिक्षा मंत्रालय, भारत सरकार के अधीन राष्ट्रीय महत्व का संस्थान)
Maulana Azad National Institute of Technology Bhopal
(An Institution of National Importance under Ministry of Education, Govt. of India)

Date: 12th November 2025

TO WHOM IT MAY CONCERN

This is to certify that **Mr. Sagnik De** worked under my supervision as a **Research Intern** in the Department of Electronics & Communication Engineering, Maulana Azad National Institute of Technology, Bhopal, from **12th August 2024** to **10th November 2025**. During this period, he consistently demonstrated outstanding research aptitude, technical depth, and a highly disciplined work ethic.

Sagnik actively contributed to multiple research initiatives in **deep learning, neural signal processing, computational neuroscience, healthcare technologies** and **brain–computer interfaces**, showing remarkable clarity in understanding complex concepts and independence in executing research tasks. His ability to analyze scientific problems critically and implement solutions with precision reflects a research maturity well beyond his academic level.

During his internship, Sagnik developed a **novel deep learning framework** for classifying **dementia subtypes**, using EEG signal analysis. He efficiently pre-processed and segmented EEG recordings, generated advanced time–frequency representations, and evaluated multiple architectures, including the proposed KAN-ADViT (Kolmogorov–Arnold Network–based Vision Transformer). His method effectively captured long-range temporal patterns in EEG data and achieved highly competitive performance. This work has been submitted to ***IEEE Sensors Journal***. In another project, Sagnik designed a **hybrid EEG–fNIRS fusion framework** that enabled inter-modal feature interaction and intra-modal spatio-temporal learning for **motor imagery** classification in Brain-Computer Interface (BCI) applications. By complementing EEG's temporal sensitivity with fNIRS's spatial specificity, his bi-modal architecture demonstrated superior decoding accuracy and interpretability. This study has produced promising results and is being prepared for submission to ***IEEE Transactions on Instrumentation and Measurement*** shortly.

Sagnik's zeal for research, his professionalism, and his ability to collaborate effectively with peers, co-faculty members, and senior researchers were truly commendable. He consistently maintained clear communication and strong coordination throughout all project phases. He has been an asset to my research group, and I wish him continued success in all future academic and professional endeavors. Please do not hesitate to contact me if you need any additional information about Sagnik.

Yours sincerely,

Bajaj 12-11-25

Dr. Varun Bajaj, SMIEEE
Associate Professor
Department of Electronics and Communication Engineering
Maulana Azad National Institute of Technology Bhopal, India
Email: varun.bajaj@manit.ac.in

डॉ. वरुण बजाज / Dr. VARUN BAJAJ
सह-प्राध्यापक / Associate Professor
इलेक्ट्रॉनिकी एवं संचार अभियांत्रिकी विभाग
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