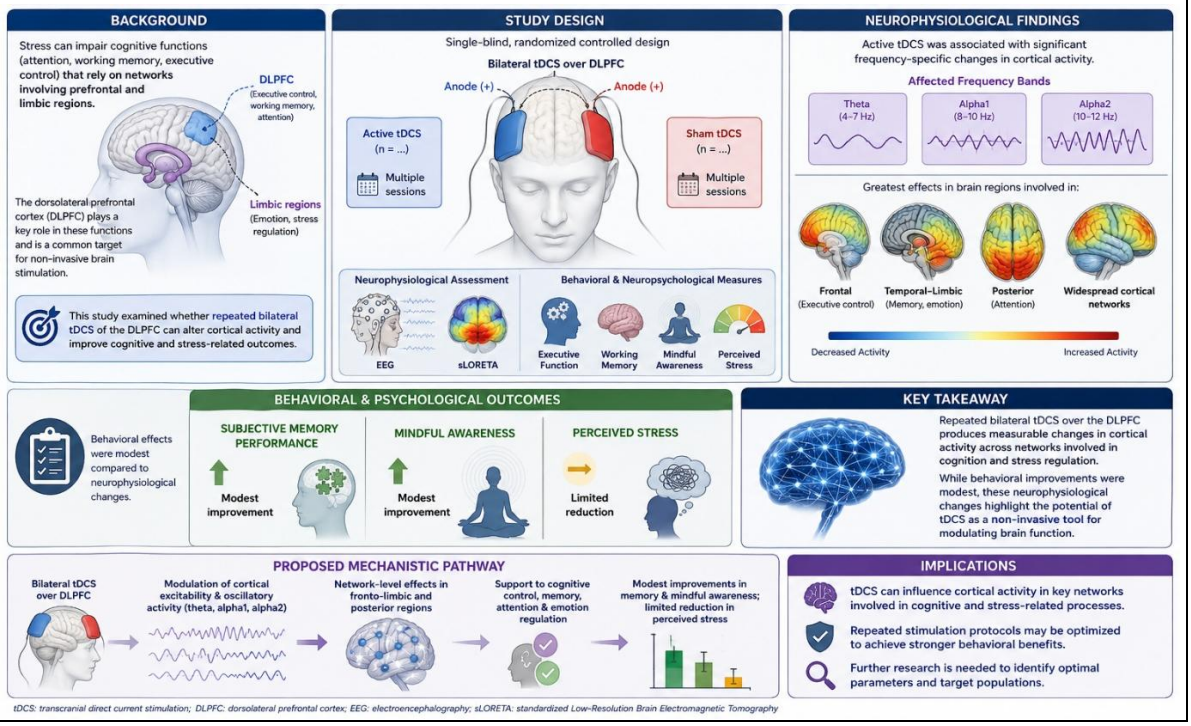
Masters Thesis Information Showcase
Spring Semester-2026
Year 2026

	Department: Biomedical Engineering Programme: Masters in Engineering Specialization: Biomedical Engineering
1	**Title of the Thesis** Investigating the Role of Transcranial Direct Current Stimulation (tDCS) in Stress Modulation and Cognitive Enhancement: an SLORETA Based Study
2	**Abstract** (min 300 to 500 words) This study investigates the effects of transcranial direct current stimulation (tDCS) on stress-related processes and cognitive functioning with particular focus on the associated changes in cortical activity. Stress can impair cognitive functions such as attention, working memory and executive control, which depend on coordinated activity across prefrontal and limbic brain regions. The dorsolateral prefrontal cortex (DLPFC) plays an important role in these functions and has therefore become a common target for non-invasive brain stimulation. The present work examined whether repeated bilateral stimulation of the DLPFC could produce measurable changes in brain activity and behavioral performance. A single-blind experimental design was used in which healthy adult participants received either active or sham tDCS across multiple sessions. Changes in cortical activity were assessed using electroencephalography (EEG) and standardized Low-Resolution Brain Electromagnetic Tomography (sLORETA). Behavioral and neuropsychological measures were also administered to assess executive functioning, working memory, mindful awareness and perceived stress. Active stimulation was associated with significant frequency-specific changes in cortical activity particularly within the theta, alpha1 and alpha2 frequency bands. The strongest effects were observed in frontal, temporal-limbic and posterior cortical regions involved in executive control, memory processing, attentional regulation and emotional functioning. Behavioral findings showed modest improvements in subjective memory performance and mindful awareness. Measures of perceived stress showed only limited reduction following active stimulation. Repeated bilateral tDCS over the DLPFC was associated with measurable neurophysiological changes in brain networks involved in cognitive and stress-related processes. Although behavioral effects were modest, the neurophysiological findings indicate that repeated stimulation can influence cortical activity in regions linked to cognition and stress regulation. These results support the potential of tDCS as a non-invasive tool for modulating brain function.
3	**Impact on SDG#___"** (min 500 words) **SDG3 – Good Health and Well Being** This research is helpful because it studies a non-invasive way to support brain function and reduce the effects of stress. Stress can affect attention, memory and decision making, so finding a method like tDCS may be helpful for improving mental well-being. The results show that repeated stimulation over DLPFC can change brain activity in important areas linked to cognition and stress regulation.

	SDG 9 – Industry, Innovation and Infrastructure It connects with SDG 9 because this study uses modern brain stimulation and brain recording techniques like EEG and sLORETA. This shows how science and technology can be used together to better understand the brain. It also supports innovation in medical devices and research tools, which may help in developing better treatments in the future. This research adds to new technology, better scientific infrastructure and future healthcare solutions.
4	**Scholar Name** (along with contact details) Scholar Name: Azmat Saleem Email: azmatsaleembutt@gmail.com
5	**Supervisor & Co-supervisor Name** (along with contact details) Supervisor Name: Prof. Dr. Muhammad Abul Hasan Email: abulhasan@neduet.edu.pk
6	**Graphical Abstract**